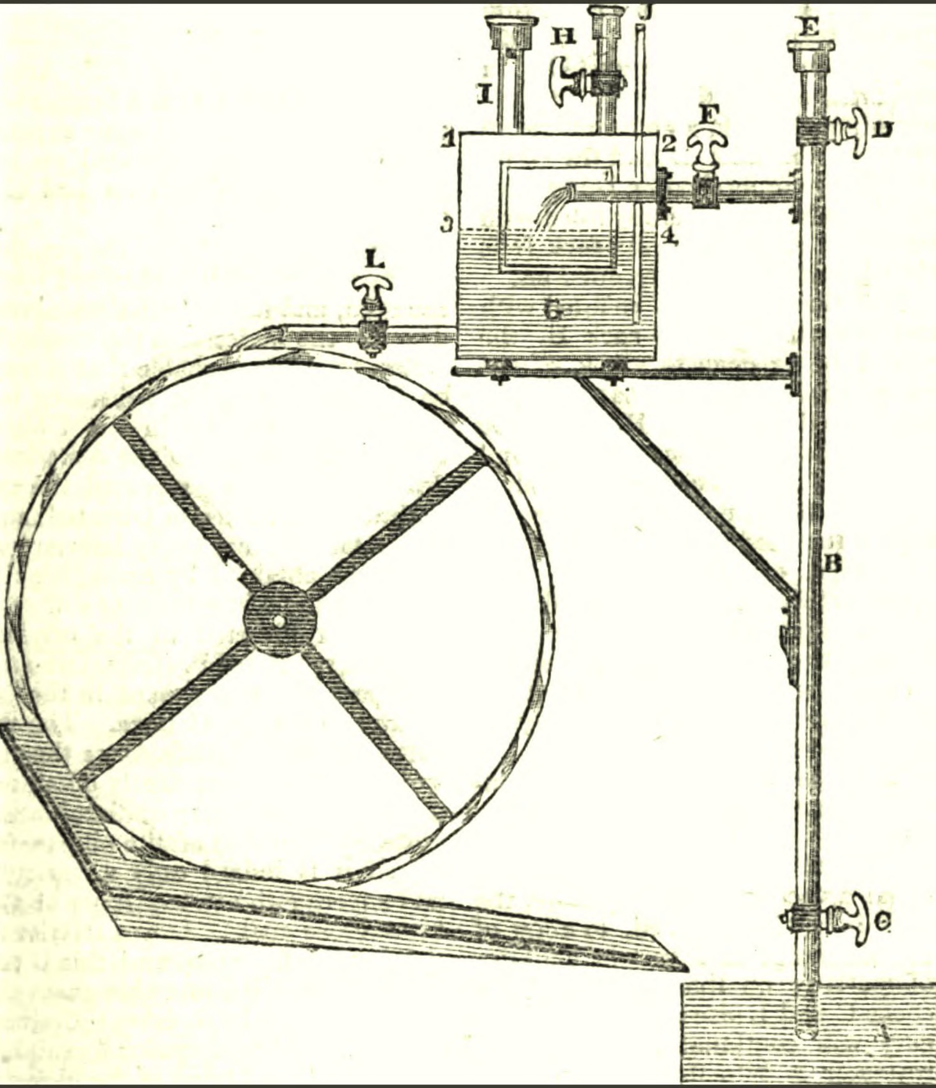


Mechanics magazine

W. Knight Sc.

THE RIGHT HONORABLE

GEORGE CANNING, M. P. &c. &c.

Engraved for Vol. VI of the Mechanics' Magazine

MECHANICS'

MAGAZINE.

VOLUME SIXTH.

"Again, for that other conceit, that learning should undermine the reverence of laws and government; it is, assuredly, a mere depravation and calumny without all shadow of truth. * * * * It is, without controversy, that learning doth make the minds of men gentle, generous, maniable, and pliant to government; whereas ignorance makes them churlish, thwarting, and mutinous. And the evidence of time doth clear this assertion, considering that the most barbarous, rude, and unlearned times, have been most subject to tumults, seditions, and changes."
LORD BACON.

LONDON:
KNIGHT AND LACEY,
PATERNOSTER ROW;
AND WESTLEY AND TYRRELL, DUBLIN.

M.DCCC.XXVII.

D. Sidney, Printer,
Northumberland Street, Strand.

PREFACE

TO

VOLUME THE SIXTH.

THE art of printing, though so peculiarly fitted to be the nurse and guardian of all the other arts of life, must be allowed to have lent them its aid but reluctantly and slowly. For ages, after its introduction, it was almost exclusively devoted to the service of poets, philologists, historians, and philosophers; and it was still chiefly to personal transmission, from father to son, that mankind had to look for the preservation of their acquisitions of mechanical knowledge and skill. Hence the monopoly of particular arts, by particular castes and families; hence the confinement of others to one or two spots on the earth's vast surface; hence the obscurity in which so many of them have remained shrouded, while the clouds of the night of barbarism have been clearing away from all around them; hence that rudeness and imperfection which, in not a few, attest the uniform influence of secresy and seclusion on the progress of improvement; and hence the fact, so fruitful of painful reflection to the man of science and philanthropist, that numerous processes of the greatest value to the arts and to humanity, have been lost for ever to the world.

It is but as yesterday that that master art, which defies all such hazards, and sets at nought all such limitations, has condescended to take the humbler arts under its protection. Nor, until it did so, could the press be said to have began to diffuse one half of the blessings with which it is fraught to mankind. For, however the circulation of works of literature may serve to exalt the minds and improve the tastes of men, it may be safely affirmed, that the page which makes one useful art better understood, or more extensively known than it was before, does more to promote the substantial welfare of nations, than any hundred pages of reasoning or of fancy that were ever printed.

Now that the arts of the workshop are, equally with the labours of the college and cloister, objects of attention to the press, they seem, as it were, placed beyond the reach of vicissitude and decay. They cannot do else than go on improving and prospering. Mountains and seas can isolate them no longer; neither obscurity nor oblivion again overtake them. Once transferred to the descriptive page, they must live for ever and for all mankind. Once laid open to all eyes, and exposed to universal scrutiny, there is not a defect in their details which will not be speedily detected, nor an improvement of which they are susceptible, but what will be, ere long, supplied. The experience of one country will be enlightened by the experience of another; and the rivalry of nations become only a rivalry in improvement. Some shifting of places may be expected to happen; one manufacture to displace another; or one nation to take up and excel in an art which has heretofore been the pride of its neighbours, or cultivated by them to little or no purpose; but in all such changes, we shall but witness the salutary workings of an enlarged state of freedom and intelligence, which enables every individual and nation to occupy themselves with that which they can do best. The arts, like plants, have their genial and adverse soils, and will no more fly the former, than take permanent root in the latter. When artificial and arbitrary means are necessary to retain a manufacture in a country, it is the best of all proofs, that its home is elsewhere. Nor is there any nation so destitute of local advantages, but what there must be certain branches of industry in which, if it pleases, it may excel or, at least, equal every other nation.

It is *misapplied labour* alone, which has any thing to fear from the unfolding of the Book of Arts to all the world; such manufactures as would have long since perished, but for the monopolies, and injurious privileges of all sorts, by which they have been upheld, that are likely to take their flight in search of more auspicious climes. Every country will preserve, precisely, those manufactures which are most adapted to the genius and circumstances of its inhabitants; and, in proportion to the amount of labour thus saved, from unprofitable pursuits, will the produce of art be every where multiplied, and the comfort, wealth, and refinement, that follow in its train, augmented.

Happy are we to reflect that, in these anticipations, we concur in opinion not only with the philosophic few, who in this, as at former periods, precede the general march of society, but with all the well-informed, both among the governing and governed, of the age in which we live. To establish a free interchange of commodities between Britain and other nations, by the abolition of all commercial restrictions, is but one portion of that liberal policy, which has made the existing administration of this country, at once so popular and so powerful. To establish a free interchange of thoughts and ideas—of enquiry and information—of discoveries, inventions, and improvements, in the arts and sciences—has been equally an object of solicitude and negotiation, with Mr. Canning and his colleagues. Nor, as this enlightened statesman has somewhere, in his official correspondence,* observed, "because Great Britain can receive

* In his correspondence, we believe, with Mr. Pinckney, on the Orders in Council.

more than it is likely to bestow, but because the prosperity of all other countries, is, essentially, the prosperity of Great Britain."

We now lay before the public, the Sixth Volume of a publication which, an unrivalled circulation, (many times greater than that of all the scientific periodicals previously published,) warrants us in saying, has helped more than any other, to diffuse that sort of knowledge, of which we have been speaking. Conceived in the spirit of the age, it has partaken of its triumphs. Open to all and for the benefit of all; so cheap, as to be within every one's reach, and so useful, as to carry everywhere the seeds of improvement; it has been equally supported and encouraged by men of all classes and denominations. Imitators, in abundance, it has produced, nor has it been slow to welcome them, as coadjutors and allies in the same good work; but it is, perhaps, still more to its credit that it has, hitherto, pursued its onward course, without provoking either opposition or hostility.

The Editor embraces with pleasure, this opportunity of again returning thanks, to his numerous friends and correspondents, for the able assistance which they continue to afford him; and of renewing his solicitations to all who have any thing useful to communicate, connected with art or science, to avail themselves of the superior means which the Mechanics' Magazine affords them, of making it at once extensively known, and candidly appreciated.

1st January, 1827.

Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 141.] SATURDAY, MAY 6, 1826. [Price 3d.

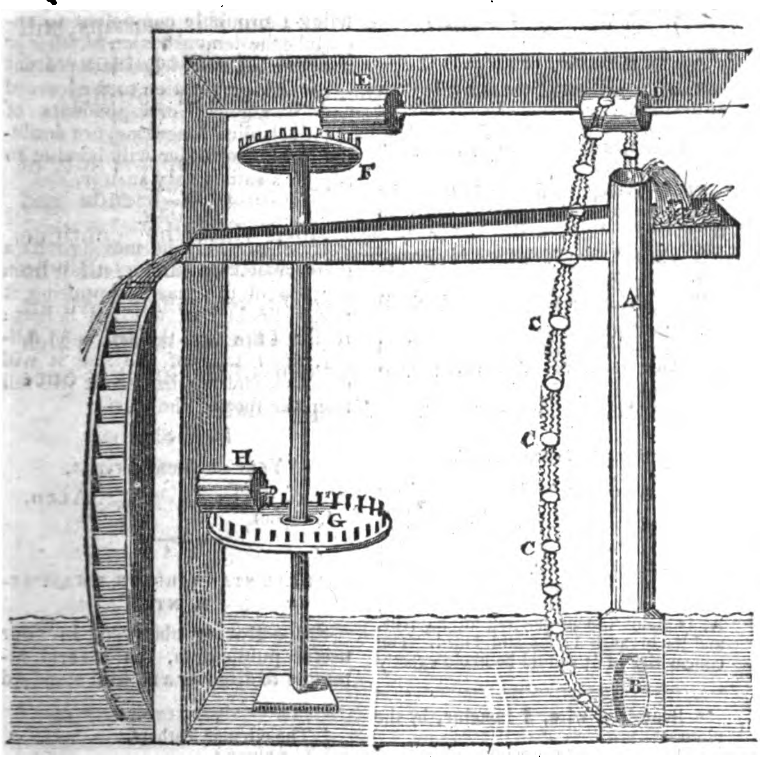
TO SCIENCE.

Of pow'r, wealth, freedom, thou the cause,
Foundress of order, cities, laws,
Of arts inventress thou:
Without thee, what were human kind?
How vast their wants, their thoughts how blind!
Their joys how mean and few!

Sun of the soul! thy beams unveil!
Let others spread the daring sail
On Fortune's faithless sea:
While undeluded, happier, I
From the vain tumult timely fly,
And sit in peace with thee.

Akenside.

ANCIENT ATTEMPT AT PERPETUAL MOTION.



ANCIENT ATTEMPT AT PERPETUAL MOTION.

Sir,—The underwritten is translated from an ancient Latin book in my possession (entitled "De Simia Naturæ," Autore Roberto Fludd), which treats of every science known at the time it was published, and largely of the science of mechanics. What follows I have extracted merely to show that the discovery of the perpetual motion was as nearly attained then, perhaps, as it is now.

I am, Sir,

Your well-wisher,

P——.

OF ANOTHER USEFUL INVENTION FOR RAISING WATER EASILY, BY THE WHICH A CERTAIN ITALIAN VENTURED TO BOAST THAT HE HAD DISCOVERED THE PERPETUAL MOTION.

Description of the Instrument.

A is an exhauster, or pump.

B, a little wheel placed at the bottom of the exhauster, about which pestils, or circular *flaps* of prepared leather, revolve lightly, so that they rise easily; they are connected by crooked iron.*

CCC, pestils or circular leathers, by means of which the water is raised in the pump.

D, a wheel, by which the said circular *leathers* are raised up.

E, a pinion, moving the wheels D and B.

F is a wheel, continued from the wheel G, whose teeth the pinion E propels circularly.

H, a pinion moving the wheel G.

Use of this Instrument.

This instrument is classed with those of the first sort,† on which account it is absolutely necessary for a multitude of purposes, because it bears upward a large quantity of water with the least labour; for the number of wheels is not variable; but the length of the receiver, A, is about the proportion of 35 feet, and its breadth 1 foot and 1-3rd. The concavities of it should be made exactly round, that they‡ may not lose any water by contracting in their ascension; the concavity of the pump, therefore, should be perfectly round. The great water-wheel should be 24 feet diameter, and the wheel, G, 20 feet.

The Italian, deceived by his own thoughts, conceived that as much water would be raised by this pump as would keep the wheel perpetually in motion; because, he said, that more force was required at the extremity of this machine than at the centre;§ but because he calculated the proportions of power wrong, he was deceived (undeceived) in practice.

This last remark is a dose for many perpetual motion-seekers.

FALL OF A BALL FROM THE MAST-HEAD OF A SHIP IN MOTION.

Sir,—Having heard it disputed whether a ball let fall from the top of a ship's mast, when the ship is moving rapidly, will fall at the foot, or nearly so, of the mast; and not being thoroughly competent to undertake the demonstration whether or not it be the case, I beg leave to put the following question to the learned and ingenious Correspondents of the Mechanics' Magazine, not doubting but one or other will be able to supply a satisfactory answer.

Question.

If, when a ship be moving with a given velocity, a ball be let fall from the top of the mast (supposing it perpendicular) of a given height: required the time the ball is in falling, the nature of the line it will describe, and the distance it will fall from the foot of the mast?

I am, Sir,

Your obedient servant,

Aled.

Liverpool.

NATURAL STANDARD OF MEASUREMENT.

Sir,—Having observed, in your useful publication, the several attempts to discover a natural standard

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* Bent iron wire, I imagine, by the plate.

† In reference to previous rules.

‡ The circular leathers.

§ The pump?

of lineal measure different from that of the pendulum, I beg to propose, for the consideration of your readers, a few observations towards clearing away the difficulties that attend the subject.

The perpendicular height of a column of water or mercury, sustained by the pressure of the atmosphere, would be a natural standard of lineal measure, if the pressure were always the same; but, as this is not the case, we must have recourse to some method by which we can easily ascertain when the air is of any assigned weight.

Water, it is well-known, when subject to the pressure of the atmosphere, does not always boil at the same temperature, but the heat varies as the pressure is increased or diminished. Now, if the perpendicular height of a column of water or mercury, sustained by the pressure of the atmosphere, when boiling water is of any assigned temperature, be taken as the standard, the thermometer will always show when water boils at the same heat, and consequently when the weight of the air is the same. But by the present method of constructing the thermometer, the height of the mercury in the barometer is necessary to be attended to: to obviate this defect, some such contrivance as the following may be made use of:—

Dip the thermometer in freezing water, and afterwards in water boiling in vacuo: the mercury, standing at different heights in the thermometer during these two operations, will furnish us with two points; by the help of which all the degrees may be marked off without the assistance of the barometer. The temperature of the water or mercury in the barometer, when used for the purpose of experiment, must also be well observed.

In the hope that my remarks on this occasion will not be unacceptable,

I remain, Sir,

Your most obedient servant,

C. H. C.

PROPELLING STEAM-VESSELS.

Sir,—I have noticed, in your Magazines, many projects for propelling steam-vessels, and you must know, Sir, I am wonderfully pleased when I get upon one of those things, and quite anxious to see them in some degree of perfection; yet, notwithstanding the many improvements that are suggested, I fear I am still to be tossed and tumbled about with the jarring motions and awkward plunges of the vessel, when the sturdy paddles contend with the sturdy waves. We like the sliding motion, the stealing pace of the sail-vessel, and I fancy it is to be accomplished in the steamer; but pardon me, Mr. Editor, if I should offend your readers with a foolish project.

Would not a stream of water, ejected with a considerable velocity from the stern of the vessel, propel it forwards? And, supposing the whole power of a steam-engine commonly used upon steam-packets to be directed in this manner, would it not answer the purpose of paddles, and do away the unpleasant motion in steamers?

These are merely questions, and I shall leave it for abler sailors than I am to answer them. It appears to me, at first sight, that a great deal of friction would be thus dispensed with; that the simplest sort of engines might be used; and that the well-known loss of power in paddles would not have to be sacrificed.

I am, Sir,

Your obedient servant,

E— M—.

Leeds.

A QUERY.

Would not an object obscurely seen through a fall of snow, be rendered invisible by the flakes being arrested in their flight, and fixed in their respective positions? The reason of this? and is there any analogy in the superior transparency of paper when in motion?

B. C.

BALLOONING.

(To the Editor of the Mechanics' Magazine.)

SIR,—The interesting paper in your valuable Magazine (No. 1) respecting Aërostation, and subsequent papers on the same subject, have suggested the following thoughts, which, if they be worthy of your attention, I will briefly state.

In the first place, the attempt to mount on *wings* has never yet, from the days of Icarus to the present time, been successful, neither do I expect ever will be so.

In the second place, we observe, in Nature, another mode of aërostation, which is exemplified in the *various* kinds of parachutes by which the seeds of syngenesious plants are carried through the air, and which mode has been proved to be in some degree successful.

In the third place, it therefore appears probable that the most likely and safe way of making discoveries in aërostation, would be to examine well these little natural parachutes, and form machinery for the support of a weight equal to that of a man, in the form of parachutes of various constructions, some of which might be suggested by those natural parachutes.

In the fourth place, having weighted a parachute with a weight equal to that of a man, it should be conveyed to the summit of a hill, when the wind suited, and, no doubt, when the parachute should be adjusted to the weight to be conveyed, it would carry it through the air.

In the fifth place, and above all, in case the parachute should lay the apparatus in a horizontal position, or in any position which would endanger human life, the cause of the defect in the apparatus should be ascertained by varying the form of the parachute, and proving whether or no any change in the formation could prevent such danger; for, unless it could do so, the experiment should end here. Perhaps, indeed, such danger may arise from a misproportion between the weight and the parachute, or from too great concavity in the latter, whereby the wind may gather too strongly within it, or it may be from bad materials. I would then propose various degrees of expansion to be tried, and am disposed to think that the expansion of thistledown would not be subject to such danger. And in respect to materials, as we observe some kinds of down to be feathered, I would make the experiment whether the following would not be the best form of a parachute:—Its general form should be that of a wheel, from the centre of which should be suspended a pole of adequate length, which very adaptation of length might itself effect the purpose upon the principle of the lever. The spokes of this wheel should be made of the lightest materials, as of cane, and they should have an orbit of strong string, and other interior circles of the same materials. Between them, large and strong feathers might be fixed in holes prepared to receive them in the cane, and the cane in those places secured from splitting by bandages: the whole would then form a machine resembling the winged down of plants. Such experiments might indeed at first be made upon a small scale, with a very small weight, before the larger and full apparatus were formed.

Sixthly, supposing that thus far the experiment has succeeded, and we may venture to make an aërial voyage—

> . . . . . . , " Quâ me quoque possim
> Tollere humo, victorque leves volitare per auras."

The next question is, how we may to a certainty be able to return again to our native planet, and not be hurried farther than we wish through the atmosphere; for it is not improbable but that the same wind which carries us at first for our pleasure, may continue to carry us afterwards against our pleasure, as the horses of the sun treated poor Phaeton. It is therefore essential to the utility and safety of the machine, that it should be so formed as to contract or expand after the manner of an umbrella, which might easily be effected by a rod within the pole and a screw, or in some other way, by diminishing the expanse of the parachute: this, however, is a secondary consideration. In the first instance, a string attached to the ground, or held by persons on the ground, might be sufficient.

Seventhly, would it not be practicable, also, to contrive some kind of protection to the body, in case of any accident; or even to make such experiments from the top of a mast at sea, with a dress which would secure a person from any injury if he fell into the sea, and likewise support him in it?

Lastly, if all should succeed prosperously, we might next consider of some plan for steering the vessel. Now, if the parachute could be formed in the shape of a boat, and a small light boat also form the seat of the aerial navigator, I should not despair of directing its course either by a sail, or a rudder, or by both. I am surprised that nothing of this kind has ever been tried in respect to balloons.

All these experiments might, I conceive, be made with little or no danger from the mast of a ship, if the seat of the parachute were attached by a thin cord to a boat.

If any one doubt of the power of the parachute, he may easily prove it by means of a sheet of silver paper tied to four pieces of string of equal length at the four corners, all the other ends of the string being tied to a concentric cork. As regards the use of feathers, I would, by the way, wish it to be considered whether the very ridges which are formed by the fibres of the *pinnæ* be not formed for the purpose of catching and acting upon the air in a much greater degree than a smooth surface could do.

I remain, Sir,

Your obedient servant,

DÆDALUS.

P.S. If a large feather be held up against the wind, the effect of the wind upon it will appear surprising, and experiments might be made in order to find out whether any particular surfaces are acted upon more than others by the wind, by fixing surfaces of different forms, but equal weights and sizes, in a small piece of wood, to be diminished until one of the surfaces oversets it by the action of the wind.

DESCRIPTION OF A METHOD OF CONSTRUCTING AND FORMING RAILWAYS, SO THAT THE CARRIAGES MAY ALWAYS RUN UPON A DEAD LEVEL.

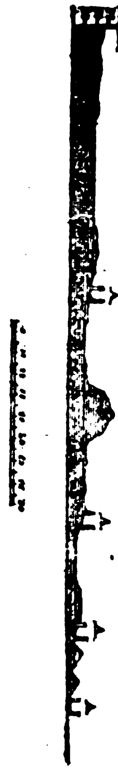
BY JAMES ELMES, M.R.I.A.

Architect and Civil Engineer.

Mr. Elmes proposes to form his railways or tram-roads of cast or wrought iron, or other metal, or of any other material, as stone, granite, marble, &c. They may be of any convenient shape, width, size, or dimensions; and with or without blocks, foundations, or footings. They may also be of any given inclination to the horizon, or level therewith, as may best suit the purpose of running loaded vehicles or carriages up, and empty carriages up; or loaded carriages both up or down thereupon. Mr. Elmes proposes to adapt his tram-plates or rail-roads to the width, figure, and dimension of the carriages to be used thereon. The roads or ways may be laid single, double, or treble, or more, in parallel lengths, as may be found necessary; but machinery must be employed to change from either line to the other. The new principle, however, on which Mr. E. chiefly founds his claim to novelty, is "the introduction of this description of carriage-ways or roads, from their present limited powers and use, to every required situation and level in which common roads may be required, thereby communicating the valuable qualities of tram-roads or rail-ways to every road in the United Kingdom, whether for carriages of the present description and denomination, which now are and can be used on rail or tram-roads, or for stage, mail, and other coaches, chariots, cars, vans, wagons, carts, &c. on or by the side of turnpike or other roads, taking them over different levels in a novel manner, and to which such roads and machinery have never been applied."

In order to do this, he proposes, first, to take a survey of the intended line of road, and lay it down in drawings for levels, lines, &c. precisely as if surveying a line of country for a canal, and to mark on his map, plan, and section, the situations in which locks would be required if intended for a canal. On his first level he lays his tram-plates or stone-sleepers, as before described, of any width, shape, or dimension, or material, till he arrives at the place and situation in which a canal would demand an ascending or descending lock or locks. In this situation he proposes to raise or lower all the carriages to the next level by such machinery as may be found most convenient; and to proceed in a similar manner on a new level, till a repetition of the same methods or expedients be required to descend or ascend to another level.

As a peculiar advantage over, and as a different principle from the lockage system of canals, Mr. Elmes does not confine himself to the small but necessary descents and ascents of that system, but purposes to ascend or descend to or from any given height that he finds requisite by one lock, instead of by a series of two or more, as in the case of canal works. By this means he thinks he will render this useful but hitherto limited manner of constructing roads as general and applicable as turnpike-roads or canals, and remove from them their greatest objection, namely, the necessity of carrying them as deviously and as circuitously as the New River is from Ware to London, for the purpose of preserving their level for the transport of loaded carriages both ways, or for an inclined plane.



Description of the Engraving.

The engraving represents the section of an actual survey of the Womersley Railway, which is now before Parliament, and was chosen for its shortness and varieties of levels. The various levels are formed by deep cutting and embanking; and the locks, marked A, A, A, which are formed of solid bridges, working up and down in hollow cast-iron columns, carry the wagons, coaches, caravans, or other carriages, with horses, drivers, passengers, and luggage, up or down.

By this means, a rail-road, upon a series of perfectly dead levels, may be constructed from London to Edinburgh.

Mr. Elmes has also designed a railway of granite or marble, suitable to his present invention, or upon greatly inclined planes; a description and engraving of which we hope to be able to give in a subsequent Number.

MR. CHEVERTON'S NEW GAS POWER-ENGINE.

[*To the Editor of the Mechanics' Magazine.*]

SIR,—To remove an imputation that may be cast, I owe it to myself to state that the preceding communications relative to a new motive-power, were written before I understood the nature of Mr. Brunel's engine, and that the invention is *bona fide* my own. It is with mingled feelings of satisfaction and mortification I perceive, that though our plans differ in regard to the production, regulation, and timing of the power, the leading principles on which I have proceeded are precisely those which have been adopted by so able an engineer. I must acknowledge my regret, that, so sanctioned by great practical knowledge and experience, I did not place a greater value upon my invention as a *project*; and, instead of waiting to put it to the test of experiment, that I did not make it public at least two years ago.

I am, Sir,

Yours respectfully,

BENJ. CHEVERTON.

Kingsdown, Bristol.

Continuation of Mr. Cheverton's description of his New Gas Power Engine, from page 423, Volume Fifth.

SAFETY OF THE ENGINE.

There is a fear lest an idea of the amazing force which it is proposed to bring under control, may so operate on the public mind as to produce a *panic*, which, however groundless, would powerfully militate against its general adoption as a mechanical agent. Besides, then, what is really due to the importance of the inquiry, it becomes necessary to treat the subject in a manner more diffuse and enlarged than to the reflecting mind may be thought requisite—to multiply considerations, and to suggest precautions, which the experienced engineer will deem wholly superfluous. The inquiry presents itself under two particulars—the danger arising from explosion, and the liability of its taking place.

1. Though that event may be highly improbable—though the chances should be made, as I believe it may, any number to one against it, yet there would be a more complete *feeling* of security if we could be assured that, in case it should happen, no personal injury would be the result. It is proper that measures should be taken to remove even those misgivings, which reason would disown. In order to this, let us estimate the danger as arising from the violence and from the magnitude of the explosion.

However intense the force of the confined gas, if the quantity liberated is inconsiderable, little mischief can result. For instance, Mr. Faraday had *glass* tubes burst in his hands, when there was an internal pressure equal at least to that of fifty atmospheres. It never can be necessary to employ in an engine more than double that pressure. Mr. Howard exploded fulminating mercury in a glass globe of six inches diameter without its being broken—a substance which exerts an initial force great beyond all calculation. If an elastic fluid does not act with an accelerating force on its object, the velocity imparted is not comparatively great. In an explosion with a small quantity of gas, the force is instantly dissipated, and the parts fly off with the velocity given by the first impulse. The initial force may be immense, and the effect not nearly equal to what would be produced by a much less but constant force, operating during a certain range. This is beautifully illustrated in Mr. Perkins' experiments with the steam-gun. With a force one twenty-fourth that of gunpowder, he gives a much greater velocity to the balls; and gunpowder, again, is much more efficient in this respect than detonating powders of inconceivable force.* In an explosion with a large quantity of gas, its sphere of action is more extended, and the fragments are scattered with an accelerated velocity. To avoid, therefore, exaggerated notions of the danger to be apprehended from the violence with which a gasometer would burst, we must not so much regard the initial force of the confined gas, however great that may be, as the quantity set at liberty. In respect to the magnitude of an explosion, it is the only consideration.

Whatever may be its violence, if of inconsiderable extent, we could circumscribe its fury; but on a large scale, though of inferior force, we should in vain attempt its control within any moderate bounds. It is important, therefore, to ascertain the quantity of gas that can be suddenly let loose at any one time, in order to show that it is completely manageable within a space perfectly consistent with compactness. Let an extreme case be taken—an 80-horse power-engine (if more power be required, it will be advisable in other respects to have more than one engine); the minimum and maximum pressures equal to those of 60 and 100 atmospheres; a sufficiency of gas generated to admit of 15 double strokes per minute, and to allow of an average acting power of 40 atmospheres being taken for only one-fourth of the time alternately; the latitude of space given in the gasometer, the condensing space allowed in the generator at the lowest pressure, and the quantity of liquid convertible into gas, to be respectively equal to one-fourth the bulk of the body of oil put in motion. This supposes the liquid employed to expand in the form of gas under the highest pressure, to a little less than six times its bulk, which is thought to be a sufficiently low estimate even for the carbonic acid, though it is lighter probably than water, and its gas is heavier than air.

From these data it will be found that the greatest quantity of gas which can be instantaneously liberated is about two and a half cubic feet at its greatest density, or 250 cubic feet under atmospheric pressure, occupying a cubical space of little more than six feet dimensions. The liquid in the generator at the time of an explosion would not, of course, as an elastic fluid, contribute to its force—it would only rapidly evaporate.

Now this quantity of gas is not so great but that it may be easily controlled, even if it possessed the expansive force of inflamed gunpowder. Though the latter is at least sixteen times greater, let a comparison be ventured on the ground of equality—that is, on the assumption that the engine is at work under a pressure equal to sixteen, instead of one hundred atmospheres. What quantity of gunpowder will produce an equal explosion? From many accurate experiments made by Mr. Cruickshank, it appears that, of 100 grains of good gunpowder, 47 pass into the gaseous form. Taking other data and assumptions from Mr. Robins, viz. that the average specific gravity of the elastic products is equal to that of the atmosphere, that the specific gravity of gunpowder is equal to that of water, and that the augmentation arising from heat is in the ratio of 4 to 1, it follows that the volume of elastic fluids

* The *rationale* of the very different effects of these powders, I imagine, must be this:—The quantity in weight being given, there is, in respect to the detonating powders, a larger proportion which takes the gaseous form, a greater concentration of the elastic fluids in the solid form, and a much more rapid combustion; there *may* be a greater quantity of æriform products from the same weight of base, and a more intense heat for the instant. These circumstances necessarily produce an immense initial force—its development is instantaneous, and produces all the effects of percussion. But there are others which give it a fugitive character, and by limiting its sphere of action, prevent it from imparting a superior velocity to balls. There is a much less proportion of permanently elastic fluid, the high temperature required for the existence of the vapours and volatilized products cannot be maintained for any extent of range, and there is a less *quantity* of caloric either for this purpose or for sustaining the augmentation of the expansive force arising from heat.

at the instant after explosion is 1600 times the bulk of the powder inflamed, and that ten pounds will produce 250 cubic feet.

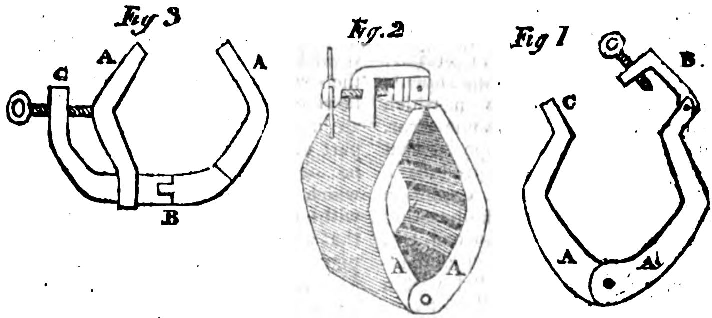
This is a very low estimate of the force of fired gunpowder, especially if Count Rumford's experiments could be relied on, but in which there must certainly be some error. Let it, however, be supposed that this quantity does not produce a greater or more violent explosion than would result from the bursting of a gasometer. Now no one will think the explosion of such a quantity may not be controlled within the boundaries of a cylinder of very moderate strength and dimensions. It is fired from guns and mortars without alarm, and these have to sustain its immense initial force; but we are only concerned to restrain and point its force in a harmless direction, when it is almost spent. Two hundred and fifty cubic feet of gas may be liberated even in a *close* vessel of that capacity; and if made of wrought iron plates one-fourth of an inch thick, would be capable of withstanding ten times the pressure to which such explosion would subject it. But there is no propriety in closely shutting up the engine: there should be free vent for an explosion upwards. To have additional strength and security, the enclosing cylinder may be made double; the annular space to form the refrigerators, or a common reservoir for water. Let the subject be viewed in regard to compactness. If the safety-cylinder has a diameter of seven feet, and is ten feet high, it will contain all the apparatus of an 80-horse power-engine, and have a clear capacity besides equal to 250 cubic feet, corresponding to the quantity of gas that would be liberated in case of an explosion.

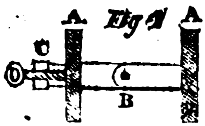
It may still be thought, that though an effectual defence is provided against the *pressure* of an explosion, yet fragments of the gasometer would be scattered with such violence as to destroy the cylinder or the guards placed above it. Not to mention that these defences may be easily made even musket proof, in fact, indefinitely strong, I would say, let them for once be put to the proof—the experiment would never want to be repeated, and the result would be an undoubting confidence on the part of the public. It should also be observed, that the gasometer, which is the only dangerous vessel, will be very strong and heavy, and that an explosion can scarcely happen in the way of fracture, but from a separation of its parts. Mr. Brunel, I perceive, has most judiciously proposed to compose his of only two pieces, and to have the joint at the bottom (this is principally to avoid leakage); consequently, in case of the fastenings giving way, the mass of metal forming its superior part, will oppose such a resistance to the explosion, both from its weight and inertia, that probably it would be projected but a very little height above its base, even if unrestrained. I judge from the recoil of a piece of ordnance, with a bore of half the area of the gasometer. It may excite surprise, that the possibility is admitted of this vessel bursting into fragments. We are too little acquainted with the subject positively to say that the cohesive strength of of the metal would not be gradually diminished by the liquid or its gas under high and long continued pressure, though there may be no immediate chemical action apparent. Liquids, under high pressure, pervade the pores of metals: water, heated under the same circumstances, decomposes glass. It is worthy of remark, that, in such a case, the vessel would not be simply ruptured, as by mere dint of force, but would fly into a number of pieces. The means of prevention belong to the other part of the inquiry, to which we next proceed.

B. C.

(To be continued.)

NEW METHOD OF HEAVING SHIPS' CABLES.





SIR,—The following description and sketch of a method for Heaving in a Ship's Cable, may merit the attention and adoption of all our nautical merchants, on board of such vessels as use a capstan and messenger. Seafaring persons are not ignorant of the very great expenditure and waste of nippers now used, which must be made from good yarn, and not unfrequently a serviceable cable even obliged to be cut up for the purpose. I propose to substitute wood, and partly iron, or iron nippers, which shall require fewer hands, and work with greater facility and expedition, as well as be less liable to injure the cable. According to the present mode of heaving in, when there is a heavy swell, or great strain, it frequently happens that the cable runs through all, and is greatly injured by the friction. If the mode I propose should answer, and the expense of trial will be but trivial, the economy will be immense. If you can forcibly bind the cable and messenger by simple means, without injury to either, by means of wood or iron, and I think there is no doubt of the practicability of the thing, a very essential national benefit will be obtained.

I am, Sir, yours, &c.

Lieut. HIGGINSON, R.N.

Description.

Figs. 1 and 2 represent the same machinery, only in different views.

Fig. 3 is an apparatus on the same principle, but on a different construction.

Fig. 1 is an end view of two pieces of iron, AA, box-jointed at the lower end; their width about eight inches each; the thickness must depend on whether they would be best made of wood or iron, but in either case they should taper from the lower part.

B is a joint clamp, moving on a bolt through the upper end of that side of A, with a screw through the clamp end of B, and a hole through the head of the screw for a bar lever.

C, against the other piece, A, is a continuation of the piece A, slighter, and projecting in the form given. Against this the screw is to act, when the two pieces, AA, are closed at top, and the clamp, B, shut down, as shown in the perspective, fig. 2.

Fig. 1 is open, for placing within it the cable and messenger; and fig. 2 represents the machinery closed, with the lever and screw for acting, to give the requisite pressure to the cable and messenger. I have the inner edges of AA rounded off, to prevent any chance of cutting or injuring the cable, and let them be scored within, as represented inside of fig. 2, to correspond and receive within their score the lay of the cable or chain, to create a greater resistance. I have formed AA angular, for keeping the cable and messenger more securely in position, and, I think, also increasing by this form its binding effect.

On the external and upper end of that side of A, as represented in fig. 2, underneath the screw, where the clamp is closed, a groove is formed, leaving a shoulder on each side, for the clamp to fit well in. By this means the two opposing strains of the cable and messenger will bear more equally on the upper and lower extremities of the two pieces, AA, which might otherwise cause a partial side strain on the screw, so as to injure its worm or thread, and prevent its free action.

Fig. 3. AA are two arms, similarly formed to the beforementioned, but differently connected; the lower part, B, is a square bar of iron, horizontally jointed, as shown, about the centre; the bar is continued up as high as C, through the upper end of which form your screw orifice; the piece, A, connected with the screw must be moveable, to slide to and fro on the bar, B, by a groove formed centrical in the under part of A, so as to slide on the bar, B, and connected to the screw by a hole through the central part of A, for entering the end of the screw made smaller at that end, and rivetted on, with a nut to secure it, making it free to turn within the orifice of A, so that the action of the screw will close and open the sliding piece, A, on that side. The piece A, on the opposite side, will be a fixture or continuation of the joint-bar, B. By the action of the screw, when the messenger and cable are placed within, you produce your pressure by the screw-lever; the horizontal joint of B is intended to relieve any strain that might otherwise be brought on the worm and thread of the screw, from the action of the two opposing powers.

No. 4 is a bird's-eye view of the machinery of fig. 3.

Use old hammock, or matting made for the purpose, to prevent chafing. I should suppose, that three of these nippers put on at a time, would on all occasions effect the desired purpose. One hand need only attend at the hatchway, for relieving the screw power and taking off the nipper, and two may attend to the clapping on; so that there needs no number of boys or men, of six or seven, to hold on nippers, besides the difficulty and delay, both in clapping on and taking off, and now and then a hand or two wanted with a knife, to cut and clear many jammed nippers.

These nippers must be made proportionate to the size of the cable they are intended for; I can give no accurate judgment of their weight, but, of course, all extraneous weight will be avoided in their formation. If made for chain cables, doubtless they may be made lighter, as the inequalities of the chain present greater facility of resistance, consequently a less powerful pressure would be needed; and if chain messengers can be used with the chain cable (and I see no reason why they should not), the facility of creating a nipping power for heaving in, will be still greater.

This powerful steady screw-nipper cannot injure a hempen cable, as long as your pressure is so forcible as to prevent friction by their escape, as is frequently the case with the present nippers; even when the anchor is up to the bows, and ready to cat, down it goes, and labour and time are lost.

Objections may be made to the screw-power on account of the wear, consequently, in time, liable to recede from the forcible nip acquired; but this may be removed by a slight wedge applied between that part of the nipper against which the screw presses, and the part through which the screw acts. Or the nipper, fig. 1, may be used, by a simple bar lever power, in lieu of the screw, and the wedge to secure the nip.

ENGLISH GRAMMAR.

Sir,—I am much pleased to see that you have given insertion to the commencement of a series of articles on English Grammar. The science of language is not so much attended to in this country as its importance demands; and that part which is most attended to is the least useful, namely, the dead languages. It is not uncommon that we find persons who can decline *hic, hæc, hoc,* and gabble for hours about *longs and shorts,* who cannot speak and write their own mother tongue with even tolerable accuracy; and others will show off with their *Parley-vous le Francois, Monsieur,* and give us the next sentence in as bad English as can be well put together. I do not deprecate the study of the dead languages, nor of other living languages besides our own; but I do think that our native tongue is of the most importance, and ought to be studied in preference to all others.

I am glad to see this subject taken up in the pages of the Mechanics' Magazine, not only in consideration of its great utility, but in the hope of having some obscure parts more fully explained than they have hitherto been. We have a variety of grammarians, and scarcely any two of them agree on all points. By whom, then, are we to be guided? The grammarians differ, and so do also the best writers of the day. I want to see the disputed points argued and decided, as far as argument can decide them. This, I trust, will now be done. As your Correspondent proceeds, I will, with your permission, notice whatever points I conceive disputable; and I hope that others, more competent, will do the same. I cannot boast of a classical education, nor even of a common school education—for I never was at school—but I have studied some of our best grammarians, and may, perhaps, know as much of the subject as one half of those who have passed years under the tuition of a master; and, by the aid of your pages, I hope to learn a great deal more: let others learn Greek and Latin; I have but little time to spare, and wish to learn my native tongue.

I am not satisfied as to the propriety or impropriety of some material alterations in our orthography. Some persons write *music* and *critic*, and others *musick* and *critick*. Which method is most proper to be followed? May not the *k* be deemed superfluous in *all* words ending in *ic?* Again, some write *honor, honorable, labor, laborer*; and others *honour, honourable*, &c. Is not the *u* superfluous in all words of this description? It is not pronounced, and therefore I incline to the omission. It seems to me, that the *u* should be retained in those words only which are pronounced with the dipthong long, as in *mound, mouth, profound, rebound*, &c. I do not agree with fanciful innovations in language; but these alterations are already made by many of our best writers, and it is well to create a uniformity as soon as possible. The French at one time wrote many of their passive participles with *eu*, as *leu, peu, seu, veu*, which they now write *lu, pu, su, vu;* and the reasons given by modern French writers for this omission of the *e*, will apply equally well to our omission of the *u* in those words where it is not sounded, or does not lengthen the other vowel.

These may seem immaterial points, but they are a part of our language, and ought to be decided one way or the other; and I am persuaded that a place in the Mechanics' Magazine will be well occupied in their discussion.

Believe me, Sir,

Most respectfully yours,

R. H.

SICK CHAMBER FURNITURE.

In the parish of Chipping Ongar, in the county of Essex, there are provided for the use of the poor, in the time of sickness, not only bed-linen and a wrapping flannel gown, but also a large easy wicker chair, with a head to it, a bed-chair, and a stand for a candlestick, with a convenient apparatus for a pannikin at the top, in which any kind of liquid may be heated, merely by a rush-light. These articles, with blankets, which are distributed amongst the poor in winter, and are required to be returned in warm weather, are kept at the Workhouse, and may be obtained upon application.

The chair, which is also made to answer the purpose of a night-chair, being of wicker, is lighter and more easily carried about than a wooden chair, and has been provided at a reasonable expense, having cost only 1*l*. 6*s*. It has likewise the advantage of being easily washed, as the lining (which is wadded) is only tied in with tapes, and being hooded, is a shelter to the patient against the wind. The candlestick is of modern contrivance, consisting of a tube with a kind of bason at the top of it, both of which are filled with water. Into this tube a rush-light is placed, which, as it wastes in burning, is raised up by the water, and kept always at the same height, by which means it is sufficiently near to the pannikin fixed in a frame above it, to warm any liquid which it contains.

Observations.

The want of some conveniences of this kind in country parishes, must have been frequently noticed by those who are in the habit of visiting the sick cottager or his family. Many a poor person has been prevented sitting up when it was advisable so to do, by not having any thing to sit in but a common chair, which does not afford the support to be found in an easy chair, nor the warmth and comfort to be derived from a wrapping flannel gown, aided by the lining of the chair; and when the weakness of a patient has rendered a removal from the bed almost impossible, the want of a bed-chair has been ill supplied, by some person supporting the patient during the time of administering either medicine or food. The difficulties which poor families experience in obtaining a change of bed-linen during sickness is very obvious; nor is it a trifling inconvenience, that out of a scanty pittance they are sometimes compelled to keep a fire during the night, when the state of the patient would not require it for warmth, and when the heat of a candle, if they had the means of supplying it properly, would be sufficient for the purpose of warming any liquid. If it should appear, upon consideration, that these domestic comforts of the sick poor may be provided in any parish, at a very trifling expense, it is not too much to hope, that this mode of alleviating the sufferings of the sick, and of accelerating their recovery, will be adopted by other parishes.

IDEA OF A SELF-ACTING PUMP.

Sir,—In your 139th Number you have given another "Idea of a Self-acting (alias Perpetual) Pump," by our old friend, Robinson Crusoe; whom I trust I shall not offend, when I declare that, like Viator's, it is erroneous in principle. I pledge myself, with your permission, to prove it so, in your next or following Number, and also to produce a plan of my own for a Perpetual Pump; thereby giving to both Viator and Robinson Crusoe an opportunity of *paying me off*, should they be so disposed, and catch me tripping. I have for some time had the sketch by me, but, from various circumstances, have been unable to arrange it, fit for insertion in your valuable repository of mechanical facts and projections.

I am, Sir,
Your obedient servant,
MONTIS, Junior.

TO FIND THE MOON'S AGE.

SIR,—The epact for the present year, 1826, is 22, *i. e.* the moon's age at the commencement of the year, in days.

EXAMPLE.

Let it be required to find the moon's age on the 20th of September, 1826. It is generally known that a mean lunation, or the time from change to change, consists of $29\frac{1}{2}$ days, or 59 half days nearly, therefore

Epact	22
January	31
February	28
March	31
April	30
May	31
June	30
July	31
August	31
September	20
	285
	2

59)570(9
531
——
2)39
——
$19\frac{1}{2}$ days,

moon's age, 20th of September, 1826.

The above work may be much shortened, thus: the months January and February may be left out of the calculation, because the number of days contained in both months is 59, or exactly two mean lunations.

The months March, May, July, and August, contain one day and a half each above a mean lunation; and the months April and June contain half a day each more than a mean lunation; which differences altogether make seven days, therefore

Epact.. 22
7
20
——
$29\frac{1}{2}$)49(1
$29\frac{1}{2}$
——
$19\frac{1}{2}$ days, moon's age, as before.

Now, $360° \div 29\frac{1}{2} = 12°$ (rejecting the fraction), the moon's mean daily motion eastward in her orbit, which, in time, is 48 minutes, then $\frac{48}{60} = \frac{4}{5}$; therefore, if we multiply the moon's age by 4, and divide the product by 5, we shall obtain the time of her southing, $\frac{19\frac{1}{2} \times 4}{5} = 15$ hours, 36 minutes, or the moon will pass the meridian at the Royal Observatory at Greenwich, on the 21st of September, at 36 minutes past three o'clock in the morning.

We cannot pretend to say that this result will agree with the Nautical Almanack, but we may consider it sufficiently near for common purposes.

I am, Sir,
Your obedient servant,
JOSEPH HALL,
Teacher of Mathematics.
Harpurhey.

ON HEAT.

(For the Mechanics' Magazine.)

SIR,—Most of the notions that have been promulgated respecting the nature and properties of heat, seem to be so very unsatisfactory, and so extremely irreconcileable to the laws of chemical and mechanical philosophy, that the changes wrought in its collection, and by its action, would appear as inexplicable as the operation of gravity itself; but I feel confident that the operation of the matter of heat in its combinations with, and separations from, other bodies, will be found to be purely chemical, and governed by the same laws, or nearly so, as any other simple substance, though its properties remain unchanged when in union with other matter.

1st. I consider heat to be a fluid composed of material particles, which are naturally deposited in the pure state of fire by chemical action.

2dly. That heat cannot be fixed, nor can it become a constituent part of bodies without indicating its presence to a degree equal to its density.

3dly. That the term *latent* is not applicable to heat, either in a pure or combined state, as its presence is always indicated to a degree equal to its density.

4thly. That in all chemical changes where heat is evolved, one substance, at least, must have previously lost its attraction of cohesion by the interposition of heat, or, in other words, become fluid, and thereby a reservoir for that matter which is parted with only at the moment of union with some other matter for which the substance has greater affinity, and the effecting of this new combination is what, in common language, is termed combustion.

5thly. That all bodies, whether metal, wood, stone, coals, or the most inflammable material known, even gunpowder, possess naturally the same quantity of heat in the inverse ratio of their densities, neither of which is capable, whatever may be their affinity, of adding to the quantity evolved by their union with fluids.

6thly. That fluids, and especially elastic fluids, are the grand natural repositories of heat, from whence all the accumulated and concentrated matter, or pure heat, termed fire, is collected.

The basis of inflammable substances is inflammable gases, in a fixed or solid state: this has been produced by a deprivation of heat, which the operations of nature are continually effecting. For example, in vegetable productions we are supplied with this necessarily concentrated matter in abundance; but this matter, though it effects the deposition of heat, does not in any degree add thereto; it is only the cause of heat being deposited in the pure concentrated state of fire, by the superior affinity that the oxygen of the atmosphere has for the gases set at liberty, whereby the oxygen, on entering into the new combination, gives up the cause of its elasticity, viz. its heat, and becomes a part of the compound of a non-elastic fluid; hence the deposited fire, or concentrated heat, is derived solely from the oxygen undergoing the change.

Thus, on pure or uncombined heat, termed fire, being applied to any inflammable substance, as wood, coals, &c. the gases contained in these bodies immediately begin to expand, and charge themselves with the heat so applied; when at liberty, they are in a fit state to unite with the oxygen, which instantly flows and effects the combination alluded to above, by which its heat is deposited; and as the accumulating fire gives liberty to the gases more freely, a greater quantity of oxygen is consequently required, until it has arrived at its maximum of velocity and intensity, which depends on the purity of the material undergoing decomposition, the quantity of such material, and the velocity of the flow of oxygen, as occasioned by natural draft, arising from rarefication, or excited by mechanical means.

That heat cannot be fixed, is sufficiently manifest from its properties, for it is the cause of all fluidity and elasticity; by its power the particles of many substances, however solid, are divided and liquified. Charge any substance in nature with heat, and a corresponding degree of intensity will be exhibited; and such intensity, if the matter charged be a fluid, may be decreased by divisibility to any degree; but still its presence will be indicated, as will presently be shown; hence the heat is not lost, but become powerless, by division and the distance of its particles, arising from combination and expansion.

It may be objected, that, from the small quantity of oxygen in the composition of our atmosphere, so large a quantity of heat cannot possibly be collected; to this I would reply, that the quantity of heat in combination is extremely great, and the heat deposited by the continual and increasing union of the oxygen, has not an immediate and adequate means of escape, consequently it accumulates in a greater or less degree, in proportion to the velocity of evolution.

That the quantity of heat is extremely large in gaseous bodies, is easily demonstrated, by tracing solid matter through the several changes, until its arrival at the state of permanent elasticity, and marking the great absorption that takes place, from its increased capacity for heat. Thus, in liquifying 1 lb. of ice, at 32° temperature, it is necessary to heat 1 lb. of water to 140°, to cause the effect, when, on a mixture taking place, the ice is melted, but the whole is reduced to 32°, the temperature of the previously congealed mass, the excess being requisite to its altered capacity, and is due to its fluidity. Again, when water is converted into steam, its capacity for heat is again increased, for water requires to be heated to about 1100° to flash into steam instantaneously, the whole of which heat it retains; though, by being allowed to expand to 1800 times its original bulk, it indicates a temperature of only 212°. But here, as in the former case, the heat is not lost, nor its properties changed; its particles are only divided by expansion, and consequently cannot indicate the same intensity. Hence we may infer, that the imperceptible vapour that daily rises from the earth's surface absorbs the same quantity of heat in volume, though not in intensity, from the rarefied state at which it is produced, as if heated in the state of water to 1100°.

Again, in decomposing the vapour, or separating the oxygen from the hydrogen, its component parts, it is necessary to subject the particles to contact with the red-hot surface of iron, when the oxygen becomes a fixed or solid oxide, and deposits its previous heat, from which, and the red-hot metallic surface, the hydrogen is charged, and rendered a permanent elastic fluid. Thus is clearly demonstrated the great quantity of heat absorbed by elastic fluids.

As a further and practical proof, we have only to refer to the manufacture of gas, where the retorts and their contents are subject to the most intense heat, which is required to set free the gases, by recharging those that have become fixed and solid from deprivation; yet the gas produced indicates nothing of the intensity of heat it has been subject to, though it has it in combination; this is in consequence of the great expansion it has undergone from a solid state.

The operation of making gas is nothing more than a transfer of heat from the oxygen of the atmosphere to the hydrogen set at liberty; or, in other words, it is merely an expansion of one body, and condensation of the other, occasioned by the transfer of the cause of their elasticity, and which is universally the case, in a greater or less degree, where fire is produced, the fire being merely the heat temporarily deposited during the transfer.

I am, Sir, yours, &c.

* * * * * * Y.

(To be continued.)

NEW PATENTS.

John Billingham, of Norfolk-street, Strand, civil engineer; for an improvement or improvements in the construction of cooking apparatus. Dated April 18, 1826.—Two months to enrol specification.

James Rowbotham, of Great Surrey-street, Blackfriars-road, Surrey, hat-manufacturer, and Robert Lloyd, of No. 71, Strand; for a certain method of preparing, forming, uniting, combining, and putting together, certain materials, substances, or things, for the purpose of being made into hats, caps, bonnets, cloaks, coats, trousers, and for wearing apparel in general, and various other purposes. Dated April 18, 1826.—Six months.

TO OUR READERS AND CORRESPONDENTS.

The two articles, one by J. C. E., describing a Mercurial Vacuum Engine; and the other by "An Inquirer," containing a Plan of a New Two-wheeled Carriage, would have been inserted before now, but that the drawings illustrative thereof have been lost or mislaid since they were given out of the Editor's hands to be engraved. If we are favoured with other copies of the drawings, these communications shall not be denied their claim to an early place.

The following articles (among others) are in the hands of the Engraver, and shall appear in succession in our present Volume:—Improvement on the Cycloidial Chuck, by H. Frampton—New Plan of Working Ships' Pumps, by ditto—Short Method of Training Guns on board Ship, by Lieutenant Higginson, R.N.—Improvement on Gun Quoins for Use on Ship-board, by ditto—Description of the Russian Modes of Heating Houses, by A. W.—Account of a Self-Acting Horizontal Mill for Pumping Water, used for many years in the South of Scotland, by J. Gladstone—On Air Stoves, by M. Saul—Plan of a Vacuum Power Engine, by R. Crusoe—Description of a cheap Substitute for the Bellows Blow-pipe, by G. Dakin—Application of Mr. Brown's (query, Mr. Cecil's) Gas Vacuum Engine to the propelling of Boats, by J. A. Whitfield—Plan for Crushing Bones for Manure, by ditto—Plan for Regulating Chronometers, by W. Crosbie—Description of Mr. Hayter's Perspective Tripod—Plan of a Rotatory Steam Engine, by H. C——ll.

Communications have been received from—T. M. B.—H. C.—Diamond—Monitor—An Old Stager—F. F.—D. X.—A well-wisher—Phædrus—W. Simpson—N. Smith—Tubal Cain.

A Supplement, containing Preface, Titles, and Index, to Vol. V., will be published on the 1st of next Month.

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Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 142.] SATURDAY, MAY 13, 1826. [Price 3d.

"The learning of antiquity must always be venerable, but it does not follow that it is entitled to adoration. There have been one or two modern discoveries worth all the ancients ever knew."
Boileau.

TURNING.

IMPROVEMENT ON THE CYCLOIDAL CHUCK.

Fig. 1

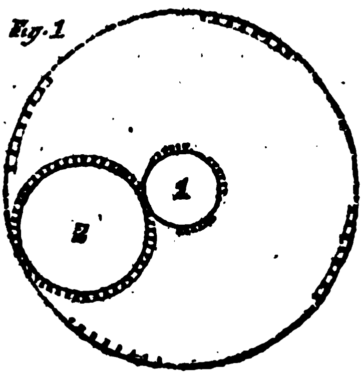


Fig. 2

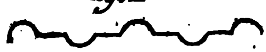


Fig. 4

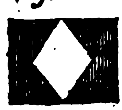


Fig. 5

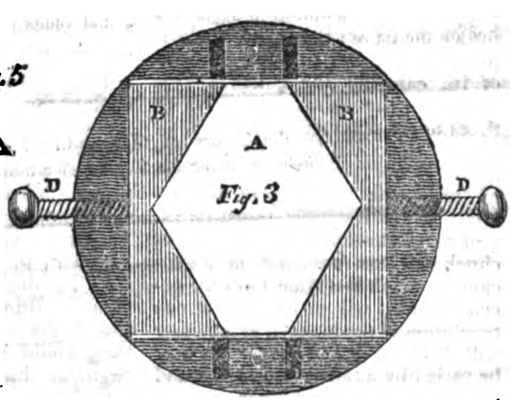


Fig. 3

Fig. 6

TURNING—IMPROVEMENT ON THE CYCLOIDAL CHUCK.

SIR,—I wish some person who has a square chuck (I do not mean a square hole chuck) would favour your readers with a drawing and description of it, and likewise describe the method taken to give a slow motion to a rose-engine. The method I use, is to place an endless screw on the arbor of the first pulley, which works in a pinion of eight leaves, on the arbor of which is another endless screw, which works in another pinion of eight, on the mandril; but this mode is not slow enough—a pinion of 24 would be better. If we leave out five teeth at each of four places in the first or fixed wheel, and place as many teeth on the plate to which it is fixed, opposite the same places, and at such a distance from it as to take into the teeth of the second, on the outside, when it passes the blank places in the first, the figure will be of a serpentine form. Fig. 1 will illustrate my meaning.

It is proper to observe, that these teeth should just let the wheel, No. 2, be free from them before it takes the teeth of the first; and *vice versa*. But if there were no more than six single teeth, standing at equal distances on the first, and two or three teeth at a place opposite the blanks, as above, the figure produced would be like fig. 2, or something similar to it. For the first figure I mentioned, I would fix a 96-toothed wheel on the puppet, to turn a pinion of 12 leaves for a second; on the arbor of which place another 96, to turn a pinion of 16, carrying the chuck. This will cause the chuck to revolve 48 times to the mandril's once, and, of course, there will be as many turns in the figure. For different numbers of turns, the numbers of the pinions, or small wheels, must be varied as circumstances direct. This chuck will decorate a box or watch-case in much less time than the eccentric, as it will do as much at one revolution of the mandril as the other will at 48, &c.; and the figures may be varied by altering the radius and eccentricity, as in the other.

The following is a chuck I have invented for holding boxes, or other short work, which, I think, may compete with Mr. Speers:—

Fig. 3 exhibits a front view of it; it is of metal, and an inch and a half thick, besides the part that screws on the mandril.

A is a square hole, and level at bottom, an inch deep, more or less.

BB are two pieces an inch thick, or sufficiently thick to be level with the surface of the chuck when put into it; across the ends of them are cut rabbets a quarter of an inch wide, and so deep as to admit the plates CC to slide on them, to hold them down close to the bottom of the square hole. These plates have two slits in them, through which two screws pass to hold them firm to the face of the chuck, and keep the pieces, BB, in their places; which slits allow the plates to slide back when you exchange the pieces, BB, for a different size, as you must have two or three pair of them, as they cannot be screwed more than an inch closer together; for that is the use of the screws at the sides, DD, which also adjust the work to the centre at A, one way, as the form of the pieces do the other. The pieces BB are of the shape represented in fig. 4, and CC are like fig. 5. If the square hole should be too deep, a round back-board, something less than the work, may be put in first. And if some round blocks be turned, of two, or two inches and a half thick, and one of them put into this chuck and screwed tight, it will serve to clap a box or cover on, to do any thing to the outside of it, and preclude the necessity of a greater number of chucks.

I never saw an engine-lathe, or engines for a lathe, till I made them for my own use (except an oval chuck); but I should be much obliged to any person who would send a drawing and description of the following, to be inserted in your Magazine, viz.—the Sliding Rest, Segment, and Rose Engines; Chuck for Turning Squares, Universal Chuck, Running Center Chuck, and Right Line Chuck; and that they would say, also, whether the Segment Engine describes circles complete.

The following is a description of a Segment Engine I invented for my own use:—First, on the mandril is screwed a chuck, with a screw and slider, as in the eccentric chuck; on the centre of the slide projects a round and polished pin, 3-8ths of an inch high, which, by turning the screw backwards, may be set out to an inch from the centre, more or less, as may be required, according as the segment desired may be greater or less. On the slide screw is a small round plate, divided into ten equal parts, and the screw is ten turns in the inch, which, by the help of the plate, and a small point on the chuck, divides the inch into 100 equal parts, 96 of which I make equal to a circle; so that if the screw be turned backwards nine turns and six-tenths, the engine describes a complete circle; consequently, the number of turns and parts gives exactly the measure of the desired arc. A block of wood is fixed to the face of the puppet, sufficiently thick to be flush with the face of the chuck, only the pin projects beyond it. On this block is placed a rack, as represented in fig. 6, in the slit of which the pin moves; this rack turns on a screw, by which it is fastened to the block, and its teeth turn a toothed-wheel moving on a pin, the teeth of which are two less in number than those of the rack. On this is fixed an eccentric chuck, which screws out either way, forward or backward.

I have since invented an engine which turns circles, segments, or right lines, at pleasure, at any part of the work, and in any direction. I, however, defer the description till I write again. I know not what means are made use of for dividing mathematical instruments, but I have contrived two engines that will divide, one right lines, the other circles, in any required number of parts, equal or unequal, with the greatest accuracy and despatch.

To return to my improvement on the cycloidal chuck: it will be proper to have seven pair of wheels, viz.—two of 96, two of 48, two of 32, two of 24, two of 16, two of 12, and two of 8 teeth each; and then I would recommend to fix a 96-toothed one on the puppet, in the manner your Correspondent recommends; and the other 96 for a third wheel; the second and fourth to be changed as occasion requires. But as the second is easiest changed, I should think it best to change that only, when that will give the required number of turns. The following table will show the number of turns to be obtained by any combinations of these numbers:—

Second.	Fourth.	Turns.
48	48	4
32	—	6
24	—	8
16	—	12
12	—	16
8	—	24
32	32	9
24	—	12
16	—	18
12	—	24
8	—	36
24	24	16
16	—	24
12	—	32
8	—	48
16	16	36
12	—	48
8	—	72
12	12	64
8	—	96
8	8	144

These wheels are to be toothed, so that any of them will work well with any of the other. If your Correspondent will give this a trial, I think he may safely compare it to the kaleidoscope for variety, if he varies the radius and eccentricity also, through all the varieties to be obtained by that means.

I am, Sir,
Yours respectfully,
H. Frampton.

MR. CHEVERTON'S NEW GAS POWER-ENGINE.

(To the Editor of the Mechanics' Magazine.)

[CONTINUED FROM PAGE 9.]

Safety of the Engine.

2. The second particular under this head refers to the liability of the engine to explode. It will be proper to view this part of the subject in connexion with the steam-engine, not only because it will enable us to form a correct estimate of the comparative liability of the two engines to explode, but it will afford a preparatory insight into the nature of the securities which ought to be adopted, and impress the necessity of resorting to other means for protection than what have hitherto been employed.

Nothing would be more simple, or more removed from casualty, than the prevention of explosion, provided dependence could be placed on the original strength of vessels continuing always the same; boilers could then be made equally free from danger, whether containing high or low pressure steam, and the safety-valve would become in reality what its name imports. Now, though it is so obvious that this proviso is, in most cases, inadmissible, yet some vague idea to the contrary must be entertained, or the unlimited confidence rested on that contrivance is altogether unaccountable. The name may have misled—it is properly a regulation-valve; that is its direct and necessary effect, but safety is only an incidental and contingent result. A standard of strength is set up, and the safety-valve effectually regulates the maximum force of the steam to that point. Left to itself, it is an infallible check to the further increase of its strength, but it has no relation to the decreasing strength of the boiler. It is assumed or *hoped* that the latter will not descend to the same point. The standard of strength continues constant, but the diminution may go on till they meet for any thing in this contrivance to prevent it; hence safety ultimately depends on a variety of considerations, and too often on that of expense. It frequently happens that this observation accompanies the account of the bursting of a steam-boiler, that another was being constructed at the time.—What has been said equally applies to Mr. Perkins's contrivance of a bursting globe, and to the fusible plug. They are alike nugatory with the safety-valve, in respect to the particular adverted to. They have their uses, and most important ones, to which it is not denied that they are fully adequate, but they have a reference only to the force of expansion, and not to the capability of resistance. This is slowly but constantly being undermined, and in danger of being rapidly reduced. There is a fear of deposits causing the metal to *burn*—of inattention to the water-line occasioning the iron to be heated to the degree required for the production of hydrogen gas, and to the inflammation of which must doubtless be attributed the more tremendous explosions—those are the hazards. There is a certain and unceasing erosion of the metal by the action of the fire, and an increasingly destructive effect on the cohesive force of what remains; but, above all, there is the mischief arising from the unequal expansion of the metal on its opposite sides, occasioned by one having the temperature of the water and the other being exposed to the most intense heat. What can be expected from a difference of many hundred degrees* between the temperature of the two surfaces of a boiler made of thick and frangible metal, but that the inside will be rent in numberless minute fissures, a few of which, taking the lead, will terminate in a fracture. Even in the case of thinner and tougher metal, the grain must be strained or ruptured afresh with every lighting of the fire. In vain do we, to fly

* This may be allowed without supposing the boiler to be at a heat at all approaching that of the fire.

other evils, seek for security in thickness of metal for the difference of temperature, and the resulting mischief is thereby augmented. Hence the reason why the large and thick evaporating-pans so often crack, though open, and consequently subject to no pressure but what arises from the weight of the substances which they contain: the effect is generally ascribed, I believe, to this last and certainly inadequate cause. Hence, also, the great difficulties which Mr. Perkins has had to encounter in respect to his generator: he sought for strength in substance, and was foiled; he has found it, I believe, in thinner metal, but of great tenacity. His best security, however, is in his peculiar and admirable method of producing steam, by which the bursting of the generator has no other consequence than inconvenience and expense. The subtle agency of caloric is probably exercised with deteriorating effect on the strength of metals, in other ways than those with which we are acquainted. Where there is accumulation, difficulty of transmission, and proximity of very different intensities, other effects than what mechanically arise from unequal expansion, and having some analogy to or connexion with electricity, may well be conceived from such a state of things; and certain it is that agent is developed.

Now all these inconveniences and sources of danger are avoided in the new engine—no intense heat is required; and, what is of equal importance, no intense heat is immediately applied. Caloric is imparted through a medium, and though in a diffused form, the abundant store which is every where present, the facility of communication, and the extensive surface of the generator, are circumstances which more than make up for its want of concentration, by the celerity with which the required quantity is afforded. On the other hand, it is very probable that sources of danger peculiar to the case will have to be encountered, but happily they are of a more manageable character. They arise from the chemical action of the gas or liquid on the vessels, and by chemical means it may be counteracted; at least there is a wide field open for the attempt: but, from the agency of electricity may probably be derived the most efficient aid. The admirably ingenious method devised by Sir H. Davy, for the protection of the copper sheathing of ships' bottoms from the corrosive action of sea water, may perhaps be employed in this case with the most complete success. I am not aware whether this application of that most efficient and beautifully simple contrivance has attracted his attention. It will, however, be assumed that no liquid, metal, composition of metal, chemical or electrical means can be found, through the use of which a *slow* deteriorating effect on the strength of the vessels can be avoided. Should it be otherwise, still it would be proper to adopt the precautions which will now be proposed.

What is the nature of a safety-valve? It is a weak place in a vessel, which, first giving way, prevents an entire explosion by the permission of a partial one, and this being of trifling extent, it is accompanied with no bad consequences. How obvious, then, that it ought not to continue of the same strength if the vessel does not: to say the least, the decrease should be proportional. Instead, therefore, of enabling the weak place to oppose, under every circumstance, precisely the same resistance, by the invariable pressure of a weight, it ought to make an integrant part of the vessel, and be alike subject to all the casualties or increasing operations which affect its strength. Hence this safety *vent* (as I shall take the liberty of calling it) will not possess a regulating character. The two purposes are incompatible in one contrivance, and should be accomplished by separate means. In the steam-engine, the steelyard (or safety) valve should be retained, both as a convenient mode of equalizing the intensity of force, and as an immediate check on *that* source of danger; but in the gas-engine it is inadmissible. The regulation of the intensity of force must and can be identified with the regulation of the production of power.* The contrivance for security being thus divested of its embarrassing duplex character, the proportion between its capability of resistance and that of the vessel, may be very different in the case of the safety-vent, from what has obtained with the safety-valve. In the latter case, the proportion is at first between 10 and 20 to 1 in favour of the vessel. This is to cover, at a venture, all subsequent reductions of its strength. The resistance of the valve continuing at unity, the ratio, or measure of safety, is always lessening, consequently the vessel becomes more and more dangerous the longer it is in use; and without giving any indication of its progress, it gradually approaches to the verge of an explosion. But with a safety-vent, the proportion may, with propriety, be as 2 to 1,† for it will never be *less* than it was at first. I have said that, in order to ensure this result, there should be at least a proportional decrease in regard to the vessel and its safety-vent, of their respective capabilities of resistance. It would be better, however, so to provide, that the diminution should proceed by equal decrements; consequently the vessel will become more and more safe the longer it is in use—that is, the ratio of their strengths will increase in favour of the vessel. This is of easy contrivance, in respect to the generator. It is only to make one of the tubes of half the strength of the other. Suppose it to be capable of resisting, at first, a pressure equal to 500 atmospheres, all the others 1000 atmospheres, and the usual working pressure to be equal to 100 atmospheres. The original proportion between the weak place and the vessel is as 2 to 1; but at the time of its giving way under the ordinary elastic force of the gas, it will be as 6 to 1. Allow of an occasional increase of power to double the usual amount, and if a rupture then takes place, the proportion will be as 3½ to 1. Thus, instead of making the difference so very great, when every thing is new and trustworthy, I would propose that it should be inconsiderable at first, and be made to increase with the frailty of the vessel. These proportions will be thought greater than need be, if the definitive nature (it may be said, the infallible character) of the security is considered, as also the peculiar construction of the generator. For as to this last respect, if, by some unaccountable negligence, there should be defects in the tubes, so considerable that some of them should happen to be weaker than the safety-vent, the weakest would go first, and answer the same purpose. To secure a certainty as to the ratio, it should be a peremptory rule, that there shall be an entire set of new tubes, in case of the safety-vent being burst, whether in consequence of a gradual deterioration, or of an accidental increase of force. It may be thus ruled in case of the rupture of a faulty tube, but there is not the same necessity.

From what has been said, it will be seen that, by this contrivance, every possible source of danger is met and obviated, so far as the generator is concerned; and which vessel, it will be remembered, is the only one which requires to be made thin, or which is peculiarly exposed to injury. The others should be made so immensely strong, as to excite no greater apprehension of their giving way, than is now entertained in regard to the *cylinder* of the steam-engine. If Mr. Perkins has succeeded in compressing water with a force equal to the pressure of 2000 atmospheres, they may, before being put into use, be proved up to that point, which would exceed by twenty times the resistance which they would have to exert. The utility of this proof would be to detect flaws, and to try

* In the steam-engine there is a threefold regulation, of the production of power by Mr. Murray's damper, of the intensity of force by the steelyard-valve, and of its admittance to the resistance by the throttle-valve. With a safety-vent the invention would be more complete; every operation would then have its check.

† It is scarcely necessary to remark, that this is not the proportion between the strength of the vessel and the working pressure, as in the case of the safety-valve.

the tightness of the joints, rather than the entire strength of the vessels. I have in another place admitted the *possibility* of the cohesive force of thick metal being gradually destroyed by the gas or vapour*, of the liquid employed. Not to be wholly without a warning on this head, I would propose, that two plates, of the same metal as the gasometer, having the same area of resistance, but of only half its thickness, should be securely joined together, with an interval between them of one-sixteenth of an inch. This space should communicate by a very small aperture with the generator or gasometer, and be loosely packed with some absorbent substance, on which the liquid employed has no effect. The plates being exposed to the temperature of the atmosphere, the packing would be kept constantly moist with the liquid, thus sufficiently subjecting them to its deteriorating action; at the same time, alternate condensation and evolution of gas could be effected to so little amount, and would proceed so tardily, as to occasion no hurtful influence on the operations of the engine. This safety contrivance would, of course, explode before the gasometer, and in quite a harmless manner. The effect would be similar to the bursting of a cannon by the freezing of water confined in its bore, or like the rupture of Mr. Perkins's generator. It would not be proper to give it a tubular form in this instance; for though made equal to the strength of the gasometer, the greater thinness of metal would occasion its deterioration to proceed with too great relative rapidity. This sort of safety-vent may be placed at the bottom of the alternator, and made to communicate with the generator by one of its tubes, lengthened for that purpose. The packing would be dispensed with, and being always full of the liquid, it would be subjected to a trial yet more severe.

I am, Sir,
Your obedient servant,
BENJ. CHEVERTON.

Kingsdown, Bristol.

(*To be continued.*)

* By this word, I mean that state of extreme comminution which, without rendering particles invisible, enables them transitorily to float in any atmosphere. It would be well if the term was restricted to its popular meaning, and used in this sense in chemistry, otherwise we have a phenomenon without a name.

MEASURING THE CONTENTS OF CYLINDRICAL VESSELS.

SIR,—I perceive I have been anticipated by W. T. R. (a Blue), page 351, vol. v., respecting the measurement of cylindrical vessels; but, though he has given the *fractional multiplier* required, he has *not* given the method of finding it; neither has he given the divisor by which the same results may be obtained as by the *multiplier*. Under these circumstances, Sir, I leave it to your judgment whether it may not be proper to insert my communication.

I am, Sir,
Your very obedient servant,
T. S——+, Jun.

The following is the method adopted by T. S.:—

If the radius of a circle be ,5, and the circumference 3,1416, then 3,1416 × ,5 × ,5 = ,7854, which is the multiplier for finding the superficial content of a circle in square inches.

Then, as the imperial gallon contains 277,274 cubic inches, ,7854 ÷ 277,274 = ,00283257716, ÷ the multiplier sought; ,002832, however, will be sufficiently accurate for all *practical* purposes.

Now, supposing we take the same example as that cited by your Correspondent, then, according to the rule given by him, 21,5 × 21,5 × 76,25 × ,002832 = 99,818265 = 99 gallons, 3 qts. 0 pint, 2 gills, ,184 + imperial measure, which is equal to 119 gallons, 3 quarts, 0 pint, 2 gills, 83 of the *old* measure, the imperial being *one-fifth* larger.

There is another method, adds T. S., by which the contents of cylindrical vessels in imperial gallons may be ascertained, which is, by finding a *divisor* which will give the same result, and with equal facility. It is thus obtained: 277,274 ÷ ,7854 = 353,036 +. Then 21,5 × 21,5 × 76,25 = 35246,5625 ÷ 353,036 = 99 gallons, 3 quarts, 0 pint, 2 gills +.

HORIZONTAL WINDMILL, FOR PUMPING WATER.

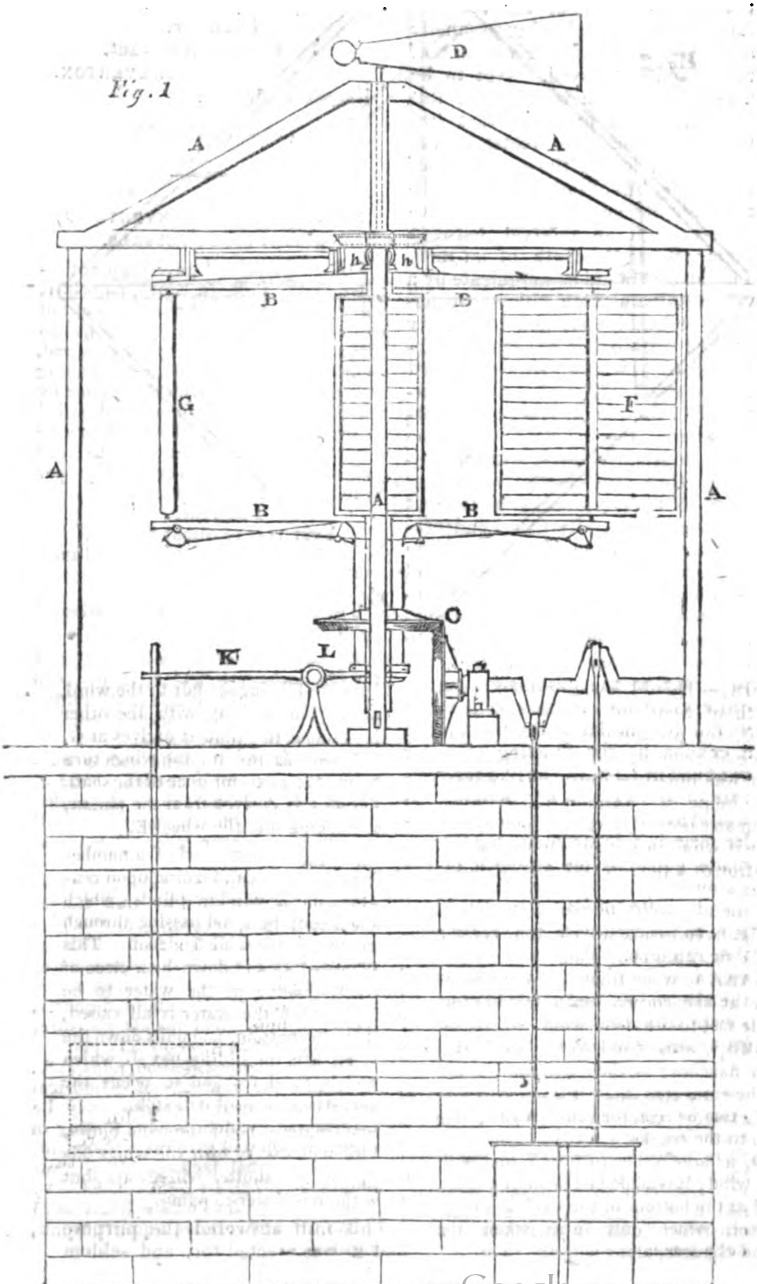
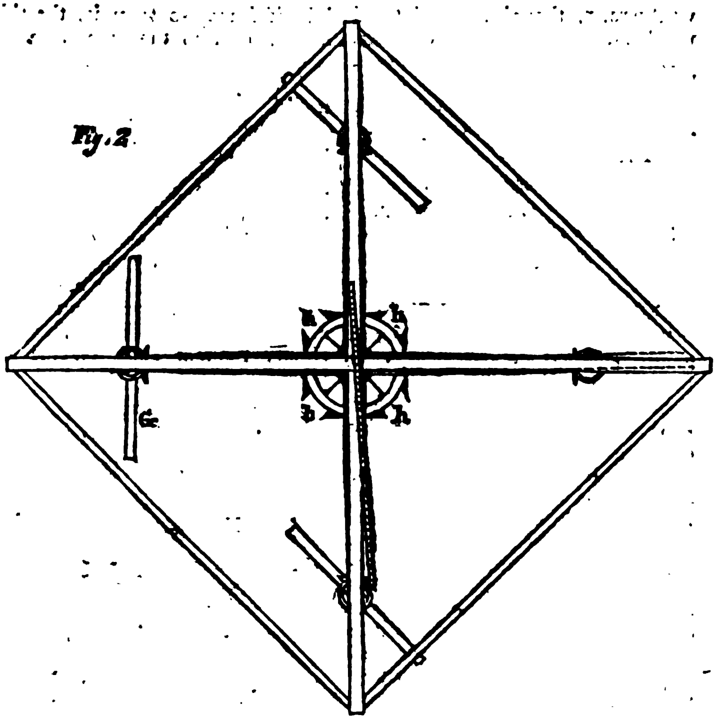


Fig. 2.



SIR,—This Mill was erected in the south of Scotland, about the year 1810, for pumping water off a low piece of ground, which in rainy weather was mostly covered with water, and being a considerable distance from any house, it was so constructed that it would act itself, with the exception of a person giving it oil daily.

Description.

Fig. 1 represents an elevation of the mill; fig. 2 a ground plan.

AAAAA, wood framing, bound together at the corners with iron knees, made fast to the stone-work.

BBBB, arms fixed to the shaft with iron flanches; at their extremities, are bushes to receive the wings.

C, two wheels, for conveying the motion to the cranks.

D, a large vane, to turn round with the wind; it is made fast to an iron shaft, and at the bottom of the shaft is a bevel wheel, which only turns when the wind changes, along with the vane.

The wing F being set fair to the wind, is carried round along with the other three; and by the time it arrives at G, goes edgeway against it: the wings turn half round their axis for once of the shaft. This motion is derived from the pinion, *hhhh*, working into the wheel E.

The wings are composed of a number of thin pieces of deal, turning upon centres (the same as window-blinds), which open and shut by a rod passing through the centre of the wing gudgeon. This rod is moved up and down by a piece of wood, I, floating in the water to be pumped; when the water is all raised, it falls to the bottom, and pulls down the lever, K, lifts the sliding-box, L, which the rod is fixed to, and so opens the shutter, when the mill will stop.

From whatever point the wind blows, the vane will always turn the wings fair for it, and the shutter will always shut when there is water to pump.

This mill answered the purpose that it was erected for, and seldom went wrong, though exposed to all weathers, and raised a deal of water.

Mills made on this principle would be very serviceable in many situations, where other powers cannot be had without considerable expense.

I remain, Sir,

Yours respectfully,

J. GLADSTONE.

Leman-street.

NEW GUN-CARRIAGE TRUCK.

SIR,—The new discoveries continually making for destroying the human race, although contrary to the dictates of humanity, are no less sanctioned by self-preservation, by enabling us more effectually to defeat our enemies. The following sketches and descriptions inserted in your scientific Magazine, may tend to effect the above purpose. If by a simple method (although long in detail) three shot in lieu of two can be discharged in a given time, the power of resistance is increased one-third; and this, I think, may be effected by a temporary fifth gun-carriage truck, applied transversely to guns, more particularly on board of ship.

The present mode of training heavy guns to any object, is not only laborious, but extremely unsteady and uncertain,—dragging the gun by tackle-falls, and the jerking aid of handspikes and iron crow-bars, to the great injury of the deck; the hooking, unhooking, and overhauling these tackle-falls, greatly retard the operation of firing, and make it difficult to take a correct aim, unless at close quarters, which the French do not like, and, if possible, endeavour to avoid.

The weather guage has its advantages as well as its disadvantages; the former, in keeping clear of smoke, and consequently enabling you more easily to distinguish your enemy; the latter, in not at all times enabling you to open your lower deck ports.

The lee gauge has its disadvantages, as before cited, and also in rendering it more laborious, and consequently requiring more hands occasionally to work the guns, against hill, if I may so term it, the ship heeling over to the other side. It is here where the transverse truck, which I propose, would be chiefly useful.

To have the decks as clear as possible, in time of action, of all disposable paraphernalia, and the training of the guns made easy, and nearly as possible with perfect security, if to be accomplished by simple means, is certainly very desirable—the trial is worth the very trifling expense. One good precise aim, with increased celerity, is worth twenty random shots on the old plan.

I am, Sir,

Your humble servant,

G. M. H——N, R.N.

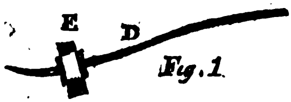
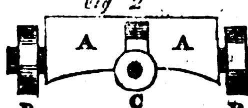


Fig. 1.

Fig. 3

Fig. 2



Description.

Fig. 1. D is a crow-bar, always placed to each gun, such bar being made to vary but little from its present form in use, excepting being made perfectly circular on that part where the truck, E, is to ship on and traverse, with a shoulder to keep it in place, and a linch-pin on the other side; the form of the bar being such as to ship and unship the truck at pleasure; the bar may be applied to any of the usual purposes required. To lift the after gun-carriage trucks half an inch from off the deck, place the claw of your bar underneath the centre of the axle; the truck, D, then beomes the lever point, and the shorter you can make your fulcrum from the weight you

desire to raise, the greater your lever power. The pressure (I should think) of two men on this lever will lift the two after-trucks clean off the deck, and bring the whole weight of the after-part of the gun on the transverse truck, D—the gun is then nearly on a pivot; have a short hook-rope on each side of the extreme after-part of the gun-carriage, and two or three men could train the gun steadily and truly to the object required. When obtained, remove your lever instantly, as the gun is then on its proper trucks for the recoil; with this you need not the jerking training of handspikes, and tackle-fall purchase, which in hooking, unhooking, and overhauling, takes time, and is greatly in the way, in the hurry and bustle of action.

ANOTHER METHOD.—Fig. 2. AA represent the after-axle of a gun-carriage; BB, the two trucks; and C, the transverse truck, half an inch clear of the deck; form a dovetail groove in the after-part of the axle, leaving a ledge on the upper part of it; then have an iron piece formed with a projecting axle from its lower extremity, for the truck; this iron piece fitting into the dovetail groove of the axle, so as to slide freely within the axle groove, leaving a space (as shown by the dark space in the axle) clear between the upper ledge of the axle, and the upper part of the sliding transverse truck iron piece, as in this space (shown by the shading of it) you ship your crow-bar, or handspike lever, by which pressure you force down the transverse truck, and raise the after-part of the gun-carriage, and thus, as in the mode of fig. 1, neutralize the two after-trucks. With this lever you have a powerful force in aiding the training, in addition to the hook-ropes; for at the same time that the men retain the pressure on the lever, they can add their force to training, without fear of displacing the lever, if the upper part of the groove in the axle be made sufficiently deep, and the sliding-iron made to project beyond the surface of the axle, with a perpendicular projection from its upper end, thus [J, for the lever-power to rest in; and with so long a lever as the crow-bar will form, from the extreme end of the gun, I think the power would be sufficiently great for training, that it would not even require the side hook-ropes to be used.

Another method may be applied instead of the groove, as in fig. 2, by means of an iron bar, as in fig. 3, applied at pleasure, bolted through at each extreme end of the after-part of the cheek of the gun-carriage; in the centre part of this bar (it being made of a greater substance in the centre) have a square orifice cut through, and a piece of iron for sliding easily within it, with a projecting axle at its lower extremity for the transverse truck, with a horned projection, as represented on the upper part of the sliding-piece, made to screw off and on, for the facility of shipping and unshipping the machinery; then form an orifice in the axle of your gun-carriage for the entrance of your lever, resting it within the horned projection of your sliding-piece, and it will produce the effect as before-mentioned—depressing the transverse truck, and raising the gun-carriage. To the machinery of either fig. 2 or 3, it will be necessary to have a spring to return the truck to its proper position, and there keep it. After its required purpose is effected, it may be thrown up by hand with a slight catch, but this would not be so certain; and if not clear of the deck at the recoil, all would be torn off.

For the iron eye-bolt affixed to the centre of the after-axle, for hooking on a tackle for running in the gun, when necessary, may be substituted a span-rope, with an iron grommet.

MODEL OF A WINDMILL WANTED.

SIR,—I have a patent corn-mill (one strong man power), which I much wish to work on R. H.'s plan (No. 113, vol. v.); but his is objectionable, on account of noise, my mill being in a private house: I also wish to be able to shift the wings or arms, leaving only the perpendicular shaft standing. Now, I would willingly present a guinea to any mechanic who would produce me a model which shall answer my purpose. The mill is now in a loft in the roof, with R. H.'s perpendicular shaft B attached to it, but my ingenuity can get no further.

I remain, Sir,

Yours respectfully,

W. W. H.

INCREASE OF HEAT IN DESCENDING INTO THE EARTH.

The increase of temperature in coal mines in proportion to their depth, is a fact familiar to every person who has had occasion to frequent them. The cause of this has been the subject of much speculation; one class of writers ascribing it to the existence of some great source of heat in the interior of the earth; and another to the decomposition of pyrites, which abounds in coal and the accompanying strata, and which is known to produce, when decomposed, actual combustion. The following explanation of the phenomenon, given by Mr. Matthew Millar in the Memoirs of the Wernerian Natural History, appears to us, however, a great deal more simple and satisfactory:—

"In every mine, with the exception of a few, which are level-free, the ventilation is carried on by causing the air at the surface to descend, and traverse the works, and then ascend. Now, it is evident, that if a portion of air from the surface be carried down to the bottom of the mine, it will be condensed in proportion to the depth of the mine, and, in consequence of this condensation, will become heated, and the degree of heat will of course be in proportion to the depth of the mine. The air thus heated traverses the works, and imparts its heat to the strata; it then ascends, and is succeeded by a fresh portion of air from the surface, which in the same way becomes heated, and imparts its heat to the strata, and they, in turn, communicate it all around. Thus, in a long course of working in a deep mine, the air at the bottom is heated, and also the rocks to a considerable depth; and when the working ceases, the mine takes a long time to lose its temperature; and this is found to be the case particularly when the mine becomes full of water, the water being found at first of a high temperature, and gradually to lose its heat, which is in consequence of the strata imparting theirs to the water; and as soon as they have given out all their heat, the water indicates the mean temperature nearly of the place.

"The reverse takes place in an old mine when reworked; in that case, the temperature rises gradually as the working continues: and in those mines which are not worked, but in which the ventilation still goes on, I believe it will be found that they do not lose more of their temperature than can be placed to the abstraction of the other causes of heat in working mines, such as that produced by the men and the lights.

"The exact quantity of heat given out by air in proportion to its condensation, it is difficult to ascertain; but every day's experience proves it to be very considerable; and, I believe, this, added to the other obvious sources of heat in mines in a state of working, will be found sufficient to account for their high temperature."

CAUTCHOUC MOULDS.

Sir,—Cautchouc is said to be elastic, strong, and *adhesive on the surfaces*; the water passes through it *slowly*, and it will keep in the state here described for several months. These properties show that it is particularly well adapted for enclosing any flat piece of work that is to be cast in plaster of Paris or other cement. By cutting the cautchouc into slips of various sizes, it would thus serve as a permanent wrapper, and be an improvement, I conceive, upon the method now in general use, of battering out a lump of clay to the size required, which operation is, from obvious reasons, obliged to be repeated almost every time a mould is cast.

I am, Sir,

Yours respectfully,

T— T—.

Terra Incognita.

HOW TO ASCERTAIN THE SHAPE OF TEETH IN WHEELS.

Sir,—If the following method of ascertaining the exact shape of teeth in wheels, either for mill-work or clock-work, should be thought useful, your insertion of the same in the Mechanics' Magazine will oblige the undersigned, who has proved it of advantage in mill-work. It may possibly be nothing new to many, but, being so to myself, I was willing to forward it, believing there may be some who do not know so good a method.

I am, Sir,

Yours most respectfully,

Wm. Saunders.

Shillingford, Oxon.

For two wheels, say a spur-wheel of eight feet, and a nut 20 inches diameter (though it matters not of what diameter), take a piece of three-quarters board, sufficient for four or five cogs. In the case of the nut fix a bit of wire for a centre, then make a cuckold with three nails drove through a piece of board, and, having made a hole for the centre in a bench or on a plank, lay it down, and fix the cuckold so as to describe the pitch-line on the board when moved forward; it should then be worked off true to line and square with the plane, and, when that is done, it should be put down again, and a piece of tin tacked on to extend beyond the pitch-line rather more than it is intended the cogs shall exceed it in length. Turn it again, and strike the pitch-line on the tin; then provide for the spur-wheel in the same way. When both are done, take the pieces of tin off carefully, that they may be put down exactly in the same places when wanted. Now place the two centres or wheels on the bench, or on a plank, so that the pitch-lines shall come nearly in contact. To connect these, take two strips of thin tin, eight or ten inches long, and rather less than half the thickness of the board in width, and nail them on the edges of the board, that is, one end of the strip to the nut, and the same strip to the spur-wheel, while the other strip is reversed. When that is properly done, both wheels will move either way correctly. Now tack on the nut the piece of tin that was taken off, and fix the cuckold on the spur-wheel, so that the point may be just in pitch-line when exactly straight between the two centres. Next move the wheels forward and press the cuckold slightly, and it will describe the shape of the nut-cog on the outside of the pitch-line on the tin. That done, fix the cuckold on the nut, and let the point be placed at the end of the nut-cog in the shape-line last struck: take up the tin from the nut, and be sure not to disturb the cuckold, and put down the tin belonging to the spur-wheel. Now move again, pressing on the cuckold, and it will describe the shape of the spur-cog on the inside of the pitch-line; then take up the cuckold, and move the wheels till the point where the last shape-line intersected the pitch-line on the spur-wheel, which is exactly between the two centres. After this fix the cuckold to the nut with the point just at the intersection of the pitch-line, then move it, and it will describe the shape of the spur-cog on the outside of the pitch-line. Next fix the cuckold on the spur-wheel, with the point at the end of the spur-cog in the said shape-line, then take up the tin from the spur-wheel, and put down the tin again on the nut; now move it, and it will describe the shape of the nut-cog inside of the pitch-line.

N.B. In striking the pitch-lines, allow for the thickness of the two strips of tin which connect the wheels. As the back part of the cogs may be the same as the front, and are easily taken off the tin with a pair of compasses, there is no need of a repetition for the back part. The advantage to be gained by this method, is, that more cogs are at work at the same time; and they will work deeper than some other ways; indeed, an inch and a half pitch will work an inch and a half deep, and be left full of wood, as it is common to express it, at the pitch-line.

PREPARING COLOURS.

SIR—Having more than once seen in your valuable Publication (of which I am a constant reader), the nature and brilliancy of Colours adverted to, and having some little experience on the subject, I feel induced to attempt to communicate, with your permission, some of the fruits of that experience. And, Sir, first, let me say, that William Galward, your correspondent, is perfectly correct, in the importance he ascribes to the colours being perfectly levigated, and used with size instead of gum-water, which not only destroys their beauty, but even turns some almost to blackness. The mode, however, which he recommends for washing the colours, I do not agree with. The manner of washing I would recommend is this:—First, the matter intended to be brought by this operation to an impalpable fineness, must be well levigated; or, if it be a body of a chalky texture, as the ochres, it must be broken to a gross powder by pounding. Let it then be put into a deep bason of very clean water, almost full, and well stirred about therein. After it has rested till the grosser parts sink to the bottom, let the water, together with the finer parts yet suspended in it, be poured off into another bason of the same kind, and suffered to stand at rest till the powder has totally subsided, and left the water clear. Let as much of this water as can, without disturbing the sediment, be then poured back into the first bason, and let the stirring and decantation, &c. be repeated as before, and as often as may be necessary to separate all the powder that is of sufficient fineness. The remaining grosser part may be then again ground, and the same treatment repeated, till all the powder or matter is obtained in the state required. In some cases the operation has to be repeated several times, before the colour can be rendered so perfectly fine as is generally necessary; but when it is duly executed, pigments may be reduced to the most impalpable powders with the greatest ease, even though, like vermilion, they be of the most obdurate texture. The ochres also, or any such bodies of a chalky or clayey texture as grow soft in water, may be freed from gritty impurities, and rendered of the highest degree of fineness even without any previous grinding.

All colours which are thought to have any mineral intermixture, should be washed several times, that all the injurious particles may be removed. Where small quantities are wanted to be levigated, as for artists, the small glass mullers, with a thick sheet of glass, which are made for that purpose, and to be had at the colour-shops for artists, are most proper.

I am, Sir,

Your obedient servant,

J. AUSTIN.

Hackney-road.

P.S. I should be glad to inquire, through the medium of your work, whether any of your intelligent readers can inform me of the ingredients used in the making of carmine, and the quantity of each necessary? I shall be glad to return the favour if I can.

CAUSE OF EARTHQUAKES.

Dr. Young considers an Earthquake to be analogous to a vibration of the air. M. Gay-Lussac approves of this similitude, and illustrates it in the following manner:—

"The astonishing considerations," he says, "in this great and terrible phenomenon are, the immense extent to which it is felt, the ravages it produces, and the potency of the cause to which it must be attributed. But sufficient attention has not been paid to the ease with which all the particles of a solid mass are agitated. The shock produced by the head of a pin at one end of a long beam, causes a vibration through all its fibres, and is distinctly transmitted to an attentive ear at the other end. The motion of a carriage on the pavement shakes vast edifices, and communicates itself through considerable masses, as in the deep quarries under Paris. Is it, therefore, so astonishing, that a violent commotion in the bowels of the earth should make it tremble in a radius of many hundreds of leagues? In conformity with the law of the transmission of motion in elastic bodies, the extreme stratum, finding no other strata to which to transmit its motion, makes an effort to detach itself from the agitated mass, in the same manner as in a row of billiard balls, the first of which is struck in the direction of contact, the last alone detaches itself and receives the motion. This is the idea I have formed of the effects of earthquakes on the surface of the globe; and I should explain their great diversity, by also taking into consideration, with M. de Humboldt, the nature of the soil and the solutions of continuity which it may contain. In a word, earthquakes are only the propagation of a commotion through the mass of the earth, and are so far from depending on subterranean cavities, that their extent would be greater in proportion as the earth was more homogeneous."

ELECTRICITY AND MAGNETISM.

Sir—Your Correspondent H.R.W. says, he should be obliged to any of your scientific Correspondents, if they could inform him whether it is possible to communicate magnetism to a piece of steel wire, by means of a large electrical battery, without making use of a helix. In answer to your Correspondent H. R. W, I have only to recommend him to adhere to his second method, and he will be sure of success. I have repeatedly performed the experiment, and always succeeded in rendering the pieces of steel magnetic, though not so powerful as when I made of use of the helix.

H. R. W. need not hermetically seal the glass tube; it is only labour without advantage: a glass tube, open at both ends, and surrounded by a helix, will be sure to answer his purpose. H. R. W. wishes for a theory of the experiment; I must, therefore, refer him to Mr. Barlow's Essay on Magnetic Attraction, published by Taylor, of Holborn; or to the Annals of Philosophy, where he will find Dr. Woollaston's theory fully explained. I hope H. R. W. will keep his promise, by sending you his list of experiments, illustrative of the general principles of electricity; and trust you will give them early insertion, for the general benefit of such of your readers as may be fond of this interesting science.

I remain, Sir,

Your obedient servant,

A Conductor.

P.S.—G. M. H—n wishes for a receipt for Varnishing Ribbon: that, Sir, is a secret known only to the mathematical instrument-makers. I should, therefore, recommend him to apply to them, who, no doubt, with the offer of a good reward, may be induced to impart the secret.

W. D. requests to know from Galvanus, what is the method he uses for Coating his Electrical Jars with Tinfoil? and also, whether it is material what sort of Varnish should be used for the ribbon?

Another Correspondent, who "was much pleased with the inquiry of Junior, Number 110, and not less so with the prompt answer, by Mr. Pickett, in Number 85," and who has a machine of his own mounting, requests "Mr. Pickett, or any other Gentleman, to inform him what is the proper length and breadth of the Cushion, in proportion to the Cylinder; also the best method of fixing it to the frame of the machine, so as to act with the most effect."

HARMONY OF THE SPHERES.

The following beautiful analogy which obtains in the motion of the planetary orbs, was, we believe, first noticed by Mr. J. Utting, in the Philosophical Magazine, vol. 62, No. 304. It is, at least, not generally known:—

If the mean orbicular motion of each planet in its orbit, be multiplied by the square root of its mean distance from the sun, a product will be obtained common to all the planets: for instance, if the orbicular motion in miles of each planet in one sidereal day, be multiplied by the square root of its mean distance from the sun, the product will be 15,634,588,170 miles, a *constant* quantity for all the planets, as the mean velocity of the planets, multiplied by the square root of their respective mean distance, is always a *constant* quantity.

The same analogy obtains in each respective system of satellites; for, if the velocity of a satellite be multiplied by the square root of its mean distance from its primary, a *constant* product will also be produced in each respective system of satellites; and if this *constant* product be multiplied by the square root of the reciprocal of the sun's attractive power, and that of their respective primaries, the same result will be produced as that which obtains in the planetary motions, as above. Thus a *constant* product, or *quantity*, obtains in the motions of the planets and their respective systems of satellites, extending to the whole planetary system, resulting from the periodic times and mean distances of the planets, with the periodic times and mean distances of their satellites, compounded with the attractive power of the sun, as compared with that of the primary planets, around which each respective system of satellites circulates.

STEAM-ENGINE.

Sir,—Permit me to assure your Correspondent, X——x, that his idea of the *objections* to his improvement in the Steam Engine (page 444, Number 140) is perfectly correct.

The principle of the intended improvement is similar to that described in a former number of your Magazine, by Mr. Shuttleworth; and the same objections will apply in both instances—that it would be impossible to make the periphery of the wheel, where the power is applied to *work steam-tight*, for it must either be in such close contact with the surface to which it is opposed, as to prevent its moving at all, or else it would permit such a quantity of steam to escape as to render the engine of comparatively no effect. Such, at least, is the opinion of Your constant reader,

Paul Pry.

London, May 1, 1826.

NOTICES
TO
CORRESPONDENTS.

T. H., of Oxford-street, Reading, must allude to some other Journal. We have no recollection of any such specification.

Investigator conjectures rightly. His former communication never reached us.

Communications received from—G. S. —F. J. L.—J. S.—P. P.—Aurum—A. B. —H. F.—Q. S.—H. H. H.—W. Dobson—S. W.—An Artizan—Wheelie—Factor—P. O.

*** *Advertisements for the Covers of the Monthly Parts must be sent to the Publishers before the 20th day of each Month.*

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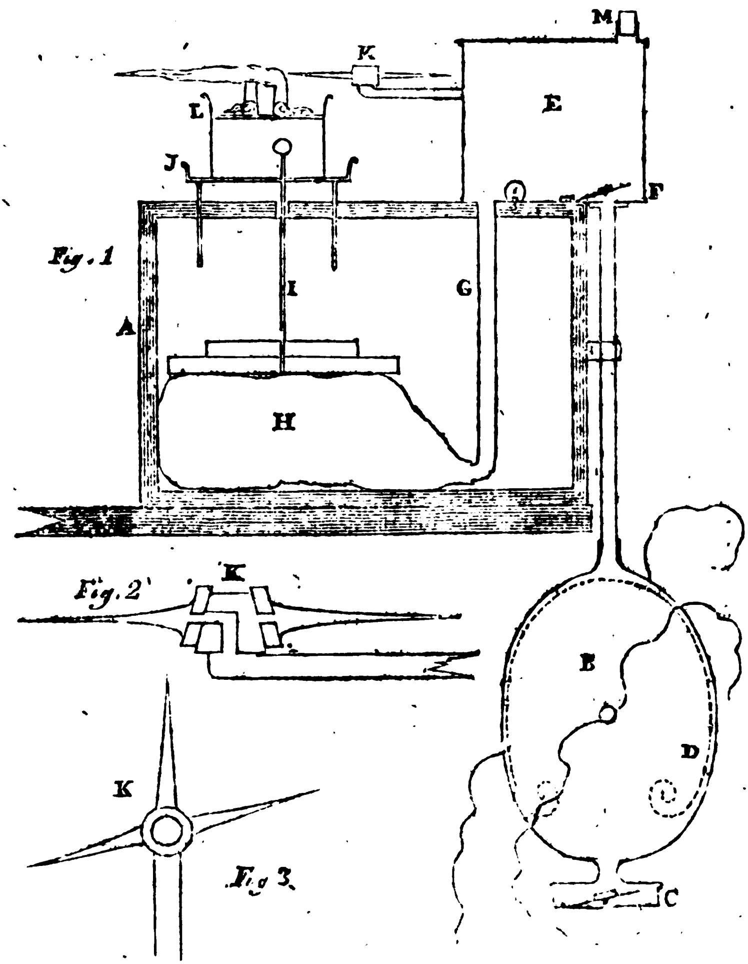
Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 143.] SATURDAY, MAY 20, 1826. [Price 3d.

CHEAP AND SIMPLE BLOW-PIPE.



BLOW-PIPE.

Sir,—I send you herewith a drawing of a Blow-pipe, with a constant stream, which I have lately made out of an old powder-flask and two bladders, which is considerably cheaper, quite as powerful, and much more easily constructed than the bellows blow-pipe.

Description.

A is the box to fix it to, and to rest the arm upon.

B, the feeding bladder.

C, the valve. The strings are best fixed by putting a pea inside, and tying it up with the bladder—they are to be tied to the knees. There should be a piece of wire, C, inserted to prevent the side of the bladder from collapsing.

F, the receiver, with its valve.

G, a pipe leading to the bottom of the box, to which the bladder, H, is tied.

I, the weight, with a wire passing through the top of the box.

J, the moveable stage for the lamp.

K, an improved head for the jets. This was made out of an old cock, and will be found much more convenient than screwing them in, as they can be changed in an instant; three jets of different sizes are quite sufficient. The bladder was first tied on the top, at M, and the weight to the end of that, but it would not blow any thing nearly so long or so steady as it does when fixed near the bottom of the small tallow lamp, which I have found very useful, as it is merely a tin hoop, with a bottom soldered within a quarter of an inch of the top, and two pipes for the cottons, soldered on the bottom. When used, it is only necessary to hold it over a candle for a few seconds, till the tallow in the tubes melt; it will then supply itself, by laying pieces of tallow near the flame. An oval flask answers best, because it does not take so much room between the legs—I mean the part that is taken off to make the valve, C. The holes in the upper and lower valves were one inch diameter, and there was a small piece of lead rivetted to the leathers (but I should think this is not necessary). The weight is about three pounds; but it is very easy to press on the nob, if a sudden heat is wanted. As a proof of the steadiness of the flame, I have just been spinning glass with it, by winding it on the cylinder of an electrical machine.

The first blow-pipe that I made acted by condensed air: this was very powerful, but it was almost useless, on account of one hand being engaged in regulating the stop-cock. The next was a hydro-pneumatic one: this was soon laid aside, as it required nearly as much exertion of the lungs to raise the column of water, as it does to use the common blow-pipe. The third was a bellows blow-pipe: this acted admirably, and the only objection to it is the expense (Accum's price was five guineas); and, after all, if it is not fixed upon a very firm support, it is by no means a steady blow-pipe.

I am, Sir,
Yours respectfully,
G. Dakin.

HORSE COLLARS, ETC.

Sir,—In answer to the inquiry of Equus, of High-street, Birmingham, in No. 136 of your valuable Magazine, for the best method of making horse-collars, &c. as represented in figs. 1st and 2nd, I beg to make the following observations:—

A breast-collar, as described in fig. 2, when the horse is in motion, is continually chafing across the breast. I have known a horse with one day's journey (harness of this description having frequently come within my observation) very much galled, though there was a pad or false collar underneath the breast-collar, which, no doubt, greatly relieved the animal. Harness of the above description, for vehicles where shafts are not required, may be tolerably easy.

I would recommend Equus to have harness as described in fig. 1, taking especial care to have the collar made to fit; then he and his horse may travel comfortably, particularly where Macadamizing is brought to perfection.

I am, Sir,
Your obedient servant,
An Operative.

NAVAL ARCHITECTURE.

(To the Editor of the Mechanics' Magazine.)

Sir,—The mechanics of this country have reason to rejoice at the opportunity your respectable Journal affords them, of communicating and receiving useful knowledge; and very great praise is due to you, for your exertions in the conduct of such a multifarious work; the very circumstance of its pages being open to all opinions, takes from you the charge of partiality, and makes each writer, very properly, accountable to your readers for the correctness of his opinions.

I am led to these observations from the very extraordinary doctrines promulgated by "Noah," in a letter which recently appeared in Number 131 and 134, of the 5th vol. of your Magazine, on the subject of Ship-building: his views on the practice of the ark are *primitive* indeed, and such as I should think unworthy of his namesake, the Patriarch of old. Our contemporary scorns the trammels of science, and sets up his vessel by mere empyricism; calculations are totally disregarded. If this *thumbing system* (for it deserves no better name) were to be generally adopted, all hope of arriving at "fixed principles," the desideratum so ardently to be wished for in Naval Architecture, would vanish. Noah had evidently been seized with a fit of the *cacoethes scribendi*, when he sat down to write, and I should be disposed to give him credit for writing to the best of his judgment, but for the unenlightened and invidious spirit evinced in his prefatory remarks, which but too clearly prove the end he has in view.

I shall not attempt, Sir, to follow Noah through all his dogmas, but merely make a few remarks on some of his most glaring errors. Noah says, that "his information is intended for those who already know the *theory*." I must beg to say, that mine, on the contrary, is intended, with due deference, for the guidance of *practical men*, lest they should be led away by his specious arguments, and be induced to become the followers of false principles. Passing over the grand *arcanum* by which "a vessel is to be produced of such dimensions, as to be best calculated for the purpose required," the young shipwright is next desired to prepare a block model *to the timbers*, which, if correctly proportioned, will displace water equal to the weight of the vessel with all her furniture, the *bottom planking being previously added*. Now, every shipwright knows (or ought to know, before he commences modelling) the difficulty and tediousness of such an operation; and, moreover, when the model is completed, little or no dependance can be put upon the accuracy of its form, or upon the exactness of the method of immersion, by which the displacement is to be obtained; and further, every one at all skilled in draughting is aware of the difficulty of obtaining the thickness of the planking in different sections, and which, at best, can only be obtained by methods of approximation. But admitting, for argument's sake, there be no practical objections to this practical plan, it is not likely that the *first* model would be perfect in all its parts, the draught must consequently be altered, fresh moulds made, and a new model formed, as often as alterations were conceived necessary; the labour of such a task would be discouraging to a young constructor, and very few persons could bestow the time that it would necessarily occupy. These are excellent rules for calculating the displacement of a ship, simple in application, and certain in result, which would not require as many *hours* to put in practice, as the model-plan would *weeks*. I shall have much pleasure, Mr. Editor, in sending you an exemplification of these rules, should you deem the subject of sufficient importance to occupy a few pages of your valuable Magazine. Noah's opinion concerning the rule for casting the tonnage of ships, shows very forcibly that he is not aware of the fallacious base on which it is founded: the *depth* is altogether neglected as an element in the expression, and the *breadth* and *length* are the only two factors in the fraction. The correct tonnage is the weight of the volume displaced between the light draught of water (with ballast on board only), and the load water-line, with stores, equipments, &c. locally disposed, and the ship at her *sailing trim*. It would be worthy of the Legislature to call for an amended or new rule, constructed on true principles, by which the revenue could not be cheated, and ship-owners would be compelled to abandon those mean artifices by which they avoid the duties, sacrifice many good properties of their vessels, and thereby endanger their safety. The melancholy accounts of disastrous shipwrecks, which so frequently harrow the feelings of the humane, ought to be sufficient to stimulate our ship-owners to prompt inquiry as to the best means to avert these fatal consequences—laying aside interested motives, in comparison with the lives of thousands of their fellow-creatures. It is notorious that our merchantmen are constructed, for the most part, upon no other principle than that of *gain;* and so badly adapted are they, both in form and stowage, for rough weather, that they often become perfectly unmanageable; and the *dernier resort* of the crew is to *batten down the hatches*, and "trust to the mercy of the pitiless storm." I trust the nature of the subject will be sufficient apology for this digression. But to proceed with the object of this communication: Noah talks of "a ship swimming on a *pivot*," and makes use of many other odd expressions, which are perfectly unintelligible—*ad captandum vulgum*. "It is (*not*) true that a hollow bottom adds to the stability of all floating bodies." The stability of a ship depends on the form of the body between wind and water;* and the only effect that the form of the bottom below this has on the motion of the vessel, is in influencing the time of an oscillation, by which she may roll *quicker* or *slower*, from the resistance of the water, but she will ultimately come down to the same bearings. There may be "advantages in a *raking stern-post*, but it cannot be admitted as a consequence, that "the point of the water's action on the rudder becomes the pivot whereon the vessel, *as a wheel*, revolves." It may be laid down as an axiom in naval science, that every motion of a ship takes place round axes passing through its centre of gravity. A ship, in tacking or wearing, partakes of two motions;† one round a *vertical axis*, passing through her centre of gravity; and the second, a progressive change of position through all her bearings, from the larboard to the starboard tack, or *vice versa*.

We now come to an assertion which, I am sure, will not require much theory or argument to réfute, viz.—"that the best place for the ballast is on level with the line of floatation." Noah has probably heard, that it is desirable sometimes to *wing* the ballast; so it is, in some description of vessels; but *winging* does not mean raising it to the plane of floatation: it signifies, spreading it from the middle line, at the same time keeping it as low as possible, so as not to raise the centre of gravity, or to lessen the stability. "It is, therefore (*not*) a mistaken notion to suppose, that a vessel's ballast ought to be down low in the bottom." And again, "your ballast ought (*not*) to be as high as possible." I have often "been in row-boats, gigs, and galleys, under sail, without ballast," and I agree with Noah, that "they lose nothing of their stability," because they are peculiarly constructed for their respective services; and I have frequently "looked" with admiration "at our men-of-war, our old three-deckers, with four tier of guns," &c. but I much doubt if they would be "the stiffest and best sea-boats in the world," if it were not for the effect of many hundred tons, collectively, of iron ballast, tanks of water, provisions, coals, &c. stowed as *low as possible* in their holds, together with stores, &c. on the lower decks. The last query in the same paragraph, respecting cargoes of iron, &c. is unworthy a reply; but I must beg your indulgence whilst I say a few words on another fundamental error—an assertion unsupported by theory or practice, viz.—that "all *lean* vessels *forward*, require the mast *well aft*, and the reverse if *full*." In a sharp or *lean bowed vessel*, the mean direction of the water is well forward, and therefore, *cæteris paribus*, she would necessarily require a press of head-sail, to bring the centre of effort of the wind on the sails forward also, so as to meet the resistance of the water on the lee bow; to effect which, the mast must be moved *forward*. It may be apropos to mention here, that a material advantage is gained by having the greatest breadth before the middle of the length; it enables a constructor to obtain a *full bow*, and place his mast (contrary to Noah's idea) further *aft*; thus taking the weight from that part of the ship which is the least supported by the buoyancy of the fluid, and rendering her less liable to pitch heavily in hollow seas.

I have drawn this letter to a greater length than I had anticipated, but I felt unwilling that such dangerous opinions should be disseminated without comment; more especially as your valuable register of the improvements of the age has long since crossed the Atlantic, and found its way all over Europe, where the theory of naval architecture is not despised or neglected. The best and surest means of eliciting truth, is by encouraging free discussion; and as this candid spirit seems to be the principle which guides your labours, I submit these remarks to your readers, with the hope that they may be found correct; and subscribe myself,

Sir, your humble servant,

INVESTIGATOR.

* A nautical expression, signifying that part of the body, or zone, included between the limits of the angles of immersion and emersion, when under press of canvass.

† These manœuvres have given rise to many interesting queries respecting the loci of the curves described by the head and stern in going about: they are subject to mathematical investigation, which I will elucidate in a future letter.

SKAITING AND WALKING.

Upon what principle is it that the space gone over in skaiting is so much greater than that gone over in the same time and with the same exertion in walking? The answer to this question would furnish curious hints as to an advantageous application of force on railways, &c.

At first sight it might seem easy to answer, that the propelling impetus communicated by the muscles of the leg behind does not, in walking, carry the body beyond the spot where the other leg is set down, but is checked and momentarily stopped there by friction; whereas in skaiting, this impetus not only carries up the centre of gravity to that spot, but, owing to the smoothness and slipperiness of the skait-irons and ice, enables the body to glide forwards over a considerable space besides: each impetus thus causing a deal more ground to be passed over than in walking, where the progressive motion is at each step checked, and determined to the spot where the foot is set down. But such a solution is not consistent with a just idea of the nature of the action of walking. The velocity of progression of a man walking uniformly is not materially checked by any friction between his foot and the ground; nor is it momentarily stopped, as it were, and renewed at each step. It continues uniform, like the velocity of a boat uniformly rowed; *i. e.* is never much under or over a certain mean point. About the time of setting down the foot it is, perhaps, a trifle less than the mean rate; and just after the exertion of the muscles of the hinder leg it is a trifle more; so that, for example, if a man walk at the rate of four miles an hour, his velocity is sometimes a little more and sometimes a little less than that; and so keeps passing at every step from the somewhat more to the somewhat less, without ever being suddenly checked or stopped, or ever differing much from that mean velocity of four miles an hour, even for the smallest instant of time.

The fatigue in walking does not arise from the quantity of force *necessary* to propel the body (in *quantity* I include frequency of application), but from other causes connected with the machinery of animal bodies, which I will endeavour to explain; first observing, that the truth of this assertion will be perceived indirectly, by considering, that in walking down hill it is so far from being necessary to use force to propel the body, that, if the declivity be considerable, it is, on the contrary, necessary to check the tendency to accelerated velocity: so that if the necessary propelling force was the principal cause of fatigue on level ground, we ought, comparatively speaking, mile for mile, to be little exhausted in descending gentle pleasant declivities, where the ground is good and the footing firm; as, for example, on the mossy, short, elastic, yielding grass on the sides of some mountains. The additional shock in walking down hill, occasioned by the descent of the foot, is, according to my experience, very trifling on such ground as I have mentioned. But if any one should maintain that, owing to this or any other cause, walking down declivities cannot be compared with walking on level ground, let him imagine a man standing on level ground, and constantly (or by intervals, as he pleases) pressed forward by a proper force, properly applied against his back—such an one as gently to force him to gather up his legs and walk, without using any propelling force of his own: would this enable him to go so much further in a day, as to authorise us to conclude that the principal cause of fatigue in walking is the exertion of the necessary *propelling* force? I presume, not.

In order to explain the machinery of walking, let us imagine a body moving on a wheel of spokes (by which I mean one whose spokes are unconnected with each other, except at the centre of the wheel); and let us, in the first instance, suppose this body standing at rest on two of its spokes, and then to be propelled forward by some external force. It is evident, that while the forward spoke is becoming more and more erect, the (centre of gravity of the) body must rise; and that it must afterwards fall through the same degrees, till the succeeding or third spoke comes into contact with the ground: also, that if the ends or feet, as they may be called, of the spokes be properly shaped, the friction will be but a part of that in the case of a common wheel; also, that the force required to propel this body depends, *cæteris paribus*, on the infrequency of the spokes; because *that* determines the height to which the body will have to rise and fall, as well as the angle which the direction of its rising and falling will make with a horizontal line. This force is similar to that part of the force used in walking that is necessary simply to propel the body. Let us now further assimilate the action of our machine to that of walking, by supposing it propelled, not by an extraneous force, but by the elongation of the spokes, occasioned by the uncoiling of a spring, or otherwise, and subsequent contraction to their original length. Here we have a very near approximation to walking. Let us introduce one change more:—Let there be but two spokes; and let an internal machinery bring round the backward spoke after its elongation and subsequent contraction, and place it forward, so as to be ready to meet the ground as the next spoke. This third machine of ours will perfectly represent the action of walking, so far as concerns our present purpose. Now it is evident, as was observed before, that the first machine proceeds with less friction than a common wheel; *i. e.* if the ground be very smooth, with very little, and that there is no sudden check or stop in the progressive movement. But whatever is true of the first, with respect to friction, &c. between the ground and foot of the spoke, is true of the second and third forms of the machine; therefore, &c. Transferring this to walking, we may see that neither is it true *there*, that the exertion required depends much on friction, or stoppage occasioned by setting down the foot. In fact, this exertion is composed of two parts; one of which is that necessary simply to propel the body, and which is the same as the force required in the above machines; the other is the exertion necessary for gathering up and extending the limbs, and rolling them on the sockets of the joints, without progressive motion of the body; and is very much like that required for mimicking walking, without stirring from the place; and still nearer, if not exactly, like that required when a person is pushed forward and made to walk. And it fatigues from the same causes that throwing about the arms fatigues; the alternate contraction and relaxation of the muscles, even without effort, as it may be called (*i. e.* without any weight except that of the limbs themselves), exhausts their ready power, changes the *set* of the fibres, occasions wear and tear, and by various pressures accelerates the motion of the blood, &c. It is this division of the force I am now speaking of that causes all exertions of animals, whether man or other, in walking, trotting, &c. to be attended with so great a waste of strength. The power of a man to propel himself on a tolerable road, would, with proper machinery, be greatly superior to what he has in walking.

In short, the locomotive powers of animals are at present very disadvantageously exerted, particularly in quick movements. But in all the machinery I have heard of, the inventors, by pertinaciously clinging to certain erroneous though natural ideas, do nothing but transfer the unnecessary exertion from one part of the body to another; or else they place the animal in such a position (as in the velocipedes, for instance, where they cling to the idea of the seat on a horse) as to work the muscles in the most inconvenient manner possible.

In skaiting, instead of having our progress determined by rolling round on our animal wheels, we, besides this rolling round, slide along the ground, with the limbs relatively at rest, and thereby to a given space have fewer movements *of the wheel;* though probably the propelling force exerted is nearly the same in both cases. Besides this, in most modes of skaiting the disturbances given to the relative situation of the limbs are not only much less frequent, mile for mile, than in walking, but are reduced within much smaller limits. There are, indeed, modes of skaiting in which these disturbances are reduced almost to nothing—where the legs have no alternate motion of passing each other; but these modes are not the most favourable, perhaps, to progress. If our third machine, instead of an impetus for each spoke, had one at every other, or every third, or every fourth, &c. sufficient to carry it round over the intermediate spokes, the indefinite extension given to the space gone over at each effort would be somewhat analogous to that in skaiting: and the same may be said if, in walking, a man was pushed on so as to be forced to go two, three, four, or more steps involuntarily, as it may be called, at each push; or if he forced himself so to move by not exerting his propelling powers, except at every second, third, fourth, &c. time of taking up his leg from the ground.

The advantage of skaiting, then, is in avoiding much of that exertion which is necessary for moving the limbs among themselves, and which has nothing to do with the propelling force.

The practical corollaries I have to draw from these observations are very curious. I have for many years been anxious to realize them, but circumstances have forbidden me—they are still but theories. I think I could show a mechanician not only that the present mode of using animal power for locomotion is very uneconomical, but that there is a better mode feasible, and that *that* mode would be equally applicable to machines where steam, &c. is the moving power.

Z. A.

EMINENT MECHANICS.—NO. I.

(*To be continued occasionally.*)

ARCHIMEDES.

Archimedes was born at Syracuse, in Sicily, according to Torelli, in the second year of the 123rd Olympiad, or the 466th year from the building of Rome, which corresponds to the 286th year before Christ; but Rivaltus, who has taken much pains in assigning the true æra of his birth, dates it in the second year of the 122nd Olympiad, or the 463rd year from the building of Rome, answering to the 289th year before Christ: this difference is, however, so very trifling, that when considered with the main facts of his life, it is quite unimportant; that Archimedes did flourish about that period is indisputably ascertained.

If we may rely on the credit of Tzetzes, Archimedes lived seventy-five years.

Plutarch tells us that he was nearly related, on his father's side, to Hiero, King of Syracuse, but that his mother was of obscure origin, which may probably account for the degrading epithet applied to him by Cicero, the Roman orator, in his Tusculan questions of "*Humilem Hominculem.*"

Archimedes, from his youth, applied himself to geometry; and, in his maturer years, travelled into Egypt, whither the Greeks generally resorted in the pursuit of science. After an absence of several years, which he spent in the society of Coron and other eminent learned men, and during which period he gave indications of his future fame, he returned to his own country, and there he probably availed himself of the leisure which he enjoyed in composing those books of his which are now extant. The ardour and intenseness of his application to mathematical science rendered him the honour of his age, procured him its praise, and the lasting admiration of posterity. He was, indeed, the prince of ancient mathematicians, being in those days to them as Newton is to to the moderns; and, indeed, they much resemble each other in the bent of their genius, and the similarity of their various pursuits. He would frequently fall into a profound reverie, so as to be entirely insensible to all that was passing around him: he would study days and nights without intermission, altogether neglecting his food and disregarding his natural rest. Plutarch tells us that he was obliged to be carried to the baths by main force.

Many particulars of his life, both mathematical and mechanical, are recorded by several ancient writers, as Polybius, Livy, Plutarch, Pappus, &c. &c. He was equally skilled in all the sciences, astronomy, geometry, mechanics, hydrostatics, optics, &c., in all of which he attained a high superiority, and many and important inventions and improvements in those arts were made by him.

Archimedes contrived various machines for useful purposes. Among these may be particularly named engines for the launching of large ships. To him also we are indebted for the screw-pump, which raised water out of ships and drained extensive marshes. But he became most celebrated by the many and curious contrivances by which the city of Syracuse was so long defended when besieged by Marcellus, the Roman Consul, at one time showering upon the enemy long darts and stones of an immense weight; at other times raising their galleys out of the water, and dashing them to pieces. Nor could they find safety in removing their ships to a distance, for then he contrived to set them on fire, by reflecting on them the rays of the sun from metallic mirrors.

This latter circumstance has, by some, been deemed fabulous, and the feasibility of the plan has been much doubted, but its practicability has been fully proved by experiment. Kircher, who took the trouble of making a voyage to Syracuse with his pupil Schottus, proves that the galleys were but thirty paces from the walls, and found that the plan was quite attainable. Buffon has also practically shown that it was not to be treated either as impracticable or impossible.

However, notwithstanding all his efforts, the city was at length taken by storm, and Archimedes was slain by a Roman soldier. According to Plutarch, he was, at the time, in his study, and so much engrossed with the contemplation of some geometrical figure, that he neither heard the clamour of the besiegers nor perceived that the city was taken. A soldier, who had intruded into his study, commanded him to follow him to Marcellus, which he refusing till he had finished his problem, the soldier slew him. Livy says he was slain by a soldier, not knowing who he was, while drawing schemes in the dust.

Marcellus was so grieved at his death, that he declared his success was robbed of half its glory. He paid great respect to his remains, taking care of his funeral, and made his name a protection and honour to those who could claim relationship to him. His death happened about the 142nd or 143rd Olympiad, or 210 years before the birth of Christ. When Cicero was Quæstor of Sicily, he discovered the tomb of Archimedes overgrown with weeds and brambles: he caused it to be cleared, and the place set in order. There was a sphere and cylinder cut upon it, with an inscription, but the latter part of the verses were illegible. Archimedes had ordered that his tomb should be embellished with the two figures above-named. Many of the works of this great man are still extant, though the greater part was lost. The pieces that remain we shall give an account of in our next.

THE TOAD THE LEAST ENVIOUS OF ANIMALS!

Dr. Davy has lately been endeavouring to show, in opposition to several naturalists, that the toad is in reality what it has always been considered to be—one of the most venemous of animals. We shall not be surprised to find that the Doctor is in the right, for it is rare indeed that mankind are uniformly in error in their external impressions; but, leaving this point to be determined by the sçavans engaged in its discussion, be ours the less questionable task of showing that this much reviled and friendless reptile is—whether poisonous or not—one of the most disinterested and fraternal of all the animated tribes.

A fine toad having taken up its abode in a convenient situation for feeding, some honey was spread on a leaf, and placed at a little distance from it. The honey soon attracted a number of flies and wasps, and it was surprising to see the wary manner in which it approached the leaf, and its dexterity in snatching the insects as they alighted. Pleased with its situation and entertainment, it resorted to the same place many days. One morning another toad was seen about one foot distant from the former; a variety of insects were dropped one by one between them; their attention was mutually attracted, and they frequently set at the same insect, yet the disappointed toad never betrayed the least resentment or vindictive spirit.

This is but one of many similar observations made by Mr. William Fothergill, who states it to be his firm belief, that toads are, upon the whole, "the most patient and harmless of all reptiles!"

LORD NAPIER'S MECHANICAL INVENTIONS.

Sir,—I have often been struck upon perusing the account of a curious paper written by Archibald (first), Lord Napier, eldest son of Napier of Merchiston, inventor of the logarithms, &c.—for the particulars of which any of your inquisitive and intelligent Correspondents may consult page 49 of the Percy Anecdotes of Science. The letter in question is entitled "Secret Inventions," the third of which seemed the most curious, as it was a piece of artillery which could destroy a whole army, and cut down the masts and tackle of a fleet at once. I should feel much gratified and obliged (being a lineal descendant of the above man, although, I regret to add, not gifted with his talents of invention, though a lover of scientific studies) if any of your Correspondents could inform me what sort of an instrument they suppose the above to have been. "It is said (for a wager) that Lord Napier gave proof of the above-mentioned instrument upon a large plain in Scotland, to the destruction of a great many head of cattle and flocks of sheep, whereof some were distant from others half a mile."

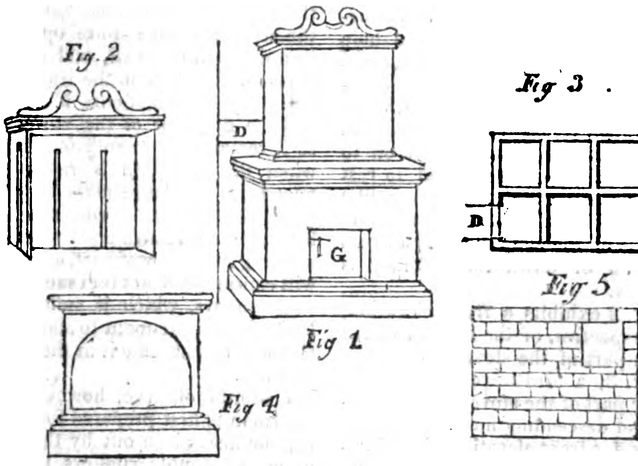
I remain, Sir,

Your constant reader,

H. H. N.

May 2, 1826.

RUSSIAN MODE OF HEATING HOUSES.



SIR,—Your Correspondent T. J. M. in your 128th Number, wishes to be informed if he is correct or not in his description of a Russian stove for warming the rooms of the houses in St. Petersburgh, and, if not correct, to be told how this is effected. Having lived some months in St. Petersburgh, and been in many houses there, in all which the same sort of stove was used, and never having heard of any other sort, I presume I may venture to say that those I saw are in general use there, and, as they differ widely from your Correspondent's idea of the subject, I send you a description. They are built of bricks and tiles, or what are called squares, and are from seven to ten feet high, according to the size of the room; they are usually placed in a corner of the room, and the exterior assumes a shape somewhat resembling fig. 1, varying in proportion and in the style of ornament according to the taste of the artist. The outside is covered with tiles resembling what are called Dutch tiles, sometimes of a plain white, sometimes inlaid in various colours,* like the old Roman tile, but glazed. The interior of the dado or base is constructed like an oven, with this difference, that instead of being arched all over the top, there is a hole left at one corner, about nine inches square, for the ascent of the smoke. The smoke passes up a tube formed of square tiles, about one inch thick, as far as the top of the upper part of the stove, and then descends down a similar tube to the bottom of the upper compartment of the stove, ascends and descends a second and third time, and then passes through the flue (marked D in fig. 1) into a chimney built in the wall, in the manner usual in this country, and then ascends to the open air. In the said chimney, just above where the smoke enters, it has an iron valve, which closes hermetically; access to which valve, by the person who tends the fire, is had by means of a double iron door in the wall of the

* A manufacture of this sort of tile is established at Berlin.

room just above the horizontal flue, D. The said valve is formed by a thick cast-iron plate, placed horizontally, and built into the walls of the chimney all round, having a round hole in the centre of the said plate about twelve inches in diameter, with a rim round the said hole about one inch and a half high, and a rabate at the bottom like the aperture of a tea-pot. This hole, when so wanted, is closed with two covers, one of which is a flat round iron to fit the inside of the rim and to rest on the rabate; the other cover, like the top of a pill-box, goes over the outside of the rim, and thus all passage up or down the chimney is stopped.

Fig. 2 exhibits a front elevation, in perspective, of the interior of the upper part of the stove.

Fig. 3, a bird's-eye view of the upper part of the stove, with ascending and descending flues.

Fig. 4, a front elevation of the interior of the dado or base, the face being removed to show the inside.

Fig. 5, a bird's-eye view of the top of dado or base.

Now for the method of using the said stove. In all weather except *unusually* cold, this stove is heated once a day (in the same way as a baker's oven) by putting logs of wood in the arched basement, piled up to the top. The person who is prepared to light the fire with shavings, paper, or other quick burning thing, first opens the double iron door in the wall of the room, removes the covers of the aperture in the iron plate which crosses the chimney, and if he finds the chimney cold, or if it is a bad drawing one, he burns a few shavings in the chimney to create a draft: he next closes the iron doors, and lights the fire.

Notwithstanding the number of ascents and descents the smoke has to make before it quits the stove, and by which every part of the stove is thoroughly heated, the draft is considerable.

The fire-door of the stove, marked G in fig. 1, being left open to supply the needful quantity of air, there being no grate, but a solid brick bottom, like an oven, to the arched fire-place. Now, as soon as the wood is reduced to embers yielding no smoke, to ascertain which *they must be carefully stirred several times* (this requires the greatest attention, for if they are not sufficiently consumed the room would not be habitable), the attendant once more opens the iron doors in the wall, and puts the covers on the hole in the iron plate; he then closes the doors in the wall and the fire-door of the stove, and so it remains for twenty-four hours, when the operation is repeated if necessary. A large mass of bricks is thus heated, and is continued in a hot state by the live embers still remaining in the lower part, and which will continue red-hot for (sometimes) twelve hours, which is sufficient to heat a large apartment to about from 60 to 65 of Fahrenheit in the coldest weather.

I should observe, however, that the room is first prepared for retaining the heat given out by the stove, by having double windows, the inner window flush with the inside surface of the wall, and the outer window flush with the outside of the wall, having the thickness of the wall between them, which is usually two or two feet and a half, or more; the inner windows are caulked, like the sides of a ship, with oakum hammered into all the crevices, and paper pasted over to keep the oakum in; the room is also furnished with double doors.

A stove somewhat similar to that mentioned by your Correspondent, but not consuming its own smoke, is used in Germany. It is an iron stove, not standing in the wall, but at about one foot from the wall, having a large tube through the wall for putting in the fuel to the lower part, and for lighting it, and a smaller tube from the upper part, for the smoke to go into the chimney. It is lighted from without, does not retain the heat longer than the fire in it lasts, and is very inconvenient, the air being either too hot or too cold.

I am, Sir,

Your most obedient servant,

A. W.

SINGULAR PHENOMENA — CAUSES REQUIRED.

1. If, after having bruised some sprigs of parsley in your hands, you attempt to rinse glasses, they will almost always snap or suddenly break.—From what discordancy between the qualities of parsley and glass does this arise?

2. If certain persons accustomed to observe objects through a telescope with the right eye, begin to use the left, the objects appear always of a greater altitude than before. —What is the reason?

3. In beds of shell marle, in the Isle of Man and elsewhere, the skeletons of elks and other animals are frequently met with in an *erect* posture, unaccompanied by sand, or gravel, or any proofs of disturbing forces.—How is this to be accounted for?

FALL OF A BALL FROM THE MAST-HEAD OF A SHIP IN MOTION.

Sir,—Permit me to offer the following solution to Aled's interesting query, relative to the line described by a ball let fall from the mast-head of a ship in motion. The ball, at the first instant of descending, partakes of the uniform motion of the ship, and is also acted on by gravity; these two forces combined will cause it to describe *a curve*, the nature of which we shall presently discover by analogy. Let us suppose a ball to be projected from a cannon placed horizontally (at the height of the mast-head above the ground), with an initial velocity equal to that of the vessel's sailing, it is quite clear that, at the moment the ball leaves the cannon's mouth, it will be subject to the same laws as if let fall from the mast-head; for the force of gravity is invariable, and the horizontal velocities are assumed the same, therefore the two balls will describe equal and similar curves; but, in the case of the projectile, it is well known that the locus of the ball is a *parabolic curve:* hence, the ball from the mast-head will fall in a *parabolic curve;* that is, supposing the resistance of the air not to be taken into account. But this resistance leads us to another point in the query, viz. "the distance the ball will fall from the foot of the mast." The ball being in contact with the mast, and partaking of its velocity, can have no tendency in itself to be separated from it, but, being left in *free space*, the resistance of the air retards its uniform motion, whilst gravity still urges it downwards; and therefore the distance at which it strikes the deck from the mast, must depend upon the height fallen from, and the state of the air at the time of the experiment.

To determine the *time* of falling, let us assume the height of the mast = 100 feet; then since $S = m F t^2$, when S = space fallen through,

$$m = 16 + \frac{1}{12} \text{ feet, the space due to}$$

1 hour.

F = force of gravity = 1; and t = time.

We have $t^2 = \frac{S}{mF} = \frac{100}{16+1\text{-}12} =$ $\frac{1200}{193} = 6{\cdot}2176$,

$\therefore t = \sqrt{6{\cdot}2176} = 2{\cdot}49$ seconds, or the ball would strike the deck from a fall of 100 feet in $2\frac{1}{2}$ seconds nearly.

I am, Sir,

Your humble servant,

An Inquirer.

Chatham, 8th May, 1826.

WATCH GLASSES.

Sir,—Could any of your Correspondents inform me of the reason of the great difference between the prices of watch glasses? the circular being so much cheaper than the flat, the former costing 3*s.* 6*d.*, the latter 6*d.* Certainly the 3*s.* 6*d.* ones are far superior, because they not only are much stronger, from their shape, but also lessen considerably the size in thickness of the watch—qualities which are very desirable; but whether there be any proper reason for the exorbitant demand is worthy the notice of the public, and which cannot be made more so than by being inserted in your Magazine.

I am, Sir,

Your obedient servant,

Glasso.

PROPOSAL FOR MECHANICS' CIRCULATING LIBRARIES.

[*To the Editor of the Mechanics' Magazine.*]

SIR,—You have done much in promoting the establishment of Mechanics' Institutes, and I am glad to see them spread so fast, that mechanics may know more particularly the principles on which they act; but there is one means by which they may receive information which is yet neglected—I mean circulating libraries, and reading-rooms attached to them. These have, hitherto, too generally furnished poison for the mind; but were some of our best mechanical, chemical, and experimentally philosophical works printed in smaller volumes, of from four to six, or eight shillings price, with only necessary plates, and circulating libraries filled with them only, established under the title of mechanical and philosophical circulating libraries, much good may be done; especially if reading-rooms were opened in connexion with them for working mechanics, from six till ten in the evening, under proper regulations; one of which should be, that no liquors or smoking be permitted. Mechanical and philosophical gentlemen might be accommodated at other hours, or the same, as they may be inclined, or as may be thought most convenient. I think this would prevent many a bright genius from mis-spending both time and money at the ale-house, which they often do more from want of proper places of resort, and proper employment for their minds, than from any depraved inclination. It would be a means, also, of separating the sober, intelligent mechanic from the sot, and placing him in such company as he may improve, or which may improve him; for I have known many intelligent men go to the circulating library for a novel, merely because they wanted something to read, and could get no better books as easy. This would also benefit the authors and publishers of such works, as more editions must be published, for, at present, they are printed in such large volumes as keep them entirely out of the reach of most working men, many of whom would gladly read and profit by them.

Another thing I have often observed with regret, which is, that the best workmen are too generally great drinkers, which often arises from this:—another knows a better or shorter method of doing a thing; this method he desires to know, but, while the other is sober, he cannot prevail on him to disclose it; he therefore takes him to the ale-house and treats him, perhaps many times, before he can obtain his desired object: this begets a habit of drinking, especially as he is often obliged to have recourse to the same means for a similar purpose.

If any of your kind Correspondents can point out a remedy for this evil, they would do a thing which would be productive of much benefit in future. It is much to be wished that those who have bought knowledge at this dear rate would not sell it at the same, and I am persuaded they would not, if they considered the ruin and disgrace it has entailed on themselves.

I am, Sir,
Your obedient servant,
H. FRAMPTON.

SOLVENT FOR PUTTY.

SIR,—Having intended, some time since, to replace some common glass, in the front windows of my house, with plate-glass, I was compelled to abandon the idea on consulting my glazier, who held out so little probability of saving any of the present glass, owing to the method of taking it out of the sashes, by cutting away the putty with a knife, which not only endangers the glass but injures materially and disfigures the sash at the same time. As I did not like to run the risk, I gave up my intention. It strikes me that some of your Correspondents or readers may be aware of some solvent for the putty, which, by application to it, might render it sufficiently soft to permit the glass to be removed without danger or trouble: at all events, if no method be known, I think, in the present improved state of chemical knowledge, it would not be difficult to discover one which would prove of such eminent use and advantage.

I remain, Sir,

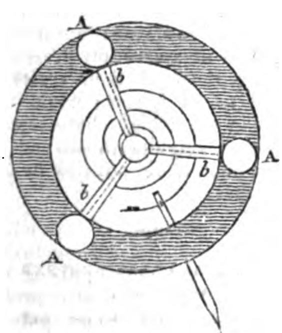
A Constant Supporter of the Mechanics' Magazine.

REGULATING CHRONOMETERS.

Sir,—Seeing, in No. 125 of your useful Magazine, a plan by your able Correspondent, F. O. M., for regulating chronometers,—without objecting to his plan, I beg to submit a plan of my own, the truth and power of it being, in my opinion, more open to experiment or mathematical investigation. Should any fatal objection be applicable to it, any of your Correspondents who will point it out will much oblige,

Sir,
Yours truly,
W. Crossie.

Lambeth, 19th March, 1826.



Description of the Engraving.

A, A, A, are three bulbs of glass, filled with mercury; their tubes, *b*, *b*, *b*, are the crosses of the balance; hence, when the temperature of the air expanded the balance, the mercury would go toward the centre (if these little thermometers were properly constructed), and preserve the momentum of the balance.

I am aware the workmanship would be difficult, yet I think I have seen as great difficulties overcome; or perhaps some of your Correspondents may be able to apply the same principle with less complexness.

P.S. Is there any fixed or produceable power of repulsion which would repulse regularly, instantly, and in proportion to distance? Some Correspondent will, perhaps, favour me by an answer.

EFFECT ON THE TIDES OF REMOVING LONDON BRIDGE.

Sir,—As the columns of the Mechanics' Magazine appear to be open at all times to the humble inquirer, perhaps you will allow me, through the medium of that interesting publication, to solicit the opinion of some of your intelligent Correspondents as to what will probably be the consequence of the removal of London Bridge, as far as it respects the ebb and flow of the tide; for if, on the removal of the bridge, the tide should flow higher than it now does, it must be evident that the injury that would be sustained (if not guarded against) by many of the inhabitants of the banks of the river would be very great; and I have no doubt that any information that can be obtained on the subject would be highly acceptable to many of them, as well as to

Your humble servant,
Aquaticus.

April 17th, 1826.

REMEDY FOR THE BITE OF SERPENTS.

M. Leguevel, "On the Properties of the Guaco," states that this shrub, which is a sort of climber, or pliant willow, found in the warm and temperate regions of the Viceroyalty of Santa Fé, towards the 45th degree of north latitude, not only possesses the property of neutralizing the venom of the rattle-snake, and other serpents whose bite proves fatal in the course of a few minutes, but may be used as a prophylactic, and with such efficacy that some doses of the juice of the pounded leaves, properly administered, will render a person invulnerable to the bite of these reptiles. This plant was transported to Martinique in 1814, and there it was studied by M. Leguevel, who has described its botanical characters. He mentions several facts attested by persons of credit, and by the local authorities, which prove that persons bitten by the most venomous serpents have, by the juice of the Guaco, been saved from any ill consequences.

FIGHT BETWEEN A HEDGEHOG AND SNAKE.

The following singular rencontre, witnessed by Professor Buckland, is related in a paper on the Habits of Animals, by Mr. Broderip, in the Zoological Journal, No. v.

"Having occasion to suspect that hedgehogs, occasionally at least, preyed on snakes, the Professor procured a common snake (*coluber natrix*), and also a hedgehog, which had lived in an undomesticated state some time in the Botanic Garden at Oxford, where it was not likely to have seen snakes, and put the animals into a box together. The hedgehog was rolled up at their first meeting: but the snake was in continual motion, creeping round the box, as if in order to make its escape. Whether or not it recognized its enemy, was not apparent; it did not dart from the hedgehog, but kept creeping gently round the box; the hedgehog remained rolled up, and did not appear to see the snake. The Professor then laid the hedgehog on the body of the snake, with that part of the ball where the head and tail meet downwards, and touching it. The snake proceeded to crawl—the hedgehog started, opened slightly—and, seeing what was under it, gave the snake a hard bite, and instantly rolled itself up again. It soon opened a second time, repeated the bite, then closed as if for defence; opened carefully a third time, and then inflicted a third bite, by which the back of the snake was broken. This done, the hedgehog stood by the snake's side, and passed the whole body of the snake successively through its jaws, cracking it, and breaking the bones at intervals of half an inch or more; by which operation the snake was rendered entirely motionless. The hedgehog then placed itself at the tip of the snake's tail, and began to eat upwards, as one would eat a radish, without intermission, but slowly, till half of the snake was devoured, when the hedgehog ceased from mere repletion. During the following night the anterior half of the snake was also completely eaten up."

HINT TO THE WEATHER-WISE.

Wheel-barometers are in very general use among meteorological observers; but they are neither so simple in construction, nor so correct and equal in their movements, as the portable upright barometer. This arises from the friction to which the former are liable, and the unequal proportion of their pulleys to the circumference of the scales. Our esteemed Correspondent, Dr. Burney, remarks—"I have seen wheel-barometers of an elegant appearance, at the time of a very low pressure, below the range of their scales of from 28 to 31 inches; while the mercury in the upright barometers, in the same neighbourhood and at the same height, did not sink below 28·10 inches."

TO UNFIX THE GLASS STOPPER OF A BOTTLE.

Take a red-hot poker and apply it round the neck of the bottle, so that it may be expeditiously heated without heating the stopper. For this purpose its head should be dipped once or twice in cold water: it may then be easily removed. I have often succeeded in this way with ladies' smelling-bottles, whose stoppers have been rendered immovable by being put cold into the bottles when heated with the hand.

B. C.

CHESNUT-TREE BARK.

It is stated, in the *Annales de l'Industrie* (vol. VI.), that this bark contains twice as much of the tanning principle as that of oak, and nearly twice as much colouring matter as logwood. With iron it forms an intensely black and durable ink. Its colouring matter has a stronger affinity than sumach for wool, and is not affected by air or light.

WHAT ARE THE ADVANTAGES OF ANALYSIS?

SIR,—D'Alembert observed, that the more *abstract* and investigation is made, the more perspicuous and satisfactory does it become; and the authority of D'Alembert appears to have made reasoning as abstractedly as possible the fashion. But, if this be true, what comes of all the boasted advantages of analysis? I should like to see this question satisfactorily answered by any one of the many intelligent Correspondents of the Mechanics' Magazine.

I am, Sir,
Your obedient servant,
A LOOKER-ON.

HOW TO GET RID OF A ROOKERY.

Sift some soot, or put it in small heaps under the trees in which the rooks have pitched.

HAASUC.

NUMBER OF FIFTEENS IN A PACK OF CARDS.

SIR,—I observe that your Correspondent, G— S—, in his letter on the subject of the Fifteens, which appears in Part 34, page 331, has, in his calculations, fallen into an error; the sixes and treys are susceptible of 40 combinations only, which reduces the aggregate number to 17264.

I am, Sir,
Yours very respectfully,
WM. DOBSON.

Downham, Norfolk, May 6th.

PLANS IN RELIEF.

Such of our readers as have seen the plan of the "Swiss Mountains" in relief, with a similar plan of the "City of Edinburgh," will readily admit their interest as a matter of taste, and their political and geological value. The "Pyramids," with the sphynx and neighbouring country, may be seen in the royal library at Paris; and we believe that a plan of "Gibraltar" in relief has been executed with great minuteness.—Evelyn, the author of the Sylva, mentions in an early part of the Philosophical Transactions, that he saw similar plans on the Continent, and particularizes an island, which gave him great satisfaction.

A correspondent of the Philosophical Magazine proposes to substitute such plans universally, for working drawings. "The want," he observes, "of such plans, has been felt in the original projection of important drainages, roads, canals, rail-ways, and all other works depending upon levels. Shading and sections are imperfect substitutes; and an actual plan in relief, except of a mountainous country, is almost useless, from the small proportion which the elevations bear to the horizontal plane. But why should not plans in relief be formed, such that the altitude of any point above the horizontal plane shall always be increased in a *fixed ratio* to the *true* altitude? If the altitude, for instance, be increased (n) times, it will in all parts of the plan bear this fixed proportion to the base line, and will truly exhibit the *direction* of the inclination, and its *comparative* magnitude. No ordinary map whatever is mathematically true; when the lines in longitude are correct, the latitudinal distances must be incorrect, and conversely: the various projections have always been formed on some conventional principle, never accurately exhibiting the true horizontal distance. To the artist I leave the mode of multiplying such plans in plaster, copper, or otherwise; and the contrivances necessary for forming a series into a volume, folded up like a backgammon board."

MIGRATION OF BIRDS.

Dr. Schinz, Secretary to the Provincial Society of Zurich, has endeavoured to discover the laws according to which the birds of Europe are distributed over our continent. The country in which the bird produces its young is considered as its proper one. The nearer we approach the poles, the more do we find peculiar or stationary birds, and the fewer are the foreign species which make their appearance. Greenland has not a single bird of passage. Iceland has only one, which remains during winter, and leaves it in spring for still more northern countries. Sweden and Norway have already more birds of passage; and we find them increasing in number in proportion as we advance towards the centre of Europe. In the intertropical countries no bird emigrates; to the north they all emigrate. The propagation of birds keeps pace with the quantity of food. Spitzbergen has but a single herbivorous species; for the sea presents more nutriment, and all the rocks and cliffs are inhabited by aquatic birds. In the frigid zone a much greater number of marsh birds breed than beyond the arctic circle and in the warm countries of Europe. Dr. Schinz also indicates the distribution of the species of domestic fowls, and remarks that each country has its peculiar varieties of fowls.*—*Bulletin Univers.*

UNIVERSAL MERIDIAN.

"It is very desirable," M. de la Place observes, "that all the nations of Europe, instead of referring their calculations of longitude to the meridian of their principal observatory, should have some common meridian, which nature seems to have pointed out for that purpose. That agreement would introduce into the geography of the world the same uniformity that exists in its almanacks and in its arithmetic; a uniformity which, extending to the numerous objects of their mutual relations, forms various countries into an immense family." M. de la Place proposes that either the Peak of Teneriffe or Mont Blanc should be the point through which this common meridian should pass.

* For Dr. Jenner's investigation of the circumstances which impel birds to migrate, see the Philosophical Magazine, vol. lxiv. page 50.

NOTICES TO CORRESPONDENTS.

Fides Defensor has overlooked a notice intended for him several weeks ago. We must still decline resuming the controversy.

We shall endeavour, in a short time, to send J. R. the information he desires.

T. M. B. and Aurum, on Philological Discussions, caution wisely; but the insertion of their communications would only prolong what they deprecate.

The subject treated of by Viator shall certainly be taken up in our next.

Communications are received from—A Subscriber—A. S. H.—S. W.—H. H. H.—H.—J. Firth—Q. S.—W. Smith—David—W. C.—T. L. C.

**** Advertisements for the Covers of the Monthly Parts must be sent to the Publishers before the 20th day of each Month.*

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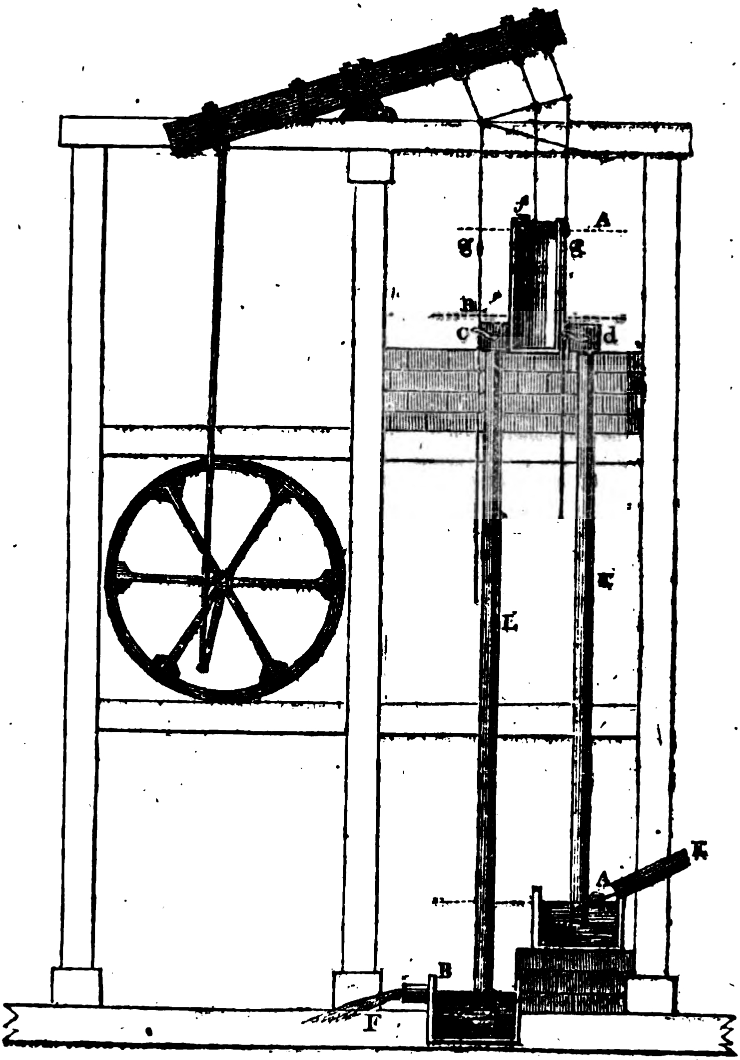
VACUUM POWER-ENGINE.



VACUUM POWER ENGINE.

SIR,—Following up the idea of your Correspondent, Z, in the 130th Number of the Mechanics' Magazine, I have devised a method of obtaining a Vacuum under the piston of an Engine of similar construction to the atmospheric steam-engine. It is simply this :—

A and B are two cisterns of water, the level of the water in the cistern A, being four feet above that of the water in the cistern B; *c* and *d* are valves, which are opened and shut by the rods *gg*. When the valve *d* is open, water rises into the cylinder through the pipe, K, from the cistern A, by the pressure of the atmosphere, as high as the dotted line, A, which is 32 feet above the surface of the water in the cistern A; now the valve *d* being shut,. and the valve C open, the water will fall to the dotted line B, that being 32 feet above the surface of the water in the cistern B, thereby producing a vacuum in the cylinder beneath the piston, or in the space between the dotted lines A and B.

The piston, now having the whole pressure of the atmosphere upon it, will descend with a force proportionate to its area, bringing down the end of the beam with it.

The piston being now at its lowest point, the rods, *gg*, will have opened, in their descent, the valve *d*, and closed the valve *c*. The water will now rise, by the pressure of the atmosphere, through the pipe K, and regain its height in the cylinder to the dotted line A, while the momentum of the fly-wheel raises the piston. When the piston has reached its highest point, the rods, *gg*, will have opened the valve *c*, and shut the valve *d*, and the piston will again descend, the water which produced the vacuum passing off through the pipe, L, into the cistern, B.

The cistern, A, is supplied with water from the pipe, E, which has a ball-cock, to preserve the level of the water. The pipe, F, allows the superfluous water to run off from the cistern, B, and thus preserves the same level of water in that vessel.

Before the engine can be set in motion, the plug at F must be taken out, the pipes L and K, and the cylinder, filled with water; replace the plug, and shut the valve, *d*, and the motion commences. It is obvious that the height of the level of the water in A, above that of the water in B, will be the length of the stroke of the piston.

Having put my ideas together on this subject in a very hasty manner, I shall be obliged to any of your Correspondents who will point out any inconsistency they may observe.

I am, Sir,

Your most obedient servant,

ROBINSON CRUSOE.

Portsmouth.

FIRST TRANSIT OF VENUS.

The first time the transit of Venus over the sun's disc was visible to mortal eyes was on the 24th of November, 1639, and the only two persons in the world who then observed it were Mr. Horrox, a young astronomer of great talents, who predicted its appearance, and his friend Mr. Wm. Crabtree, to whom alone he had ventured to announce the discovery. How enviable must have been the delighted feelings of these two young friends, at the moment when their solitary anticipation was realized! Mr. Horrox, who was suddenly cut off in the 22nd year of his age, was also the author of a Theory of Lunar Motions, which Newton has made the groundwork of his Astronomy, but not without a proper acknowledgment of the claims of this extraordinary young man, of whom he always spoke as a genius of the first rank.

ERRORS IN DR. HUTTON'S TABLES OF THE PRODUCTS AND POWERS OF NUMBERS.

Mr. James Utting has discovered no less than 1700 errors in one page (the 20th) of Dr. Hutton's Tables of the Products and Powers of Numbers. The products of all numbers from 361 to 380 at the head of the table, by 15 to 99 at the side, are all 100 too little.

CUBIC EQUATIONS.

(*Continued from page* 425, *No.* 139.)

(*For the Mechanics' Magazine.*)

SIR,—In my last communication I made a mistake in assigning the nearest limits of the irreducible equation $y^3 - a\,y = -a$, which I stated it to be: y is greater than $a^{\frac{1}{2}} - 1\frac{1}{10}$, but less than $a^{\frac{1}{2}}$. It ought to have been, y is greater than $a^{\frac{1}{2}} - 1\frac{1}{10}$, but less than $a^{\frac{1}{2}} - \frac{5}{10}$.

I shall now proceed to explain how a near value of the positive root of the irreducible equation $y^3 - a\,y = a$, or a near value of the negative root of the equation $y^3 - a\,y = -a$, may be obtained from Table I.

Example 1st.

Given $x^3 - 20\,x = 11$, to find a near value of the positive root.

Solution.

Reducing the equation to the tabular form, it becomes $y^3 - \frac{20^3}{11^2}\,y = \frac{20^3}{11^2}$ ∴ $\left(\frac{20^3}{11^2}\right)^{\frac{1}{2}} = \frac{40}{11}(5)^{\frac{1}{2}} = 8.13116 = a^{\frac{1}{2}}$.

Opposite to 8.5 we find $a^{\frac{1}{2}} = 8.04020$

.... 8.6 ...... $a^{\frac{1}{2}} = 8.13977$

Difference.......... 9957

Corrections.

.45980
.46023

43

Also 8.13116 − 8.04026 = 9094.

Hence 9957 : 9096 :: 43 : 39 ∴ .45980 + 39 = .46019 is the approximate correction to be added to 8.13116, to give a near value of y ∴ $y = 8.59135$, and $x = \frac{11}{20}\,y = \frac{11}{20} \times 8.59135 = 4.725242$.

In order to see how far the tabular solution is correct, we shall solve the equation $x^3 - 20\,x = 11$ by Mr. Raphson's method of approximation.

Solution.

When 4 is substituted for x, the result is − 16; and, when 5 is substituted, the result is + 25 ∴ one possible root lies between 4 and 5, try 4.5, and let $x = 4.5 + z = r + z$. Then

$$x^3 = r^3 + 3\,r^2 z + \text{, \&c.}$$
$$-20\,x = -20\,r - 20\,z$$
$$-11 = -11$$

$$\therefore 3\,r^2 z - 20\,z = 20\,r + 11 - r^3,$$
$$\text{and } z = \frac{20\,r + 11 - r^3}{3\,r^2 - 20} = -\frac{1}{3}r + \frac{40\,r + 33}{9\,r^2 - 60} = -1.5 + \frac{180 + 33}{182.25 - 60}$$
$$= \frac{213}{122.25} - 1.5 = .2 \text{ nearly}, \therefore x = 4.7$$

nearly.

Suppose $x = 4.7 + z = r + z$, then $z = -\frac{1}{3}r + \frac{40\,r + 33}{9\,r^2 - 60} = -1.566 + 1.591 = .025$ ∴ $x = 4.7 + .025 = 4.725$ nearly.

Again: Suppose $x = 4.725 + z = r + z$, by proceeding as above, we find $z = .000243$.

∴ $x = 4.725243$, very nearly.

Hence the tabular solution gives the positive value of x true to 5 decimal places, and more could not be expected; as the Table only extends to that number of figures.

Example 2nd.

To find the negative root of the equation $x^3 - 9\,x = -8$.

The negative root of the equation $x^3 - 9\,x = -8$ is the same as the positive root of the equation $x^3 - 9\,x = 8$.

The tabular equation is $y^3 - \frac{9^3}{8^2}\,y = \frac{9^3}{8^2}$ ∴ $\left(\frac{9^3}{8^2}\right)^{\frac{1}{2}} = \frac{27}{8} = 3.375$.

Opposite to 3.7 we find $a^{\frac{1}{3}} = 3.28287$

.... 3.8 ...... $a^{\frac{1}{3}} = 3.38108$

Difference.......... 9821

Corrections.

.41713
.41892

179

Also $3.375 - 3.28287 = 9213$ ∴ $9821 : 9213 :: 179 : 168 :: 41713 + 168 = .41881$.

Hence $y = 3.375 + .41881 = 3.79381$; and $x = \frac{8}{9} \times 3.79381 = 3.37228$.

The negative root of the equation $x^3 - 9x = -8$ is -3.37228; and all these figures we have found to be correct by the method of approximation.

Cubic equations of the form $x^3 \pm q x^2 \pm r = 0$, very often occur for solution; they may be reduced to the tabular form without taking away the second term, as follows :—

Put $x = \frac{q}{y}$, then, by substitution, the equation $x^3 \pm q x^2 \pm r = 0$ becomes $\frac{q^3}{y^3} \pm \frac{q^3}{y^2} \pm r = 0 :: r y^3 \mp q^3 y \pm q^3 = 0$, or $y^3 \pm \frac{q^3}{r} y \pm \frac{q^3}{r} = 0$; and assuming $\frac{q^3}{r} = a$, then $y^3 \mp a y \pm a = 0$.

The remainder of this subject, Mr. Editor, I shall certainly finish in my next communication.

I remain, Sir,
Your most obedient servant,
G.... S....

SCYLLA AND CHARYBDIS.

The rock of Scylla has been depicted by poets in very terrific colours; and, to describe its horrors, Phalerion, a painter, celebrated for his nervous representation of the awful and the tremendous, exerted his whole talent. But the flights of poetry can seldom bear to be shackled by homely truth; and if we are to receive the fine imagery that places the summit of this rock in clouds, brooding eternal mists and tempests; that represents it as inaccessible even to a man provided with twenty hands and twenty feet, and immerses its base among ravenous sea-dogs; why not also receive the whole circle of mythological dogmas of Homer, who, though so frequently dragged forth as an authority in history, theology, surgery, and geography, ought, in justice, to be read only as a poet. In the writings of so excellent a bard we must not expect to find all his representations strictly confined to a mere accurate narration of facts. Moderns of intelligence, in visiting this spot, have gratified their imaginations, already heated by such descriptions as the escape of the Argonauts and the disasters of Ulysses, with fancying it the scourge of seamen, and that, in a gale, its caverns "roar like dogs;" but I, as a sailor, never perceived any difference between the effect of the surges here and on any other coast, yet I have frequently watched it closely in bad weather. It is now, as I presume it ever was, a common rock of bold approach, a little worn at its base, and surmounted by a castle, with a sandy bay on each side. The one on the south side is memorable for the disaster that happened there during the dreadful earthquake of 1783, when an overwhelming wave (supposed to have been occasioned by the fall of part of a promontory into the sea) rushed up the beach, and, in its retreat, bore away with it upwards of 2000 people, whose cries, if they uttered any, in the suddenness of their awful fate, were not heard by the agonized spectators around.

Outside the tongue of land, or Braccio di St. Rainierè, that forms the harbour of Messina, lies the Salofaro, or celebrated vortex of Charybdis, which has, with more reason than Scylla, been clothed with terrors by the writers of antiquity. To the undecked boats of the Rhegians, Locrians, Zancleans, and Greeks, it must have been formidable; for, even in the present day, small craft are sometimes endangered by it; and I have seen several men-of-war, and even a seventy-four-gun ship, whirled round on its surface; but, by using due caution, there is generally very little danger or inconvenience to be apprehended. It appears to be an agitated water, of from seventy to ninety fathoms in depth, circling in quick eddies. It is owing, probably, to the meeting of the harbour, and lateral currents with the main one, the latter being forced over in this direction by the opposite point of Pezzo. This agrees, in some measure, with the relation of Thucydides, who calls it a violent reciprocation of the Tyrrhene and Sicilian Seas; and he is the only writer of remote antiquity I remember to have read who has assigned this danger its true situation, and not exaggerated its effect. Many wonderful stories are told respecting this vortex, particularly some said to have been related by the celebrated diver Colas, who lost his life here. I have never found reason, however, during my examination of this spot, to believe one of them.

Smyth's Memoir.

SILK-WINDING MACHINERY—MR. BADNALL'S PATENT.

(To the Editor of the Mechanics' Magazine.)

Sir,—Not being a constant reader of your Publication, it was not until this morning that your Number for April 15 was put into my hands. It contains an article from the pen of an individual named Jones, relative to my partner, Mr. Badnall's, Patent for the Manufacture of Silk. As it is evidently written with the intention of casting a shade upon that invention, I shall take upon myself to answer the erroneous and unfounded statements it contains.

To the claim to the invention Mr. Jones set up for our agent, Mr. Scott, in a former communication, and which he still attempts to insinuate, Mr. S.'s own written disavowal will by most be deemed a sufficient answer. To convince Mr. Jones, however, that the source from whence he has gleaned his information is not as correct, as he supposes, I would beg to inform him, that the coppers which Mr. Scott, then in the employ of Messrs. Pontifex and Co., was sent to erect, were not for the tanning process patented by Mr. Spilsbury, but for a dye-house belonging to Messrs. Badnall, Spilsbury, and Cruso; that so far from its being possible for Mr. Scott to have any claim to the invention alluded to, there is now in my possession a correspondence, prior to the period when Mr. Scott first visited Leek, between Mr. Badnall and myself, I being at that time in London, in which the principle of driving the skein of silk by power, in combination with a power of compensating any irregularity of its delivery, is not only fully discussed in words, but exemplified by drawings.

Having thus disposed of the first error, I will proceed to discuss, on Mr. Jones's own principles, the relative merits of the old and new machines. The propositions he lays down are severally as follow:—

1st, That Mr. Pattison has laid the machine aside;—that Mr. Pattison is the greatest English throwster—that, therefore, the machine is labouring under the greatest possible condemnation.

2dly, That increase of velocity being attended with equal expense, has no advantage;—that the chief advantage of the machine is velocity, therefore the new machine has no advantage.

Lastly, That a bobbin wound rapidly must make bad work; the new machine winds rapidly, therefore the invention is radically defective.

Without stopping to examine the logical accuracy of Mr. Jones's first proposition, but allowing Mr. Pattison (Mr. Pattison, jun. I conceive is alluded to) to be the greatest throwster—to be possessed of a sufficiency of acuteness to know his own interest, and of judgment to discriminate between the difficulties inseparable from a *new* system, and the difficulties inseparable from a *radically defective* system, we are not to suppose that Mr. Pattison's mantle will extend to his servants. Now, unfortunately, Mr. Pattison never saw the machine in question. But even allowing all the infallibility to Mr. Pattison and his men that Mr. Jones can desire, before we bow to their dictum, it must be shown, that the greatest throwster in the trade—greatest, of course, as possessing the largest capital, for I am not aware that Mr. Pattison possesses any thing to distinguish him from his neighbours, save extent—it must first, I say, be shown, that the greatest throwster would object to see his supremacy maintained at the expense of the good fame of an invention, the intention of which is to render capital, the cause of his superiority, less necessary. However this might be, one point I can personally attest. A few days previous to, I may almost say at the moment, Mr. P. was publicly declaring in London the machine a failure, I was myself at Mr. Pattison's factory at Congleton, and there saw the engine going, about three times faster than the other engines, superintended by the same number of children, and winding the same quality of silk. Mr. Bracegirdle, the superintendent, expressed himself satisfied, that the engine wound considerably *quicker* and *better* than the common description—that he had not yet tried how much so, as the hands were scarcely become sufficiently accustomed to it, to work it to the best advantage. Such was the fact; to reconcile, it must be the task of the greatest throwster and his advocate, Mr. Jones.

The premises of the second proposition I cannot assent to: that, because increased velocity is attended with an equivalent increase of expense, it has therefore no advantage. Is it no advantage to perform on one machine, in the same time, the work of five on another construction? Are the saving of capital on the first cost, the after wear and tear, the saving of room, points not worthy of consideration? they may be so with the greatest throwster, but the trade at large, the smaller capitalist, and the consumer will find it otherwise. Is it a slight advantage to perform the same quantity of work, though the expense be equal, by one machine in a fifth of the time that another will require? Is neither interest of money, nor a quicker return of capital, advantageous? If they be not, Mr. Jones will perhaps be kind enough to enlighten mankind as to the error into which they have hitherto been blindly plunged, in supposing that such trifles could form any part of the advantages of machinery—nay, he will be kind enough to point out in what else those advantages consist. But Mr. Jones errs as much in supposing the advantages of Mr. Badnall's patent to be confined to increased velocity. I am tempted to ask, did Mr. Jones ever witness a silk-winding engine at work? If he has, he will have seen the thread break, and that constantly, where the thread, if at all finer, was yet quite strong enough to bear the subsequent operations of the throwster. He might also have observed that the cause arose from the strain that the momentum, acquired of necessity by a swift in motion, exerts on the silk when it sticks in the skein or hank. He might then have possibly deduced, since momentum increases with velocity, the utter uselessness of driving a swift on the common principles at a speed greater than that ordinarily employed.

I need not here inquire into Mr. Jones's assertion, that the waste must be wound, and consequently the work will not be of so good a quality when wound by the patent engine, the use of the lever in which, is, by means of its power of extension and contraction, to regulate the *exact fineness* at which the thread is to be wound off *unbroken*—as that remark evidently arises from his total ignorance of the machine he is discussing. Neither shall I stop to notice what degree of contradiction exists between his observation, "that the English machines drive three times as fast as they wind at the best mills in Italy; and his opinions of the non-advantage of increased velocity, as these ideas arise from a similar ignorance of the real bearings of the case he attempts to investigate.

The third proposition is no less erroneous. The common causes of the breakage of threads in the operations of throwing, arises from the looseness and unevenness of a bobbin, wound by the common engine, and from the displacement of the threads and even breakage in such bobbins, by the frequency of the handling they necessarily require for piecing the threads. These are the true causes, combined with a radical defect in mules on the old construction, which, though it is provided for in Mr. Badnall's patent, it is not my province now to discuss. The first of the defects the patent machine remedies by the power it gives the winder, to give to his bobbins any degree of tightness he may desire. The chance of the second is rendered much less, by the less number of times that the bobbin requires to be handled, and also by the less effect such handling has on a tight than a slack bobbin. The explanation is found to agree with experience. for it is no uncommon thing to find a patent bobbin spun out without a breakage.

Finally, the fact that the silk termed Gonatia A., which, from its extreme fineness has alike defied the English and the Italian throwster, is now wound and worked by the new machinery with as much facility as coarser silks upon the old would have been, is of itself an ample refutation of Mr. Jones's statements; and it is with a feeling allied to self-debasement that I have condescended to notice the remarks of an individual who has so little regard to consistency or truth, as first to attempt to injure the character of Mr. Badnall under the paltry subterfuge of vindicating for another the merit of an invention, which, when he finds himself foiled, he would feign attempt to cry down as destitute of merit altogether. Such conduct I should have treated with the contemptuous silence it so richly deserves, did I not witness in it a fresh attempt on the part of an interested few, the situation of some of whom ought to have taught them better, to run down a series of improvements, which, though they have arisen in a manufactory of which I am a member, I do not hesitate to declare will, ere long, raise the English silk machinery to a pitch of perfection not surpassed by that of the cotton trade.

I now leave the patents to rest upon their own merits, only requesting those who may wish them well, to consider the difficulties and prejudices ever attendant on the introduction of a new system.

I have the honour to remain,
Sir,
Your obedient humble servant,
F. Gibbon Spilsbury.

Ballhaye, near Leek,
May 13th, 1826.

KITCHEN FLOORING.

Sir,—I observed, some time since, in your truly valuable publication, an inquiry upon the subject of flooring kitchens, &c., with a description of cement or mastic. Now I have been some time waiting in the hope of seeing the point discussed; but, as the wooden flooring of my kitchen is giving broad hints that something must speedily be done, will you allow me to revive the subject, by propounding the following questions:

What is likely to be the expense of covering a common house kitchen compared with boarding?

What is the best kind of cement, and whether any persons in town would undertake the job?

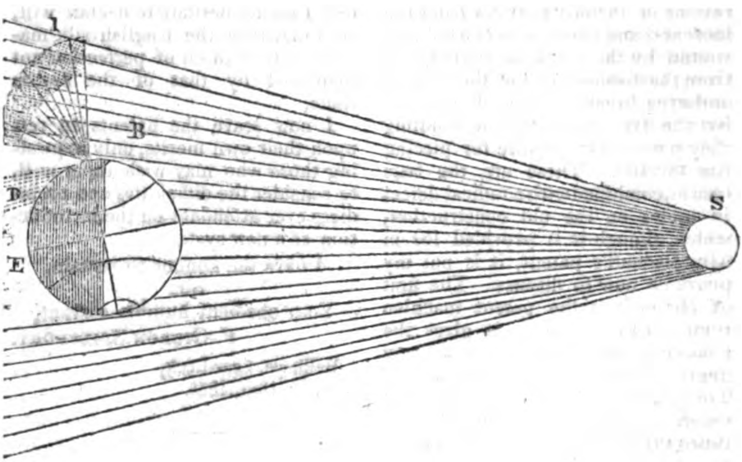
Whether the work is likely to chip off? &c.

I am informed that the flooring of kitchens, and even of upper rooms, in Derbyshire, are usually covered with a sort of mastic; but any information upon the subject will much oblige,

Your old and constant reader,
Zetrdapedon.

May 19th, 1826.

THEORY OF THE AURORA BOREALIS.



Sir,—The attempt to add another to the numerous theories which have been proposed, respecting the cause of the *Aurora Borealis* and *Australis*, may, perhaps, be thought presumptuous; but in this age of science, I should hope that any endeavour to elucidate a subject, which has hitherto baffled research, will meet with indulgence.

It is known that the ancients saw but little of those phenomena, and knew less, as the appearance of the Aurora Borealis was by no means frequent upon record, until after the year 1716. They gave it different appellations, according to its various forms and colours. Since the time mentioned, opportunities of accurately observing its movements and variations have been numerous, and all writers on the subject agree in their descriptions; viz. that it appears to stretch from the North towards the South in broad flashes, columns, rays, straight or waving lines, or arches across the zenith from East to West; that its motions are very variable, being perpendicular, horizontal, quick, slow, tremulous, and waving, and flying from one of these forms or movements to another with inconceivable celerity and brilliant changes of colour; that its tints are prismatic, and very similar to those of rainbows, haloes, paraselenæ, and other meteoric appearances, the undoubted cause of which is reflection of light from, or refraction of it through, water.

In mentioning former theories, most of which have been rejected as soon as proposed, by the scientific world, I have neither time nor inclination to describe them minutely, nor is it here requisite. It will suffice to glance at the most prominent and probable, as those supported by the names of the ablest men. Many are sufficiently absurd to carry their confutation with them; but as, of course, so difficult a problem must necessarily have given rise to very wild hypotheses, it is needless almost to say, that they are extremely abundant.

Dr. Halley gives us two solutions: first, that it is occasioned by vapours rarefied by subterranean fires, and tinged with sulphur; or, secondly, by a subtle vapour, which, entering the South pole, passes through the

Earth, making its exit at the North, and there, being suddenly condensed, gives out the same kind of light that electrics do upon friction. To confute the former hypothesis of the Doctor, it is only necessary to say, that we are now sufficiently acquainted with the laws of optics to know, that *sulphur* is not required to impart prismatic colours; and the latter is geologically impossible; or, if it were not, the appearance of the Aurora *Australis* within the *Antarctic* Circle completely destroys it.

Mr. Cotes* deduces the phenomena from streams emitted from the heterogeneous and fermenting vapours of the atmosphere. Modern chemists, I believe, recognize no such streams. Mr. Canton, Dr. Franklin, and Mr. Kirwan, with a great majority, suppose electricity in a variety of ways to be the primary cause; but Mr. Fisher, in his late Northern Voyage with Capt. Parry, affirms more than once, that the electrometer was not in the least affected with it, although it frequently streamed in its most vivid lustre over the ships. Mr. Dalton conceives it to be an effect of magnetism. I never heard that, under any circumstances, magnetism had the power of producing reflecting or refracting rays of light. Lastly, M. Libes supposes the Aurora Borealis to be produced by nitrous acid, nitric acid, and nitrous gas; but he also calls in the aid of an electric spark to produce these substances (which assume the prismatic colours), from the decomposition of azotic and oxygen gases. As far as nitrogen is here concerned, this theory is the nearest to that which I shall now offer, with the diffidence so intricate a subject excites, as nitrogen is always an agent in the formation of *ice*. But before I proceed further, I must observe that I am no astronomer, and must therefore beg indulgence for errors or deficiencies in terms of description.

It is to the work of Mr. Fisher, above mentioned, that I am indebted for the suggestion of this attempt at an hypothesis. In his accurate accounts of the various haloes, arcs, paraselenæ, &c., which he saw in the dreary regions he visited, he tells us that he always observed, during their appearance, floating particles or crystals of ice, in the atmosphere; which was also the case when the sun first appeared after its long absence, which was visible, by refraction, three days before it rose above the horizon. Now, considering the great refracting power of water, either in its fluid or congealed state, and the prismatic forms of its crystals, thus evinced in an immense degree in the formation of these meteoric appearances, and at the same time knowing the exhaling power of the sun, aided by the evaporation and expansion occasioned by volcanic and subterranean fires, which can raise vapour to almost any conceivable altitude, is it too great a stretch of imagination to suppose, that minute crystals of ice may be suspended at a great heat in the atmosphere, sufficiently high even to be exposed to the sun's rays, which of course pass obliquely over the globe, when the Arctic Circle is enveloped in the Earth's shadow? If this could take place, the rays might be refracted by clouds of the congealed atoms towards the North Pole, and cause the phenomenon of the Aurora Borealis; and towards the South in a less degree, proportionate to the supposed quantity of floating crystals in a comparatively warmer region, forming the Aurora Australis.

One principal branch of the subject to be considered, is the height of these phenomena above the Earth; and the calculations of it are as varying and discordant as the theories respecting them. Father Boscowich has determined the height of the Aurora Borealis, seen by the Marquis Poleni on the 16th of December, 1737, to have been 825 English miles; Mr. Bergman averages it at 468, Mairan at about 200 leagues, and Euler at several thousands of miles! So much for computation! The theory here offered would require an atmosphere of an altitude equal to that of the pheno-

* Vide Smith's Optics, p. 69.

menon; and the mean height of the atmosphere is supposed to be about five miles and a quarter. I say *supposed*, because, from many causes, it is known to be very unequal, and in spite of all calculation, it is confessed that the extension of its rarer strata may be *indefinite*. As an additional assistance to the opinion here broached, Mr. Forster, in his account of his voyage with Captain Cook, in 1773, says, "these columns (the Aurora Australis) are sometimes *bent sideways* at their *upper* extremities." May not this be at the points of refraction?

We are told that, although the Aurora Borealis appears to dart towards the South, it in reality points towards the North: if this be the case, it must be the atmospheric reflection of the true Aurora Borealis, which is seen on this side of the Pole.

The visible phenomenon, then, is here considered to be an atmospheric reflection of the refraction of the Sun's rays through a floating medium of crystallized water; and in this single sentence lies the essential part of the theory now offered.

It only remains to attempt to account for the various and momentary movements, extinctions, and re-illuminations of the phenomenon; and, according to this view of its probable cause, these must be effected by the rising, falling, sudden crystallization, expansion, alteration of form, and aggregation of the minute crystals or atoms, varied infinitely by currents of wind, chemical and other causes unknown.

Feeling my want of terms to render this description accurate, I subjoin a figure of the theory, in the hope of making myself more fully comprehended.

I am, Sir, yours, &c.

H. W.

Description.

S, the Sun.

E, the Earth.

I, floating particles or crystals of ice.

B, refraction of the Sun's rays, forming the true Aurora Borealis.

D, atmospheric reflection of B, the Aurora Borealis, which appears to stretch towards the South.

VARNISH FOR ELECTRICAL RIBBON.

[To the Editor of the Mechanics' Magazine.]

Sir,—As a friend of Galvanus, I must beg leave to remark, that the reason of your Correspondent, G. M. H——n, failing in his experiments with the pocket electrical apparatus, is because he has hitherto not used the proper varnish for the ribbon, the ingredients and respective proportion of which is as follows:—Every ten parts should consist of isinglass, three parts; India rubber, three parts; let these be dissolved in alcohol: next to this solution add six parts of copal varnish. Heat this compound over a gentle fire till thoroughly incorporated, and, while hot, dip the ribbon into it; when dry add another coat, till there is sufficient varnish on the ribbon.

I remain, Sir,
Your most obedient servant,
Psowtakonoski.

P.S. The white of an egg greatly improves the varnish.

ANCIENT VASES.

*From the Latin of Professor Hausmann.**

The ancient painted vases, chiefly dug up in many districts of Lower Italy, have excited much interest among the learned and the admirers of ancient art. While the elegance and diversity of their forms, together with the singularity and boldness of their figures, delight the eye of the beholder, the variety of design and subject in the paintings with which they are decorated, equally conduce to the illustration of mythology, history, and ancient art. The investigation of these paintings has already contributed in no small degree to improve our knowledge of antiquity; nor has the imitation of the forms of those vases been less a source of profit as applied to the art of pottery. The famous Wedgwood-ware owes its celebrity as much to the successful imitation of the forms of those vases as to the excellence of its material. In like manner, the beautiful ornaments observed upon these vases, have, in our times, been transferred to the subjects of many other arts; and have been employed for the decoration of buildings, rooms, furniture, articles of dress, and other works of luxury; insomuch, that antique forms have become so common in modern art, that their origin has been nearly forgotten. Although ancient art has, in this manner, made its way into the shops of potters and other artificers, and even into our drawing-rooms, yet the scientific study of technology, and the history of the mechanical and chemical arts, have hitherto been little advanced by the investigation of those ancient vases. In the writings of the ancients we scarcely find any passages in which positive mention is made of them; and none, in so far as I know, where their composition is spoken of. This point, therefore, can only be ascertained by an accurate examination of the vases themselves. During a journey which I made last year through Italy, I had opportunities of examining the splendid collections of those vases which adorn the museums of Florence, Rome, and Naples. The pleasure derived from this investigation was much augmented by some observations which it suggested to me regarding their composition. The little that I have learned with regard to this subject, either during my journey or from subsequent observations and experiments, I shall endeavour to expose in the following essay.

* Transactions of the Royal Society of Gottingen.

Sect. I.—*Of the Vases, commonly called Etruscan, in general.*

We shall confine ourselves to the vases commonly called Etruscan, although the greater part of them are not of Etruscan but of Grecian origin. The celebrated Winkelmann was the first who refuted the opinion chiefly supported by Gorius and Buonarotti, that these painted vases of pottery-ware had been manufactured in ancient Etruria.* But although it cannot be denied that the greatest quantity of vases has been dug up in those parts of Italy and Sicily which were formerly inhabited by the Greeks, nor that the style of their paintings and their inscriptions sufficiently demonstrate their Grecian origin; yet it is probable, that the art of fabricating painted vessels of earthen-ware was not confined to that portion of Italy, but also extended to other districts, since, in many places remote from it, vases of the same general description have been dug up, which, however, possess so much diversity of character, with regard to their forms and paintings, as to induce the inference, that they had not been transmitted to those parts by commerce. Nor was this art confined to ancient Italy alone, but was also practised in Greece,† and thence made its way into some of the neighbouring districts of Pontus.‡ The painted vases found in these countries are essentially the same as those discovered in Italy.

The vases found in different parts and situations of Italy differ more or less from each other, both with respect to the quality of the material, and to the workmanship and style of painting; the cause of which difference is to be sought for in the different natural qualities of the materials, or in a different degree of perfection in the art. For the art of forming vases of pottery-ware, and of ornamenting them with paintings, may not only have existed in various degrees of perfection in different places at the same time, but the state of this art had also, without doubt, been very different at different periods. And not only have earthen vases of very different degrees of fineness been manufactured at the same time and in the same places, but also plain vases, without any paintings, in all other essential respects agreeing with the painted ones, and destined for the same general purposes.

Of the painted earthen vases, dug up in different parts of Italy, those found in

* Geschichte der Kunst, p. 193, et seq.

† Clarke's Travels, vol. IV.—Walpole Memoirs, 2d Edit.—Antiq. of Athens, p. 322—Ritter's Vorhalle Europaischer Volkergeschichten von Herodotus, p. 232.

‡ Ritter, as above, p. 231.

Lower Italy and Sicily are the finest. The best of all, however, are those found at Nola, both in respect to the excellence of their materials, and the elegance of their forms, together with the beauty of the paintings and the lustre of their varnish-like coating. Many of them are so perfectly preserved, that you might imagine them newly made. Next to the Nola vases, are those of Locria and Agrigentum. Many vases have also been found near Pæstum, the ancient Capua (now S. Maria di Capua), Sancta Agatha Sothorum, Trebbia, Aversa, Avella, Tarentum, and in some other places of Apulia, and of the Neapolitan province named Abruzzo, the greater number of which are remarkable for their beauty. Of late years, vases have also been dug up in the vicinity of the cities of Angi and Pomarico in Calabria.* The largest and best collection of vases, found in these and other places of Lower Italy and Sicily, arranged most elegantly and in the best order, is preserved in the Royal Museum of Naples; this collection has, of late, been much enlarged by the purchase of the extensive one made at Nola, belonging to the family of Vienzio. Of the private collections at Naples, the most remarkable is that of the Archbishop of Tarentum, which is preserved at his seat near Portici, elegantly adorned with the choicest works of ancient and modern art; and what renders this collection still more deserving of attention is, that it is illustrated by a learned description drawn up by its accomplished proprietor himself. A great number of vases, dug up in Lower Italy, have also been deposited in the Vatican Library at Rome, and the public Museum of Florence.

In the middle part of Italy painted vases have been found much more rarely. In some places of ancient Etruria, as for example, near Voltena and the cities of Chiusi, Viterbo, and Corneto, a few were formerly dug up, some of which are preserved in the Florentine Museum.† The true Etruscan vases may be distinguished from others by the inferior quality of their materials, by the dullness of their coating, but especially by the greater rudeness of their forms and painting, as well as by certain characters of the representations peculiar to the ancient Etruscan art.‡ These differences may be very clearly seen in the Florentine Collection, where authentic Etruscan vases are placed in the same apartment with others of Grecian origin. In the great collection at Naples, I was shown only a single mutilated true Etruscan vase.

No vestiges of ancient painted vases have, in so far as I know, been found in Italy, to the north of the Appenines. Those which are preserved in the Museums of Bononia, Turin, and other cities of northern Italy, have migrated into those parts from southern Italy.

It is not my design, in this treatise, to institute any inquiry into the periods at which these vases were manufactured, not only because investigations have already been made with respect to this point by many authors of great learning, but especially also because the settlement of it would involve an examination, entirely foreign to my views, of the various inscriptions observed on those vases, as well as of the subjects and characters of the paintings. It is undoubtedly more easy to discover the period up to which these vases may have been fabricated, than the time at which the art, commonly considered as of Grecian invention, but assuredly possessed of claims to a much higher antiquity,§ took its origin. It seems not improbable, that the latest period at which these vessels were manufactured in Italy, was the time of the civil wars.|| The Roman vases of later periods, dug up in many parts of Italy, as at Nola, Pompeii, and Rome, have a very different character. They have no paintings, but are frequently ornamented with raised figures, and usually have a red coating; characters which are also observed in the Roman vases dug up in some parts of Germany and France.

To a later period also belong the vases dug up in great quantity near Aretium, so far down as the time of Vasarius,¶ many of which are preserved in the Florentine Museum. These vases have a red or blackish coating, and, in other respects, are of similar composition with the older Etruscan vases,** with which they are sometimes confounded. It seems not improbable, that they belong to the Aretine vases, so highly esteemed in ancient times, which have been praised by Martial,†† and taken notice of by Pliny‡‡ and Isidorus, although it is difficult to arrive at any certainty with regard to this point.§§

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* Milligen, Peintures ant. et ined. de Vases Grecs, p. vii.

† Fea ad Winkelmannum, t. i. p. 215.—Meyer in Boettiger's work, entitled Griechische Vasengemalge, i. ii. p. 5. 20. Peintures de vases antiques vulgairement appelles Etrusques, gravees par A. Clener; accomp. d'Explications par A. L. Millin, 1808, vol. i. p. 6, note 34.

‡ Lanzi de vasi antichi dipinti, volgarmente chiamati Etruschi. Dissertazioni tre, p. 23.

§ Ritter, l. cit. p. 230.

|| Millingen, Peintures antiques, p. 8.

¶ Lanzi, l. c. p. 39. ** Ibid. p. 37.

†† Lib. xiv. Ep. 98.

‡‡ Hist. Nat. Lib. xxxv. cap. 12.

§§ Origin. l. xx. cap. 4.

The painted earthen vessels of Grecian origin, which have been found in Lower Italy, seem to be of different ages. According to the opinion of the celebrated Millingen and some other antiquarians, an opinion which seems to be well grounded, the vases commonly, but incorrectly, called Egyptian, whose paintings are of a dusky red colour upon a yellow ground, in which condition some vases have also been dug up in Greece, are the most ancient. The vases, commonly called Sicilian,* which have black paintings upon a reddish yellow ground, are, according to the same opinion, less ancient, but more so than the vases with reddish yellow figures and ornaments upon a black ground, which are the most common of all.† This opinion has indeed been lately opposed by the celebrated Rossi, who has shown the vases with black figures to be of the same age with the rest: ‡ his arguments, however, do not seem to invalidate the former opinion.§

Many vases, either having no paintings at all, or, instead of figures, having other singular ornaments, have been dug up, both along with painted vases and by themselves, not only in Lower Italy, but also in ancient Etruria, which have either the natural colour of burnt clay, or a black coating, or have been manufactured of clay evidently mixed with some black matter. The ornaments upon the black vases are very frequently of a white colour, sometimes yellow or red. Not only the forms, but also the colours, of the black coating and ornaments, as well as other circumstances, correspond with those which are observed in vases adorned with more perfect and more complex paintings; from which it may be supposed that these ruder and less elegant vases are of the same age and manufacture with those more beautiful productions of art, which, without doubt, were more highly esteemed in ancient, as they are in modern times.

The vases dug up in Lower Italy are found in Grecian sepulchres, more or less concealed beneath the surface of the ground, and constructed of stone in a rectangular form, placed near the remains of the dead body, and sometimes also suspended upon the walls; as is clearly shown by the excellent representations delineated by Knipius, added to Teischbein's plates of vases, as well as by the accurately executed models exposed in the royal collection of vases at Naples. Many vases are also found in the same sepulchre, of various sizes and qualities. Some of these sepulchres, which are small, and constructed of rough stones, usually contain a smaller number of a coarser kind. In other sepulchres of larger size, constructed of hewn stones, and covered over with slabs like the roof of a house, some of which I have seen before the gates of the ancient Pæstum, vases of superior quality are found in great number.‖ Sometimes they occur in their original position, and in a perfect state of preservation; at other times, however, they are crushed and destroyed. Some of them have retained in a surprising degree their polish and original colours; others, especially those dug up in moist places, are slightly incrusted with a white calcareous substance, easily soluble in acids, which has probably been precipitated upon them from the water that had penetrated through the walls of the sepulchre. This preservation of vases, constructed at so remote a period, of such frail materials, and with so thin a coating, is a subject of much interest, and not less than the perfection of the art as practised by the ancients, invites to the investigation of their mode of formation.

We shall endeavour to distribute the most ancient earthenware vases, whether Greek or Etruscan, according to their mode of composition, into classes, for the purpose of obtaining a more distinct perception of their varieties.

(To be continued.)

* Meyer in Boettinger's work, Griechische Vasengemalde, I. 2. p. 17.

† Millengen, Peintures Antiques de Vases Grecs, p. iv. v.

‡ Ibid. Third letter addressed to M. Millingen by the Chev. Rossi.

§ Gottingische gelehrte Anzeign, 1820, p. 739.

‖ Hamilton in Boettiger's work cited above, I. 1. p. 34.

BORING FOR WATER.

[To the Editor of the Mechanics' Magazine.]

Sir,—If your Correspondents, T. W., Clerkenwell, in Number 130, and T. J., in Number 132, will give the address of the persons they allude to as skilful practitioners in boring for water, and also at the same time furnish some idea of the expense of boring, they will render a great service to many of your country subscribers.

I am, Sir,
Your obedient servant,
May, 1826. J— B—.

A FRAGMENT OF ROMAN GLASS FOUND NEAR BROUL.*

The invention of glass (says Dr. Rudolph Brandes) is known to be very ancient; nevertheless few antique remains of it have come down to us, or have been analyzed.

Although the art of manufacturing glass was not carried to that degree of perfection among the ancients to which it has been brought in our days, still in some branches of it they had gone very far, as has been sufficiently shown by the learned investigations of Winkelmann.

The piece of glass which I obtained from M. Dorow was a fragment of a round vase, and weighed about ten grains. Its colour was of a milky white with a very bluish cast. A pellicle of a brilliant gold colour covered its exterior, and in part its interior surface. This had so much the appearance of gilding, that without a chemical trial one would have taken it to be gold; but I shall show below that this was not the case. The long period of time during which the glass had been exposed to the effects of the air, water, and the pressure of the earth, had made a visible impression on it; so much so, that it was in a mouldering state, had entirely lost its firmness and brittleness, and when broken, pressed, or scraped, fell into small leaves like mica. It had completely lost its transparency, but it was still evident, from its appearance in the centre, that it was originally perfectly transparent, that part, from having somewhat resisted the destructive effects that had acted upon the rest, being so still. Wherever the glass was covered with the gold-like pellicle it was not transparent, but where free from it, it was perfectly clear.

By endeavouring to separate that covering, no gold-leaf was detached, but thin leaves of glass; and the surface beneath soon offered a similar appearance. In some places that metallic tarnish assumed a fine bluish, red, or green hue; and a similar appearance was produced by taking off the apparently metallic pellicle which was on the inside. This shows that the cause of this tarnish was the same as that which acts upon glass long exposed to the weather—such as in old church windows, for instance; and which has a similar appearance. However, to convince myself completely of the absence of gold, I heated as many as possible of the shining glass leaves in nitric acid, by which process the gold-coloured covering entirely disappeared, and the leaves remained without colour. The component parts of the glass, I found to be silica, soda, lead, oxide of manganese, oxide of iron, lime, and alumina. Of these constituents the silica formed about two-thirds, and the other substance the remaining third of the whole mass.

* From Schweigger's Journal, Band x. p. 304.

USE OF GAS IN DWELLING-HOUSES.

A medical Correspondent objects strongly to the use of Gas in Dwelling-houses. "The quality of the air," he says, "is rendered by it peculiarly injurious to health. The lymphatics have the power of taking up gaseous substances, and it must be evident, that however slow the process on a strong constitution, the hydrogenous properties of such gas as supplies the lamps now in use, must produce injuries to the lungs, and from thence to other parts of the frame." As far as the observations of our Correspondent apply to coal gas, which is that chiefly used in coffee-rooms, shops, taverns, and other public rooms, we are inclined to agree with him; but where *oil* gas is used, we do not believe that the air is more deteriorated by it than it would be by the use of tallow candles.

COPERNICUS.

The name of this celebrated astronomer was originally written Koppernick; he was a canon and physician, and occupied himself in directing buildings. The aqueducts which he constructed at Graudenz, Thorn, and Dantzig, still exist. He took twenty-four years to produce his famous astronomical system, against which the thunders of the Vatican were hurled when the author was dead. The sentence of condemnation was only repealed at Rome in 1821; Copernicus died in 1543. The monument which Bishop Kromer erected to him in the Cathedral of Frauenbourg, no longer exists. Prussia claims Copernicus as one of her sons, although, at this period, Thorn did not belong to the Prussians.

FRENCH METHOD OF PREPARING GOLD-BEATER'S SKIN.

Before describing this process it is proper to observe, with respect to all articles made of the gut of animals, as gold-beater's skin, lathe-bands, harp and violin strings, &c., that the muscular tunic requires, in the first place, to be freed from the external or peritoneal membrane, and the internal or mucous membrane. Of old, the guts used to be subjected, for this purpose, to a process of putrid fermentation, which was accompanied with such a fetid effluvia that it could only be carried on at a distance from inhabited places. In 1820, the Society for the Encouragement of National Industry offered a prize for a process of effecting this object without submitting the guts to the putrid fermentation, and the result was the invention of the following process, now in general use in France:—

After the guts have been freed from all greasiness, by the usual methods, and turned inside-out, they are put into a tub capable of containing as many as are produced from fifty oxen, and two buckets of water, each containing a pound and a half of the *eau-de-Juvelle** (marking from 12 to 13 degrees of the *Pèse-liqueur*, or ærometer for alkaline solutions) are poured upon them. If not sufficiently wetted, another bucket-full of well or river water is thrown over them; they are then well stirred up, and left to steep all night. At the end of this time the mucous membrane may be removed with as much facility as it could be after many days of putrid fermentation. At the moment of contact with the *eau-de-Javelle* all fetidity totally disappears. The other operations are afterwards performed in the usual manner.

We now proceed to describe the peculiar process of preparing gold-beater's skin.

When the workman has stripped off that part of the peritoneal membrane which surrounds the *cæcum*, he takes from two to two and a half feet in length of it, and inverts it, or turns it inside-out; he then leaves it to dry: when dry, it resembles a packthread. In this state it is sold to the manufacturer of gold-beater's skin, who takes the dried membranes and soaks them in a very weak solution of potash. When sufficiently soaked, so as to have become gelatinous, he places them on a wooden plank, to scrape them clean, and cut them open with a knife. When the pellicles are well cleansed, and sufficiently freed from the water, they are extended on wooden frames, three or four feet long, and about ten inches wide; these are formed of two uprights, joined by two cross-pieces; the cross-pieces have grooves of three or four lines wide made in them.

In order to extend the membrane, the workman takes it in his hands, and affixes one end of it, by its glutinous quality, to the top of the frame, taking care that that part of the intestine which formed the outside of it be placed next to the frame; he then extends it every way, and causes it to adhere to the other end of the frame: this effected, he takes another membrane, and applies it upon that which is already extended, taking care that the muscular membranes should be in contact with each other: in this way they become so perfectly glued together as to form one solid body.

The two membranes soon become dry, except at their extremities, which are glued to the cross-bars of the frame. When the whole is well dried, the workman cuts the pellicles

* This article is an alkaline liquid, manufactured in the vicinity of Paris, and sold at a cheap rate, for the use of laundresses, &c.

across at each end with a good knife, and separates them from the frame. The dried and stretched membranes are then delivered to another workman, to give them what is termed *le fond*, being the last preparation, and to cut them into convenient sizes.

In order to finish the pellicles, the workman takes each band separately, and glues it on a similar frame to that which we have before described, but without a groove: he applies the glue upon the edges of the frame, and places on it the band of the pellicle. When quite dry, it is washed over with a solution of one ounce of alum, dissolved in two wine-quarts of water, and again allowed to dry; it is then coated, by means of a sponge, with a concentrated solution of isinglass in white wine, in which acrid and aromatic substances have been steeped, such as cloves, musk, ginger, camphor, &c.; these last substances are added to prevent insects from attacking the pellicle. When sufficiently coated with this composition, or, as the workmen call it, *grounded*, they, lastly, cover it with a layer of whites of eggs. The pellicle is then cut into pieces of about five inches square, submitted to the action of a press to flatten them, and then formed into small packets or books for sale to the gold-beaters. This last process very much resembles that used in preparing the English Court-plaster.

ACOUSTIC DRAWING.

Stretch a thin sheet of paper somewhat tightly over the mouth of a wine-glass; scatter on it a thin layer of fine dry sand; then take a circular plate of glass or metal, and bringing it within a few inches of the wine-glass, draw the bow of a fiddle smartly across it, so as to make it vibrate sensibly; the vibrations of the glass or metal plate will be conveyed through the air to the adjoining paper, and the sand on its surface will be thrown into figures, which have sometimes the most perfect regularity, and are often formed with such celerity, that the eye has scarcely time to identify the different changes. The figures are most symmetrical, when the paper is equally thick and uniformly stretched. The same effect is produced by playing on a flute, or any other musical instrument, close by the side of the glass. But what appears more astonishing, even the voice, though but faintly exerted, produces an analogous impression. By whatever method, in short, the air is agitated, it is capable of communicating the motion which it has received, and that without any alteration.

ANSWER TO INQUIRY.

Page 173, Volume v.

TO GILD MANUSCRIPT WRITING.

Dissolve a little gum ammoniac in a small quantity of water, in which a little gum arabic and the juice of garlic have been previously dissolved. Write with this liquid instead of ink, or form characters with it by means of a camel's-hair pencil. Let the characters dry, then breathe upon them, and apply leaves of gold to them as for any other kind of gilding. The superfluous gold may be removed by a brush, the writing will then appear covered with gold, and may be burnished.

Permit me, Mr. Editor, to ask a question in return.—Can any of your intelligent Correspondents or readers inform me how to colour varnish red, blue, green, and yellow? like the varnish used for crystallized tinfoil for fire-boxes, &c.

H. C——LL.

The articles promised in our last, by Viator, &c. are in type, but unavoidably postponed for want of room.

*** *Notices to other Correspondents in our next.*

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OF THE

State of Agriculture and Grazing

IN

NEW SOUTH WALES;

INCLUDING

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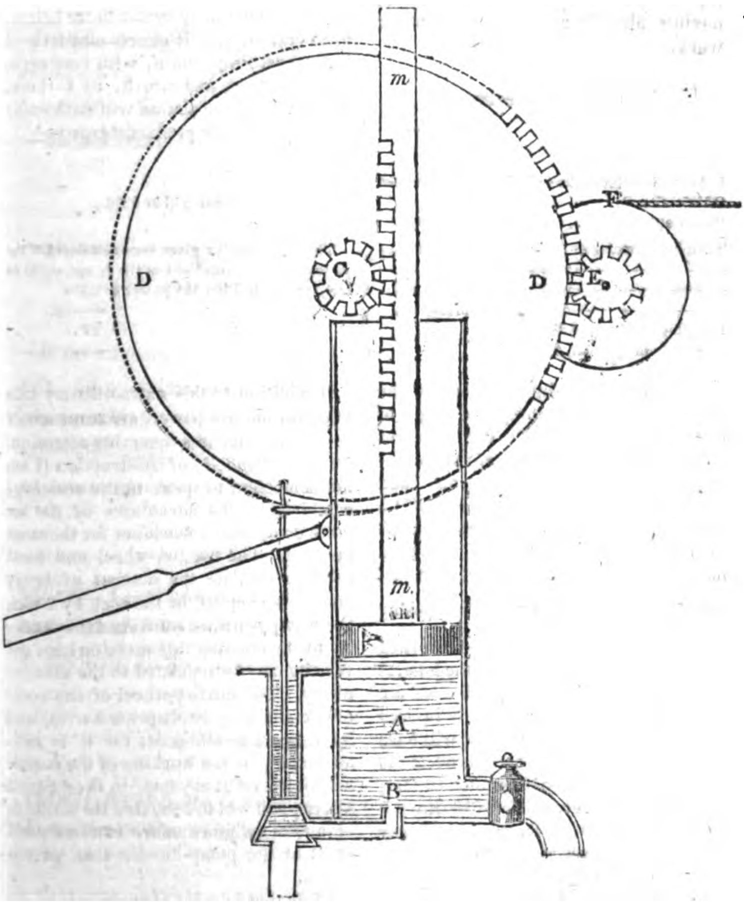
Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 145.] SATURDAY, JUNE 3, 1826. [Price 3*d*.

The wise and active conquer difficulties
By daring to attempt them; sloth and folly
Shiver and shrink at sight of toil and hazard,
And make th' impossibility they bear. *Rowe.*

BROWNE'S HYDRAULIC PRESS.



BROWNE'S HYDRAULIC PRESS.

(To the Editor of the Mechanics' Magazine.)

SIR,—Agreeing fully with the ingenious writer of the following article, that, in the prevailing rage for applications of steam as a moving power, the equal, if not superior, fitness of water for the same purpose has been too much neglected, I presume to submit the propriety of giving it a place in your widely extended Publication; feeling well assured, that you have too much liberality to think its claims to the notice of your readers lessened by its having already appeared in another work.

I am, Sir,
Your obedient servant,
A— F—.

To the Editor of the London Journal of Arts.

SIR,—It is a circumstance very much to be regretted, that the enormous and unequalled power obtained by the hydrostatic paradox, or Bramah's press, should be so very much confined in its application, or rather, that it should meet with so little regard. The steam-engine alone engrosses every one's attention, while scarcely an individual has endeavoured either to extend the utility of, or in any way to improve upon, this highly valuable and astonishing machine. Yet are there very many and obvious instances in which it may be employed to great advantage. Where a great weight is required to be raised to a definite height, as in cranes, &c. it clearly may be used in its most simple form, with very peculiar advantage, and which, as I think, the following calculation will sufficiently demonstrate (See prefixed figure) :—

Let the diameter of the cylinder A be	12 inches	Power of the press will be 2304.
Of injection B	¼ do.	
Power applied	unity	
Then let diameter of pinion C	4 inches	This combination gives for one ascent of the piston-rod 27 revolutions of the drum, equal 84 feet, and diminishes the power to $\frac{2304}{27}$ = 85.
——— wheel D	36 do.	
——— pinion E	4 do.	
——— drum F	12 do.	
Length of piston-rod M, or altitude of cylinder A	36 do.	

Now supposing the diameter of the forcing-pump two inches, and length of its stroke six inches, the cubic content will be 18.8, and the content of the cylinder (twelve inches diameter, and thirty-six inches altitude) being 4071.5 inches; the number of strokes required to raise the piston through thirty-six inches, that is, to fill the cylinder A, will be $\frac{4071.5}{18.8}=216$; further, supposing the lever by which the pump is worked to have a power of six to one, the longest arm will at each stroke describe an arc of three feet, and consequently in two hundred and sixteen strokes it will have passed through 648 feet: 1 through 648 feet will lift (85 × 6) 510 through 84 feet, or 1 through 8 feet, will lift 510 through 1 foot—a result very far superior to any of the cranes now used; for their greatest extent, I believe (where horse-power is not employed), is 1 through 12 feet lifts 24 through 1 foot.

In addition to this extraordinary gain of both time and power, are some minor peculiarities no less deserving attention. Its great *simplicity* of construction (I am not competent to speak to the *economy*) combines all the advantages of the far more complicated machines for the same purpose. The friction-wheel and band used to regulate the descent of heavy goods, is supplied by the cock by which the water is drawn off from the cylinder A, for by opening this more or less, the velocity may be regulated to the greatest nicety. The ratchet-wheel of the common crane may be dispensed with, and its dangers annihilated, for it is self-apparent that the working of the engine may be left off at any stage in the greatest safety; and add to this, that the strength of a man is much more efficiently exerted at the pump-handle than at the winch.

I fear that in point of expense it might be found to exceed the generality of cranes, for *two pumps* would be requisite to produce a continuous motion, but where a machine occupying a little space is required to raise a great weight to any considerable height in a little time, as in lofty warehouses, &c. I certainly conceive this would be found of considerable advantage.

In pile-engines, where the weight of the ram is but trifling, and where a gain of *time* is a valuable consideration, it seems admirably adapted; for very few strokes of the pump, with *two men* in lieu of *four*, would produce an effect many times the multiple of the ordinary engines.

Possessing but an indifferent portion of theoretic skill, and boasting no knowledge beyond what my study affords, I may not have been very judicious in my choice of the foregoing combinations, having selected those which produce the nearest results upon paper, and perhaps even the calculations themselves may be at variance with practice, and I much fear this may be the case, or so simple an affair could scarcely have so long lain dormant; however, I take the liberty of submitting it to your inspection, with a view to its obtaining publicity in your most useful Journal, should it prove free from objection.

I am, Sir, yours, &c.
GORDON D. BROWNE.
14th July, 1824.

PREPARATION OF GOLD LEAF.

BY DR. LEWIS.

A bar of gold, from six to eight inches long, and three-quarters of an inch wide, is made red-hot, to burn off the tallow; and forged, upon an anvil, into a long plate; which is further extended, by being passed repeatedly between polished steel rollers, till it becomes a ribbon, as thin as paper. Formerly, the whole of this extension was procured by means of the hammer, and some of the French workmen are still said to follow the same practice: but the use of the flatting-mill both abridges the operation, and renders the plate of a more uniform thickness. The ribbon is divided by compasses, and cut with shears, into equal pieces, which, consequently, are of equal weight: these are forged upon an anvil till they are an inch square; and afterwards well annealed, to correct the rigidity which the metal has contracted in the hammering and flattening. Two ounces of gold, or 960 grains, the quantity which the workmen usually melt at a time, make a hundred and fifty of these squares; whence each of them weighs six grains and two-fifths; and, as 4902 grains of gold make one cubic inch, the thickness of the square plates is about the 766th part of an inch.

In order to the further extension of these pieces into fine leaves, it is necessary to interpose some smooth body between them and the hammer, for softening its blow, and defending them from the rudeness of its immediate action; as also to place between every two of the pieces some proper medium; which, while it prevents their uniting together, or injuring one another, may suffer them freely to extend. Both these ends are answered by certain animal membranes.

The gold-beaters use three kinds of membranes;—for the outside cover, common parchment, made of sheep-skin; for interlaying with the gold, first, the smoothest and closest vellum, made of calves-skin; and, afterwards, the much finer skins of ox-gut, stripped off from the large straight gut, slit open, curiously prepared on purpose for this use, and hence called *gold-beater's skin.* The preparation of these last is a distinct business, practised by only two or three persons in the kingdom, some of the particulars of which I have not satisfactorily learned. The general process is said to consist in applying them one upon another, by the smooth sides, in a moist and semiglutinous state, when they readily cohere and unite inseparably; stretching them on a frame, and carefully scraping off the fat and rough matter, so as to leave only the fine exterior membrane of the gut; beating them between double leaves of paper, to force out what unctuosity may remain in them; moistening them once or twice, with an infusion of warm spices; and, lastly, drying and pressing them. It is said, that some calcined gypsum, or plaster of Paris, is rubbed, with a hare's foot, both on the vellum and on the ox-gut skins, which fills up such minute holes as may happen to be in them, and prevents the gold from sticking, as it would otherwise do, to the simple animal membrane. It is observable, that, notwithstanding the vast extent to which the gold is beaten between these skins, and the great tenuity of the skins themselves, they sustain continual repetitions of the process, for several months, without extending, or growing thinner. Our workmen find, that after seventy or eighty repetitions, the skins, though they contract no flaw, will no longer permit the gold to extend between them; but that they may be again rendered fit for use, by impregnating them with the virtue which they have lost; and that even holes in them may be repaired by the dexterous application of fresh pieces of skin. A microscopical examination of some skins, that had been long used, plainly showed these repairs. The method of restoring their virtue is said, in the Encyclopédie, to be, by interlaying them with leaves of paper moistened with vinegar or white wine, beating them for a whole day, and afterwards rubbing them over, as at first, with plaster of Paris. The gold is said to extend between them the more easily after they have been used a little, than when they are new.

The beating of the gold is performed on a smooth block of black marble, weighing from two hundred to six hundred pounds—the heavier the better—about nine inches square on the upper surface, and sometimes less, fitted into the middle of a wooden frame about two feet square, so that the surface of the marble and the frame form one continuous plane. Three of the sides are furnished with a high ledge; and the front, which is open, has a leather flap fastened to it, which the gold-beater takes before him, as an apron, for preserving the fragments of gold that fall off. Three hammers are employed, all of them with two round and somewhat convex faces, though commonly the workman uses only one of the faces: the first, called the *cutch-hammer*, is about four inches in diameter, and weighs fifteen or sixteen pounds, and sometimes twenty; though few workmen are found who can manage those of this last size: the second, called the *shodering-hammer*, weighs about twelve pounds, and is about the same diameter as the first: the third, called the *gold-hammer*, or *finishing-hammer*, weighs ten or eleven pounds, and is nearly of the same width as the two others. The French use four hammers, differing both in size and shape from those of our workmen: they have only one face, being, in figure, truncated cones: the first has very little convexity, is near five inches in diameter, and weighs fourteen or fifteen pounds; the second is more convex than the first, about an inch narrower, and scarcely half its weight; the third, still more convex, is only about two inches wide, and four or five pounds in weight; the fourth, or finishing-hammer, is nearly as heavy as the first, but narrower by an inch, and the most convex of all. As these hammers differ so remarkably from ours, I thought proper to insert a description of them; leaving the workmen to judge what advantage one set may have over the other.

A hundred and fifty of the pieces of gold are interlaid with leaves of vellum, three or four inches square; one vellum leaf being placed between every two of the pieces, and about twenty more of the vellum leaves on the outsides: over these is drawn a parchment case, open at both ends; and over this, another, in a contrary direction; so that the assemblage of gold and vellum leaves is kept tight and close on all sides. The whole is beaten with the heaviest hammer; and every now and then turned upside down, till the gold is stretched to the extent of the vellum; the case being opened from time to time, for discovering how the extension goes on; and the packet, at times, bent and rolled, as it were, between the hands, for procuring sufficient freedom to the gold; or, as the workmen say, to make the gold work. The pieces taken out from between the vellum leaves are cut in four, with a steel knife; and the six hundred divisions, hence resulting, are interlaid, in the same manner, with pieces of the ox-gut skins, five inches square. The beating being repeated, with a lighter hammer, till the golden plates have again acquired the extent of the skins, they are a second time divided in four. The instrument used for this division is a piece of cane, cut to an edge; the leaves being now so light, that the moisture of the air or breath condensing on a metalline knife would occasion them to stick to it. These last divisions being so numerous, that the skins necessary for interposing between them would make the packet too thick to be beaten at once, they are parted into three parcels, which are beaten separately, with the smallest hammer, till they are stretched, for the third time, to the size of the skins: they are now found to be reduced to the greatest thinness they will admit of; and, indeed, many of them, before this period, break or fail. The French workmen, according to the minute detail of the process given in the Encyclopédie, repeat the division and the beating once more; but, as the squares of gold, taken for the first operation, have four times the area of those used among us, the number of leaves from an equal area is the same in both methods; to wit, sixteen from a square inch. In the beating, however simple the process appears to be, a good deal of address is requisite for applying the hammer so as to extend the metal uniformly from the middle to the sides: one improper blow is apt not only to break the gold leaves, but to cut the skins.

After the last beating, the leaves are taken up by means of a cane instrument, or forceps, and, being blown flat on a leather cushion, are cut to size, one by one, with a square adjustable frame of wood, edged with two parallel slips of cane made of a proper sharpness: they are then fitted into books of twenty-five leaves each, the paper of which is well smoothed, and rubbed with red bole, to prevent their sticking to it. The French, in sizing the leaves, use only the cane knife; cutting them first straight on one side, fitting them into the book by the straight side, and then paring off the superfluous parts of the gold about the edges of the book. The size of the French gold leaves is from somewhat less than three inches to three inches and three-quarters square; that of ours, from three inches to three inches and three-eighths.

The process of gold-beating is considerably influenced by the weather. In wet weather, the skins grow somewhat damp, and in this state make the extension of the gold more tedious: the French are said to dry and press them at every time of using; with care not to over-dry them, which would render them unfit for further service. Our workmen complain more of frost, which appears to affect the metalline leaves themselves: in frost, a gold leaf cannot easily be blown flat, but breaks, wrinkles, or runs together.

Gold leaf ought to be prepared from the finest gold; as the admixture of other metals, though in too small a proportion to affect sensibly the colour of the leaf, would dispose it to lose its beauty in the air. And, indeed, there is little temptation to the workmen to use any other; the greater hardness of alloyed gold occasioning as much to be lost, in the points of time and labour, and in the greater number of leaves that break, as can be gained by any quantity of alloy, that would not be discovered at once by the eye. All metals render gold harder and more difficult of extension: even silver, which in this respect seems to alter its quality less than any other metal, produces with gold a mixture sensibly harder than either of them separately; and this hardness is not more felt in any art than in the gold-beater's. The French are said to prepare what is called green gold-leaf, from a composition of one part of copper and two of silver, with eighty of gold; but this is probably a mistake, for such an admixture gives no green-ness to gold; and I have been informed by our workmen, that this kind of leaf is made from the same fine gold as the highest gold-coloured sort; the greenish hue being only a superficial tint, induced upon the gold in some part of the process: this greenish leaf is little otherwise used than for the gilding of certain books.

But though the gold-beater cannot advantageously diminish the quantity of gold in the leaf by the admixture of any other substance with the gold, yet means have been contrived, for some particular purposes, of saving the precious metal, by producing a kind of leaf, called party-gold, whose basis is silver, and which has only a superficial coat of gold upon one side of it. A thick leaf of silver, and a thinner one of gold, laid flat on one another, and heated and pressed together, unite and cohere; and being then beaten into fine leaves, as in the foregoing process, the gold, though its quantity is only about one-fourth of that of the silver, continues everywhere to cover it; the extension of the former keeping pace with that of the latter.

MECHANICS' INSTITUTIONS.

It must be a gratifying sight to all the friends of knowledge, to witness the rapid spread of these Schools of Instruction throughout the country; and we derive ourselves much honest satisfaction from reflecting on the share which the Mechanics' Magazine had in first promoting their establishment in England. If we have not regularly recorded all the accessions made to the list, it has not arisen from either indifference or inattention, but from a desire not to load our pages with details of proceedings possessing necessarily a great similarity; and because, in the general tabular view of these Institutions, which we have for some time had in preparation (on the suggestion of Mr. Harvey), every essential particular respecting them will be equally well preserved. We expected to complete that tabular view long before this time, and should have done so, had all office-bearers been as prompt in supplying us with the necessary materials for the purpose, as the majority have been; but there are yet several Institutions from which we have had no returns. If every one of our readers who is a member of a Mechanics' Institution, would only make it his business (as we hope he will) to see that the particulars of the state of that Institution have been forwarded to us, or would himself supply us with them, if he finds that they have not been furnished, we should, in a week or two, have all the information we desire, and be in a condition to lay before the public a table of results, equal in interest and importance to any that Parliament itself has produced. We may take this opportunity of noticing a very powerful address on the benefits of these Institutions, which was recently delivered by John Bowring, Esq., the elegant translator of Russian Anthology, &c. to the Tradesmen and Mechanics' Institution of his native city, Exeter. The following abstract of it, with which we have been favoured, will be read by our readers with much pleasure:—

"Nothing," said Mr. Bowring, "can be conceived more delightful to a benevolent and intelligent mind, than to look around on the changes which are silently but surely improving society. There is an element at work mightier than the strong arm of power. It is the desire of knowledge—it is the thirst after improvement. If any thing possess strength and permanence, it is knowledge. When Bacon, one of the greatest regenerators of mankind, proclaimed, 'Let reason be fruitful, and custom be barren,' he set up a standard, and lighted a torch as brightly as when he uttered that splendid aphorism which is now become a proverb—'Knowledge is power.' It is, indeed, a generous and noble pride to call Bacon our countryman, and to find in the volumes of our English sages, the germs of those great principles which are now improving the world. Ours is a happy nation, and an anspicious age;—favourable to our public weal, and flattering to our patriotic sympathies, in which the Government itself has recognised the great and noble principle, that common interests and common duties should bind mankind together. When we stop to inquire how the contributions of science have added to human enjoyment, the mind is absolutely bewildered by the countless facts which rush upon the thoughts. Trace the progress of science from the mean canoe which the Indian paddles through the inland waters, up to the huge vessel which fears no seas nor storms, and bears its numerous population to the remotest lands. Go from the rude implements of arctic industry, to that stupendous power by which, as Sir Humphry Davy has so eloquently said, 'our mines are drained—our ores extracted—our bridges are raised—our shafts are sunk—by which the hand of an infant becomes stronger than united thousands—by which the die is struck, the metal polished, the toy modelled—power, whose giant arms twists the huge cable which is to protect the largest ship of the line, and spin the gossamer-like thread which is to decorate female beauty.' These are the results, these are the victories of science. They leave no mournful thoughts, they waken no sorrowing tears,—they are associated with benefits and blessings. Time was, when even palaces were lighted through open iron bars, and commodious dwellings had only windows of horn—when glass was more precious than silver, and far more rare. The garments, which cover the meanest amongst us, are of finer texture than those once worn by Kings; the household utensils of your lowliest dwellings are more convenient than those which once ministered to the wants of the noblest and the proudest. And still, in the great field of science, there is room for every inquiring mind to labour after improvement. To this great treasury, every one may bring an acceptable contribution. He who has not the possession of information, may come with the desire of obtaining it; and the demand for knowledge creates the supply. My friends, the spinning-jenny was invented by a barber; it now gives employment to a million of human beings. The telescope was discovered by two poor mechanics; need I point out to you the consequences of that great discovery? It is sometimes said, that 'a little knowledge is a dangerous thing.' But it is not so; it is the much ignorance which must exist where there is but little knowledge that is really dangerous: a little knowledge is not a dangerous thing, though, no doubt, a great deal of knowledge is safer and better; but then it is to be remembered, that a great deal of knowledge can only be obtained by acquiring a little at first. With the origin of Mechanics' Institutes you are probably well acquainted. Though born but of yesterday, they have already rapidly spread themselves over the country—every where producing the happiest influence on such of the labouring classes as have had the opportunity and privilege of attending them. Scarcely three years have elapsed since the mechanics of Glasgow laid the foundation of this great work, and the example they have given has spread like daylight over the kingdom. M. Dupin, in his address to the Mechanics at Paris, uses this striking and encouraging language in reference to our own country:—'England has arrived at a remarkable epoch, which has prepared for her a destiny new and more magnificent than all her prosperity hitherto obtained during war and during peace. In Great Britain, the whole industrious class is now awakened to a new existence; it is snatched from routine, it is withdrawn from ignorance—the principles and application of the useful sciences are unfolded to it. And I venture to predict (says this distinguished foreigner), that in the next twenty years the conquests of science and industry in Great Britain, will surpass those of all the generations which have given so much prosperity to her people.' It is for you, members of Mechanics' Institutions, to accomplish such generous prospects as these."

LOCK WITH FOUR KEYS.

(To the Editor of the Mechanics' Magazine.)

Sir,—When in Paris, in 1823, I saw, at the exhibition of French manufactures at the Louvre, a lock and four keys, each of which differed in form from all the rest, and nevertheless opened and closed the lock. Like many other passing strangers, I merely *saw* and *admired*; and have now, when beginning to think of the useful as well as agreeable, to regret exceedingly that I took no pains to ascertain how this harmony of contrarieties was produced. I should feel greatly obliged (and so would many others also, perhaps) if, through the medium of your interesting publication, the particulars of this invention could be made known to the English public.

I am, Sir,
Yours respectfully,
A TRAVELLER.

[As a matter of *mechanical curiosity* we should like to see this inquiry answered; but we must confess we do not immediately perceive *the advantage* to be gained by it. Is not this a mode of increasing the *facility of opening locks?* Our "Traveller's" notions of "the useful" are somewhat different from those of most of his countrymen. In England, it has always hitherto been deemed a great desideratum to produce a lock that only *one* key (not *four*) can open. For our own parts, we should like to see a lock invented that *every person* could open, and that on the *slightest touch*, but not be able to close again. As a guard against domestic treachery, such a lock would be superior to all others.—EDIT.]

MOVING THE EARTH.

SIR,—As an attempt to answer a question inserted in your very valuable Magazine, page 371, vol. v., I beg leave to offer the following:—

It is an established law in mechanics, that whatever is gained in power is lost in time, for the application of machinery increases not the actual effect in a given time, but only modifies the power proportional to the energy of the agent employed; therefore, if we admit a man capable, by the application of machinery, to raise a weight, w, to the height, h, in one second, the effect $= h \times w$ will be a constant quantity, however the factors h and w may vary in relation to each other.

Now, if we suppose, with Dr. Gregory, a man exerting his strength immediately on a mass of 25 lbs. can raise it vertically 48 inches per second, we shall have $h \times w = 25 \times 48$, and $h = \frac{25 \times 48}{w}$. To find the time of rising, w, to any given height, h', we have $\frac{25 \times 48}{w}$: 1 sec. : : h' : $\frac{h'w}{25 \times 48}$ = time. Now, in the case before us, w denotes the earth's weight in pounds, and h' is given $= 1$; therefore, to determine the answer in numbers, let the earth's diameter be taken = 7960 miles, and its density = 5 times that of water (see Dr. Hutton's Tracts, vol. II. p. 69), then $w = 119653931229818388448000000$ pounds; hence the required time = 31596702334202 Julian years, 9 weeks, 1 day, 12 hours.

I am, Sir,
Yours respectfully,
JAMES THOMPSON.
North-street, Penzance.

THE "IMPROVEMENT IN GUN-CARRIAGES."

SIR,—I would suggest to the Lieutenant, whose improvement in the gun-carriage you inserted in No. 142, page 26, to write in future in more *intelligible* terms, for the benefit of the *unlearned*, as he may, perhaps, consider those who, like myself, are unacquainted with the nautical phrases which he makes use of; for, after puzzling over his description of the carriage more than half an hour, I was just as wise on the subject as when I began, being scarcely able to comprehend his meaning in a single instance. He will, perhaps, follow the example of his brother sailor, who laughed at a certain learned Judge for not knowing where "abaft the binnacle" was: but I would have him recollect that, by so doing, he will place himself in the situation of the Judge, who *first* ridiculed the ignorance of the sailor in not being able to tell whether he came to speak for "plaintiff or defendant," without reflecting on the motto of "every man to his trade."

From what I could understand of the *effect* to be produced by the Lieutenant's improvement, if practicable, it would certainly render very great facility on board ship in time of action, but of its practicability I could not gather sufficient to form the slightest opinion, although you may be sure it was not for want of perseverance, when I tell you that my name is

PAUL PRY.

May 19th, 1826.

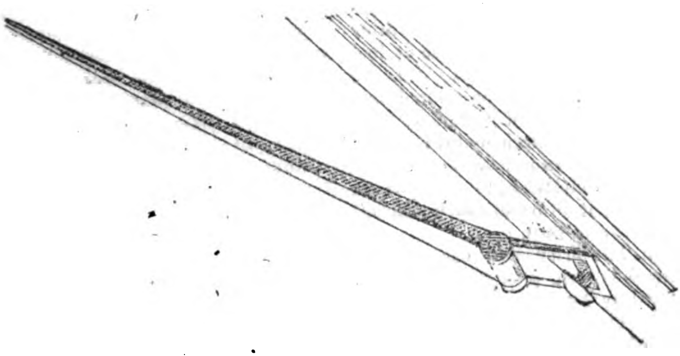
WATCH GLASSES.

SIR,—I beg to inform your Correspondent, "Glasso," of the cause of the difference in the price of watch glasses; the common, or convex, being charged at sixpence, and the flat, or lunette, at three shillings and sixpence. The former are formed from globes, which furnish five, six, or more each, according to the size required, the periphery of the circle being the area of the watch glass. The lunettes are formed singly, that is to say, each glass is the base of a cone, flattened elliptically (if I may be allowed the expression). The loss of metal in the manufacture of the convex glass is comparatively trifling, being only the spaces between the circles; whereas, in the lunette, it is much greater, being the remainder of the cone after the base is removed; this, together with the superiority of workmanship required, necessarily enhances the price considerably, but not to the extent mentioned by "Glasso," as they may be purchased for eighteen pence at Mr. Fenn's, 111, Newgate-street.

I am, Sir,
Your obedient servant,
T. W. WANSBROUGH.

Fulham, May 20th, 1826.

CROW-BAR, FOR DRAWING NAILS, ETC.



SIR,—The above sketch of a crow-bar, for drawing nails, bolts, &c. out of timber, is of so simple a construction that any explanation would be unnecessary. I presume you may think it worthy a place in the Mechanics' Magazine.

I am, Sir,
Your constant reader,
F— J— L—.

EMINENT MECHANICS.—NO. I.

ARCHIMEDES.

CONTINUED FROM PAGE 40, NO. 143.

The pieces that remain of the works of Archimedes are as follows :—

1. Two books on the Sphere and Cylinder.
2. Dimensions of the Circle, or Proportions between the Diameter and Circumference.
3. Of Spiral Lines.
4. Of Conoids and Spheroids.
5. Of Equiponderants, or Centres of Gravity.
6. The Quadrature of the Parabola.
7. Of Bodies floating on Fluids.
8. Lemmata.
9. Of the Number of the Sand.

Among the works of Archimedes which are lost, may be enumerated the following list of the description of various inventions, which may be gathered from himself and other ancient writers :—

1st. His account of the method he employed to discover the proportions of Silver and Gold in the Crown.

2nd. His description of the Coehlion,* or engine, he invented to draw water out of places where it had stagnated—still in use. Diodorus Siculus says, that he contrived this machine to drain Egypt, and that, by a wonderful mechanism, it would raise water from any depth.

3rd. The Helix; by means of which (Althanus informs us) he launched Hiero's great ship.

4th. The Trispaston, calculated to draw the most ponderous masses: noticed by Tzetzes and Orobasius.

5th. The machines which, according to Polybius Livy and Plutarch, he used to defend his native city against Marcellus; consisting of Tormenta, Balistæ, Catapultæ, Sagitarii Scorpions, Cranes, &c.

6th. His burning Mirrors, by which he fired and consumed the Roman galleys.†

7th. His Pneumatic and Hydrostatic Engines; concerning which subjects, according to Pappus, Tertullian, and Tzetzes, he wrote several books.

8th. His Sphere, on which he exhibited the motions of the heavenly bodies.

And probably many others, which have been lost to us through the barbarism or neglect of the intermediate ages, and very probably many were lost at the burning of the grand library of Alexandria, a circumstance which involved the destruction of a vast number of invaluable works, and will ever be regretted by the lovers of literature and science with feelings of sorrow, and indignation towards the barbarian who destroyed such a precious collection of the works of antiquity, which are now irrecoverably lost to us. There have been various editions of his works, the whole of which, with a commentary by Eutocius, were found in their original Greek language at the taking of Constantinople, from whence they were conveyed into Germany, where, with the aforesaid Commentary, they were published long afterwards, in 1544, at Basil, being most beautifully printed in Greek and Latin by Hervagius. A Latin translation was also published at Paris in 1577; another edition, folio, Greek and Latin, Paris, 1615. In 1675, Dr. Barrow published, in London, a neat quarto edition of these works in Latin. But the most complete of any, and which may be considered the standard of Archimedes' writings, is the magnificent edition issued from the Clarendon Press, Oxford, 1792.

For further particulars respecting the artifices so successfully practised by Archimedes in protracting the siege of Syracuse, see Rollin's Ancient History, volume VIII., subject, War of Syracuse.

* Or screw.—For a further description see Ferguson's Mechanics.

† For a full description of these glasses see Mechanics' Magazine, vol. I., No. 3, page 39.

RELATIVE WEIGHT OF DIFFERENT-SIZED SHOT.

SIR,—In vol. v., page 187, of your interesting Magazine, there appeared an inquiry as to the relative weight of different-sized shot included in the same vessel, an answer to which appeared in page 221. Prior to seeing this solution I had attempted one myself, and, on comparing them, I perceive that we agree in the general conclusion, that the aggregate weight of the enclosed shot is precisely the same whether their diameters be large or small, but we differ as to its actual magnitude. Now, as this gentleman has withheld his mode of investigation, I should deem it a particular favour if you would insert the following, in order that, if I have committed an error, some of your ingenious Correspondents will kindly point it out.

Let us conceive any vessel to be divided into n number of cubes, and a sphere to be inserted in each, then the cube being to its inscribed sphere as 1 : ,5236. If we designate each cube by c, each sphere will be denoted by ,5236 c, and consequently the content of all the spheres = ,5236 c + ,5236 c + ,5236 c, &c. to n terms = ,5236 ($c+c+c$, &c. to n terms), but $c+c+c$ to n terms = the capacity of the vessel. Hence it appears that, if any vessel be filled with shot, their aggregate solidity is equal to the solidity of the vessel multiplied by ,5236, whatever may be their diameters. Now, if the vessel be supposed to contain 100000 cubic inches, the solidity of the shot=52360 cubic inches.

I am, Sir,
Your obedient servant,
JAMES THOMPSON.
North-street, Penzance.

PROPELLING VESSELS BY STEAM.

SIR,—I am happy to see, in the Mechanics' Magazine of the 6th of May, E. M.'s idea of an improvement in the method of propelling vessels by steam. The same plan I proposed about ten years ago, and at the early part of the establishment of the Mechanics' Magazine I addressed a letter to you for insertion, signed A. R. K., in which I suggested the very principle now brought forward by E. M., and also the means for giving it effect.* But I had made no experiment, nor could I boast of science: I reasoned only from analogy—that is, if the gun recoils, or the sky-rocket, with its guide of inanimate wood, ascends by the expansion of the *elements only*, without the aid of wheels or complex and costly machinery, it seemed also possible that a vessel might be driven through the water by the same *simple means*. I now think that those who are living fifty years hence will know more of this principle than we now do, and will derive benefit from it.

I remain, Sir,
Your obedient servant,
A. R. K.

EFFECT OF THE REMOVAL OF LONDON BRIDGE ON THE TIDES.

SIR,—I conceive that the idea which your Correspondent, "Aquaticus," seems to possess of the increased height of the tide, on the removal of London Bridge, is altogether erroneous, from the observations which I, as well, I doubt not, as many others, have frequently made upon the effects at present produced by the obstructions offered by the bridge to the progress of the water, both at *ebb* and *flow*.

It has been found that there is at present, at *low water*, a difference of full six feet between the levels *above* and *below* bridge, caused by the great obstruction of the starlings as the tide falls, forming, in fact, a complete embankment; it is, therefore, evident that, on the removal of that obstruction, the height of the tide at *low water* will be considerably decreased from what it now is, but the same argument will by no means apply to its rising, for, although the

* On referring to our papers we find this to be correct.—EDIT.

facility of the water's running up will also be increased, yet that will only be an equivalent for the increased facility of its escape, for, since more will get away, more must naturally *return* also, to produce the same height in the tide.

But even at the present time the effect produced by the obstruction is nothing like equal in the *rise* of the tide to what it is in the fall, for the reason that, after it has risen a certain height, the effec of the *starlings*, so much felt towards *low water*, is almost annihilated, and the *piers* of the bridge present the only opposition, which, compared with that offered by the starlings, is a mere *bagatelle*. It may be said that, as the tide rises, the whole body of water is in motion, and consequently that *their* opposition, as well as that of the piers, must be felt the *whole* time of its rising. In some degree it certainly is so, but in nothing like the proportion in which it is felt towards low water, because it is well known that the celerity with which a body of water travels, is very much greater towards the surface than at any other part, on account of the little friction with which it glides over *itself* compared with that which opposes it when in contact with any solid. This is proved from the present appearance at *high water*, when, instead of the difference in height above and below bridge which exists at *low water*, the whole is perfectly level, and no fall whatever is observable: I do not, therefore, anticipate that any material alteration will take place in the height of the tide at *high water* from the removal of the present bridge; and, therefore, should Aquaticus or any other of your readers be holders of water-side premises, I consider they may rest perfectly satisfied that they will be as little annoyed by the tide as they are at present.

I am, Sir,
Your obliged servant,
PAUL PRY.

May 26th, 1826.

FRENCH AND BRITISH MANUFACTURING SKILL.

It appears from a statistical report of 1819, that France produced and consumed annually about one million of metric quintals of forged iron in large bars, and that the manufacture of these required about three hundred forges of the construction which had been for ages followed in that country; but, by the superior mode long adopted in Britain, and well-known in France, since the last peace, by the name of *forge à l'Anglaise* (refining in a reverberatory furnace with pit-coal, and forming into bars by laminating rollers), twenty manufactories could have done the work of these three hundred! So rapidly, however, have the French availed themselves of a knowledge of our manufacturing processes, that they have already established as many iron manufactories on the British plan as are nearly sufficient to supply all the bar-iron consumed in France! Such are some of the benefits which peace has brought to our rivals; but dark and narrow must be that patriotism which would rather lay waste with "the sword" and "spear," than spread abroad the blessings that ever follow in the train of "the ploughshare" and "pruning-hook."

SCOTTICUS.

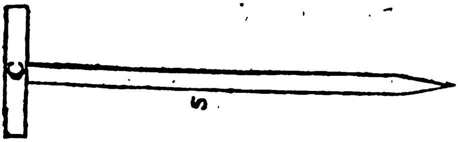
ANOTHER MODE OF REMOVING GLASS STOPPERS.

See page 46, *Number* 143.

SIR,—A very simple and easy mode of removing glass stoppers, when firmly retained, is by gentle and rapid strokes with the back of a common table-knife, on each side of the stopper, inclining the direction of the percussions upwards. By patience and perseverance (often for an hour) I have succeeded in removing the stoppers of smelling-bottles, cruets, and decanters, when every other method has failed.

I am, Sir,
Yours respectfully,
T— W— W—.

A SOLVENT FOR PUTTY.



S

H

SIR,—Having observed in your last Number (143) of the Mechanics' Magazine, a letter addressed to you from "A Constant Supporter of the Mechanics' Magazine," requiring a Solvent for Putty, or a method of removing panes of glass from their sashes; I have the pleasure of replying to his question, and shall describe a method that I have practised with complete success.

The following is a description of the above engraving, which is of a most simple construction:—

S is the shank, made of round rod-iron, of half an inch diameter, more or less, and from ten to fifteen inches long; and

C is a piece of iron of the same substance, and from three to five inches long, welded at right angles to the shank.

H is a shaft or handle of wood to hold it by.

To use the tool, put the end of it, C, into the fire, until it is sufficiently hot to destroy the texture of the putty when drawn along it, without cracking the glass or burning the sash; which will be easily ascertained in the course of a few trials, beginning at a slow heat, and drawing the cross piece, C, backwards and forwards along the putty, without touching either the glass or the sash with the iron.

The hot iron extracts the oil from the putty, and what is left on the glass is then in such a crumbling state, that it is easily and safely removed by the point of a glazier's knife.

I shall be glad to learn from your Correspondent (through the medium of your very useful work), that he has tried my method with success, which would give me encouragement to reply to other questions inserted in the Mechanics' Magazine.

I remain, Sir,
Your obedient servant,
AN OLD SUBSCRIBER AND WELL-WISHER.

London, May 24, 1826.

SIR,—Agreeable to the desire of "A Constant Supporter of the Mechanics' Magazine," contained in the last Number, I beg to propose to him the trial of an experiment, the utility of which I have experienced.

Spread over the substance to be removed, with a small brush, a little nitric or muriatic acid, and in a short time the putty will become soft, and may be easily removed, without any injury either to the glass or frame.

Vinegar has the property of producing the same effect, but it requires a much longer period.

I remain, Sir,
Your obedient servant,
J. L.

Adam's-place, Southwark,
May 23, 1826.

PROCESS OF PUDDLING IRON, AS PRACTISED AT THE LIGHTMORE IRON-WORKS, IN SHROPSHIRE.

Communicated by Arthur Aikin, Esq., Secretary to the Society of Arts, to Mr. Gill, one of the Chairmen of the Committee of Mechanics.

The different stages of the manufacture, from the ore to the making blooms, are, briefly, the following:

1. The roasted ore, being mixed with limestone, is reduced in the high smelting furnaces (with coke), which are tapped at regular intervals, and the melted iron runs into furrows, made in sand, and thus forms pigs.

2. The pigs, being broken into two or three pieces each, are re-melted in the refinery furnace (with coke), and the produce being let out into a shallow, flat, cast-iron trough, forms thick plates, called slabs.

3. The slabs being broken, are melted in the puddling furnace (with coal), and brought out in large masses, called balls; which, while yet glowing hot, are

4. Laid under a very heavy hammer, and stamped into plates, which are then thrown into water, in order to cool them.

5. The plates being broken, the pieces are piled one on the other, to the height of about a foot and a half, and placed in a reverberatory furnace, called a boiling furnace; from which, when sufficiently heated (by coal), they are removed to the shingling-hammer, where they are beaten into short, thick bars, called blooms.

The following are the particulars observed during the process of Puddling.

The furnace employed is a reverberatory one, of very simple construction, and the fuel used is coal. The flat area of the furnace being previously covered with sand, the charge was put in, consisting of 3¾ cwt. of broken slabs, which were heaped up loosely in the middle of the furnace: the door was then carefully closed, and the full force of the flame was let on. In about half an hour the door was opened, and the glowing metal being partly fluid, the workman was engaged in breaking and spreading it for about five minutes, water being thrown on occasionally in small quantities, by a scoop, and being immediately succeeded by much ebullition, and the disengagement of copious jets of white light. The spreading being completed, the door of the furnace was again closed, and the flame turned on for two or three minutes. The door was then opened, the flame turned partly off, and the charge worked by incessant stirring; a few wet scales of iron, and water in small quantities, being occasionally added: the charge now began to grow pasty, and to adhere to the tools. The fire was still further damped, and water, in small portions, was frequently added; the mass being incessantly worked with great vigour: the jets of flame were very copious, and the metal still pasty, and adherent to the tools. The working of the mass was still continued, but without the addition of water, and soon after the metal began to lose its coherence; more water was then added, and the breaking down of the metal proceeded rapidly; it still, however, adhered more or less to the tools, till it was reduced to the consistence of coarse gravel; at this period, the jets of white light were succeeded by a heavy red vapour, indicating the necessity of more heat: the full force of the flame was then let on, the door of the furnace continuing open, and the workman adding water, and stirring the mass incessantly: the jets of white light re-appeared, the metal became of the consistence of coarse sand, and began to *come into nature*, *i. e.* to *clot*. The iron now burned rapidly, with an intense white light, upon which the fire was damped a little; the metal was every minute becoming more cohesive; it was of a glowing white, and burnt away very fast; water in small quantities was still added. The metal was now of a pasty consistence, and did not adhere to the tools; *it was come completely into nature*, and was made up into several lumps; one hour and a half being expired, from the first charging the furnace.

The door of the furnace being now closed, the full force of the fire was let on for two or three minutes; after which, the door being opened, and the flame damped, the lumps were *dollyed*, *i. e.* compressed and beaten with a heavy iron mace; and were made up into five nearly equal balls; one hour and three-quarters being now expired.

The balls, glowing hot, were then removed from the furnace to the *stamping-hammer*, where they received from 70 to 100 blows each, and were thus formed into rough plates; being then cooled in water, they were weighed, and amounted in the whole to two hundred weight, three-quarters, and nineteen pounds, or nearly 86 per cent.

The following is a tabular arrangement of the ingredients and produce of each operation, calculated on one ton of blooms. The numbers express cwts. and their decimal parts.

91.41 raw ore	+	22.85	small coal produce				68.73 roasted ore.
66.73 roasted ore	+	147.28	coal, (73.64 coke)	+	17 limstone	=	32.73 pig iron.
32.73 pig iron	+	20.46	do. (10.23 coke)	.. .. ..		=	27.28 refined.
27.28 refined iron	+	29.65	.. ..	.. .. ..		=	23.73 stamped.
23.73 stamped iron	+	22. 0	.. ..	.. .. ..		=	20. blooms.
		242.24					

GAS ENGINE CARRIAGE.

A four-wheeled carriage, propelled by machinery, on the gas vacuum principle, recently brought into notice by Mr. Brown, but originally suggested by the Rev. Mr. Cecil, was successfully tried last week on the steepest part of Shooter's-hill (where the ascent is about 13½ inches in 12), which it surmounted with considerable ease. That a motive power might be gained by such means, few persons have ever doubted; and that power once gained, we do not perceive what difference it can make, except in the degree of speed, whether the carriage is moved up or down hill, or along a level plain. The newspapers gravely assure us, that "its power of motion upon a level plain was never denied; but until this experiment (that on Shooter's-hill) demonstrated *the fact*, many contended that it could not surmount *perpendicular resistance*;" that is, that it could not be heaved over the Monument, or the grand wall of China, as easily as up Regent-street or Ludgate-hill. Incredulous cavillers indeed! There is one fact—the only one, in truth, about which any serious doubt has been entertained by practical men—which we would much rather have had demonstrated than this, of perpendicular walls and inclined planes being precisely the same thing, and that is, the superior cheapness of this motive power, when compared with that of steam, horses, &c. Are we to consider the one thing just as clear as the other?

Mr. Brown has all along observed a degree of reserve on this point—though it has been repeatedly and strongly pressed on his attention—which, to say the least, looks extremely suspicious. The sort of machinery by which the gas vacuum power has in this instance been applied to the propelling of carriages—whether it be Messrs. Burstall and Hill's, or Mr. Gordon's, or some entirely new invention—is also a point on which the curious in these matters may reasonably expect to have some more satisfactory information, than is afforded by such newspaper puffs.

FIRST CAST-IRON BRIDGE.

Mr. Thomas Farnolls Pritchard, a Shropshire architect, who died in October, 1777, was the proposer and designer, in 1773, of the first cast-iron bridge which was anywhere erected, namely, that over the Severn, near Broseley and Colebrook Dale; but the Society of Arts have assigned the merit to a Mr. A. Darby, who merely furnished part of the money for carrying Mr. Pritchard's design into execution. Mr. Pritchard's, however, is but one instance in a thousand of genius being deprived by dross of its just claims to renown.

R——.

ROBINSON CRUSOE'S ENGINE.

Sir—Robinson Crusoe's Vacuum Power Engine will not go at all, for the atmosphere will press on his piston too heavily to allow the water to ascend into the cylinder through the pipe, K (being atmospheric air pressing against atmospheric air, with the disadvantage of the water and piston's gravity). But suppose it would act, and that motion were to take place, would the power be greater than that produced by the falling of the water from A to B, on the circumference of a water-wheel? I believe it would not. The discovery seems to be merely, that water would run up the pipe K, and down L, if L were the longest. I understand we have long had such a machine, under the name of Syphon, but never before termed a Vacuum Power Engine.

I am, Sir, yours, &c.

W. C.

Sir,—Under the appellation of a "Vacuum Power Engine," your 144th Number exhibits another attempt at the perpetual motion. There is certainly some ingenuity in the plan, but its defect is very apparent, and may be described in a few words. The power, in the first instance, imparted to the fly-wheel, would be so diminished before it was returned to the piston to raise it, that the vacuum would only be *partially* reproduced; the piston would fall short of A at the first attempt, further at the second, and, in all probability, stop at the second or third; in short, the fly-wheel cannot repay the power expended upon it.

I am, Sir,
Your obedient servant,
Philo-Montis.

NOTICES TO CORRESPONDENTS.

We shall endeavour to procure the address asked for by "An Old Subscriber" before next week.

Communications received from—W. E.—Mr. Lancaster—J. T.—A Miner—Montis, Junior—An Observer—A Constant Reader—Another at Bridport—Sherwood—Major M'Curdy—T. R.—Juvenis—Handsaw—W. Rialls.

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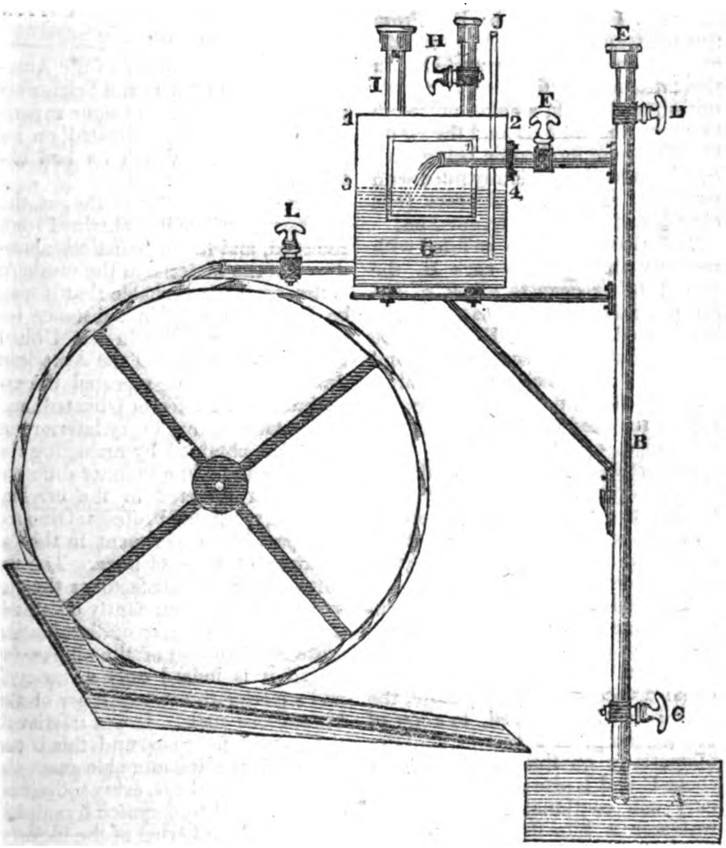
Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 146.] SATURDAY, JUNE 10, 1826. [Price 3d.

"All knowledge is of itself of some value. There is nothing so minute or inconsiderable, that I would not rather know it, than not."—*Dr. Johnson.*

ORCHARD'S VACUUM ENGINE.



ORCHARD'S VACUUM ENGINE.

SIR,—Your Correspondent Hassal will certainly acknowledge himself to be mistaken, when he reflects that the syphon, in my sketch of a vacuum engine, as it appeared in your 129th Number, operates in the usual manner. His other observations require no particular comment.

If not intruding too much on your pages, I beg leave to submit, with great diffidence, what I consider a great improvement in the plan before suggested.

A, is an iron reservoir nearly filled with mercury; B, a tube, twenty-four inches long, having its lower end inserted in that reservoir; and C and D two cocks for the convenience of filling the tube B. From this tube another tube M proceeds, at right angles, to the vessel G. In this latter tube is the cock F, to admit of, or shut off, a communication between the tube B and the vessel G. This communication being closed, the tube B is carefully filled with mercury; after which the cock D is closed, and the cap E screwed on.

The vessel G is to be filled with mercury through the cock H, the pipe I being open to allow of the escape of air. When this vessel has been filled, the cock H should be closed, and its cap screwed on, and the pipe I be also closed by a valve, which is to be pressed tight by the cap on the head of the pipe. I is a vent pipe, open at the top. The space represented by the double lines is a panel of thick plate glass, having two horizontal lines described on its surface, whereby the attendant may observe the quantity of mercury within the vessel.

The cock F being closed, a quantity of mercury must be allowed to run out of the vessel G, equal to the space 1, 2, 3, 4, which space will become a vacuum. If, therefore, the cock L be then opened, to allow of the discharge of a certain quantity of mercury on the wheel, and the cocks C and L also opened, the mercury will continually rise from the reservoir A into the vessel G, and thence be discharged upon the wheel, whence it will again fall into the vessel A, to keep up the supply. The cock F must be so adjusted as to admit into the vessel G, a quantity of mercury equal to that which is discharged by the cock L. This can be ascertained and regulated by means of the panel of glass above described.

The specific gravity of mercury being 7½ ounces, it is evident, that but a small quantity of it is required to turn the wheel, which has no friction but that of the axis on which it turns.

I am, &c.
JOHN ORCHARD.

ILLUMINATING GAS FROM COTTON SEED.

IN the eighth volume of the American Journal of Arts and Sciences is published an account of some experiments of Professor Olmsted on an illuminating gas which he had obtained from cotton seed.

The superior quality of the gas, the facility with which it is obtained from the seed, and the exhaustless abundance of the material in the southern states, render it probable that it may be found an eligible substance for gas-lights, especially in the United States. The Editor of the American Journal, not having repeated the experiments of Professor Olmsted, and understanding that a very inferior gas had been obtained by managing the decomposition in a manner different from that directed in the original memoir, requested Professor Olmsted to repeat the experiment in the laboratory of Yale College. The result was entirely satisfactory: the gas was easily and abundantly obtained, and afforded a degree of illumination quite equal to that of the oil-gas, (of which it is indeed only a variety,) and superior to most varieties of the bituminous coals. It was inferior to the pure olefiant gas, and this is the fact with the inflammable gases obtained from, perhaps, every substance, except alcohol decomposed by sulphuric acid. The kernel of the hickory-nut comes the nearest to the olefiant, and is but little inferior; the quality of the gas is considerably debased by using the entire nut, the woody covering of which affords a gas which burns with a paler flame.

It is very easy to injure the gas of cotton seed by a careless management of the heat; but this is true, probably, of all other substances which afford inflammable gases; in general the lower the heat, provided it be sufficient, the better the gas.

The following remarks were furnished by Professor Olmsted to the Editor:

"Cotton seed is highly oleaginous, and the object in my arrangements for obtaining the gas, is to bring the oily vapour, (which is expelled by a very gentle heat,) into contact with a surface of ignited iron, by which it is decomposed into carburetted hydrogen gas. For this purpose, a heat not exceeding the lowest degree of redness, is all that is necessary. If it be carried higher, a lighter kind of gas is produced, which is greatly inferior to the other in illuminating power. A furnace of brick-work, or even a common culinary fire, will afford therefore the requisite degree of heat. My method of proceeding has been as follows:

"1. An ounce of cotton seed is dried on the fire in a ladle, and a red hot iron is introduced to singe off the small remnant of cotton that adherès to the seed. It is dried; because the moisture, by its decomposition, would produce an inflammable gas, not sufficiently luminous for our purpose, and it is singed for a similar reason, the gas produced by the cotton being inferior to that of the seed.

"2. Thus prepared, the seed is introduced into an iron tube closed at one end like a gun-barrel, and is pushed down quite to the bottom of the tube by a ram-rod.

"3. The tube is next laid across a furnace, (a common fire would answer,) in such a manner that the closed end of the tube containing the seed projects out of the furnace so far, that the seed may be removed entirely from the direct action of the fire. A conducting tube is connected with the open end, to convey the gas into a receiver standing over water. Simply passing the gas through water purifies it sufficiently for use.

"4. A very moderate fire is applied, sufficient barely to keep the part of the tube exposed to its direct action, at a perceptible degree of redness. The heat being thus slowly communicated to the seed, converts successive portions of its oil into vapour, which, traversing the ignited parts of the tube, is decomposed into carburetted hydrogen gas. The first portions may be burnt at the mouth of the conducting tube, until the gas becomes as luminous as a candle, after which it may be collected for use.

"5. When the gas begins to come over less freely, the tube may be drawn forward, by little and little, into the furnace. Near the close of the operation, the gas becomes again less luminous, and it may be burnt off at the mouth of the tube as at first.

"If the furnace be of sufficient dimensions to permit a considerable space of the tube to remain ignited, the oily vapour will be all decomposed; but if the ignited space be small, a portion of vapour will make its way into the receiver undecomposed. A spiral or recurved tube for a small furnace, or a long iron tube for a broader fire, would effect the decomposition very pérfectly.

An ounce of seed, according to this process, yields 1018 cubic inches of gas, neglecting the first and last portions as before specified; consequently a pound of seed yields 16,288 cubic inches, or more than a hogshead of the gas.

"According to the former estimate, the quantity of seed annually produced in the United States, above what is required for replanting, would afford 2,827,500,000 cubic feet of illuminating gas, but little if at all inferior to that produced directly from oil. During the last year the culture of the cotton crop was greatly extended, perhaps doubled, and the quantity of seed proportionally augmented.

"It was suggested by a Correspondent of South Carolina, in a late number of this Journal, that the seed was more valuable than what I represented it; that it was a rich manure, and often sold very high for planting. It might doubtless be profitably applied as a manure, especially in the way of a compost, where its volatile principles might be arrested, and its powers rendered more permanent; but the fact is, that in many parts of the cotton districts, no use at all is actually made of it, and the high price which it occasionally bears, when replanting becomes necessary, is owing to the prodigality with which it is thrown out and exposed to the weather, on the supposition, that there never can be any scarcity of a substance which is accumulated in such quantities around the cotton-gins. The writer was assured by Henry Donaldson, Esq., the proprietor of an extensive establishment for cleaning and spinning cotton at the Great Falls of Tar River, in North Carolina, that boat-loads of seed could be obtained there at five cents per bushel. I had also held some communication with this gentleman on the subject of lighting his works with cotton seed-gas; but by removal from the country, and devotion to other objects, he was prevented. Should this article be found as eligible for gas-lighting as as it appears to the writer to be, its employment for such a purpose will prove a public benefit, both by giving an increased value to this part of the cotton crop, and by diminishing the expense and promoting the beauty and splendour of gas illumination."

D. O.

ALGEBRA.

Sir,—Every intelligent reader must approve the design of "Bija Gannita," in an article which appeared in your journal for March last. When we consider that the rapid advancement in mathematical science is chiefly owing to the unequivocal language in which its definitions and axioms are expressed, and that even in the most lengthened process of reasoning not a single term is allowed to be introduced, on which a construction could be put different from that intended, it may justly excite surprise, that any treatise in this department of learning should be deficient in accuracy and elegance. Whether it be because many of our practical works on mathematics have been written by men ignorant of the theory, or principles on which the rules are founded; or whether it proceed from the love of book-making, the fact is certain, that they betray a very culpable disregard to precision in style and arrangement. I must, therefore, so far as these remarks extend, be supposed to agree with your Correspondent, who evinces in his communications much ability and refinement. There are, however, two or three passages in his remarks on Nicholson's Algebra, which appear to me untenable; but before I proceed to mention these, you will allow me to premise that it is not so much my object to construct a defence of the work in question, as to shew that Bija Gannita's objections are incompatible with sound logic.

After stating that the questions are not solved in either a concise or an elegant manner, he proceeds to remark, "for the object in such a work as this is, not to get an answer to a problem, which is the least important part, but to illustrate by short examples the easiest and most elegant methods of working, by avoiding multiplication, changing proportions," &c. This language is capable of a double interpretation. It may mean what it really expresses, that the professed design of Messrs. Rowbotham and Nicholson *is* to teach the analytic art, in the way that this writer would recommend; or, that such is the design which they *ought* to have proposed. That it is not to be understood in the former sense is evident: inasmuch as this would have anticipated every objection: we must, therefore, look for B. G.'s meaning in the latter explanation of the passage. The method uniformly adopted, in every standard elementary publication which I have seen, is to express both the rules and the questions under them, in such language as is suited to the ignorance of the scholar From a conviction that the mind, is, at present, unapt fully to receive the ideas which the authors wished to convey, they have deemed it proper rather to enter into a minuteness of detail, than to sacrifice the least degree of perspicuity. It requires not a mediocrity of talent to prove, that the introductory part of any object of study is neither the place nor the time for conciseness and elegance; for the simple reason, that there is great danger of becoming unintelligible.

——— Brevis esse laboro
Obscurus fio ——— HORACE.

Hence it appears to me, that in teaching Algebra, provided the resolution be conducted in strict accordance with the rules, it is not necessary in the commencement to make brevity a matter of primary concern. With respect to the epithets "easiest and most elegant," it may be fitly asked, since these are relative terms, how could a student be conscious that a problem is distinguished for such qualities, unless he were previously acquainted with the common method of working it?

The mathematics of modern times are not only remarkable for the discoveries of which they boast; we cannot fail equally to admire the various methods by which these are demonstrated. But it is doubtful whether all the admirers of this noble science are equally prepared to avail themselves of the best means afforded to acquire a knowledge of it. There are, for example, many who, by means of Keith's or Bonnycastle's Treatise on Plane and Spherical Trigonometry, may become perfectly acquainted with the doctrine of triangles: whereas, if they were put to the study of Woodhouse's Analytics on the same subject, it is probable they might be less successful; because it is not every one that is blest with the power of abstraction, and the philosophical turn of mind necessary to appreciate the last-mentioned publication. Much less is it to be expected, that the pupil should be scientific at the beginning; and that teacher may surely be pardoned, who, from the fear of anticipating any posterior rule, takes rather a circuitous route in making the proof of a question appear simple and perspicuous. After all let it be remembered, that though a demonstration be concise, it is not more satisfactory in point of evidence. A theorem may be demonstrated in various ways, while the mind can repose with as much confidence on the one as on the other. In the language of Dugald Stewart, "Each of them shines with its own intrinsic light alone; and the first which occurs (provided they be all equally understood) commands the assent not less irresistibly than the last."

The second objection which Bija Gannita advances against Nicholson's Treatise is, "That the questions are thrown together with scarcely any attempt at classification or regularity." It is proper the reader should bear in mind, that nothing is here alleged against the distribution of the different parts of the work. Could an objection be raised on this head, it would certainly prove, that a very serious error had been committed. How far an attention to classification and regularity is necessary or practicable in a work like this, which is intended for the young, it is not perhaps easy to determine. It is more to my purpose to remark, that the objection will, it is presumed, apply to Bridge, Bonnycastle, and even to Bland's Equation. After turning over these volumes, I must candidly acknowledge, that it requires greater penetration than I can command, to shew that they all rise "one above another in difficulty." That it is very necessary the student should aim to exercise his memory, and to exert his inventive faculty, cannot admit of a question: but whoever has attended to the operations of the mind, in the early stages of its improvement, must have perceived that it often requires relief from the severity of study. The young scholar seldom "toils through a long question" without the assistance of the master; and the "great joy" which he feels in working a sum by his own efforts alone, is the best possible inducement to attack and overcome future difficulties. Beset the path of science with continual obstructions, and you immediately cool his ardour, and render that repulsive which would otherwise be pleasant. While I think it a great defect in the system of teaching adopted by many, that they multiply facilities for indolence, rather than afford increased illumination and vigour to the understanding; the opposite course is equally adapted to retard our progress, and to diminish genius. Supposing B. G. to be an instructor of youth, he must be regarded as a highly-privileged individual, if, under his hands they succeed, every movement which they make, in surmounting obstacles.

Having corrected a rule on Proportion, in proof of his assertions, your ingenious Correspondent adds, "This rule is moreover unintelligible to the learner, as the terms, extremes and means, have never been defined." Now this is by no means a legitimate consequence, unless it can be shewn that the doctrine of Proportion is confined to Algebra. But every one is aware that it forms a part of most publications on Arithmetic. And it is reasonable to suppose, that Messrs. R. and N. took it for granted that the common method of calculation would be known, ere that which is carried on by means of the alphabet would be attempted. In a word it seems to have been the design of these authors, to allure to the study of this beautiful part of mathematics by disengaging its elements, as far as is consistent with propriety, from whatever appeared abstruse. Anxious to introduce the scholar into the temple of Science, they have left it to others to decorate the exterior of the edifice.

With gratitude for the highly interesting and instructive papers contained in the Mechanics' Magazine,

I remain, Sir,
Your humble Servant,
T. HATHAWAY.

Sheerness, 10th June, 1826.

PERPETUAL MOTION.

SIR,—The interesting subject of perpetual motion, which has crowded the pages of your Magazine with such various communications, has now for some time been permitted to remain in silence. It has been amusing to observe the different arguments of your correspondents, who have at different times attempted to prove the impossibility of perpetual motion, its improbability, its probability, its possibility, its accomplishment by others, its accomplishment by themselves; but the contradictions in their arguments, the incompatibility of their statements, joined to the circumstance of there not having appeared in your Magazine a single sketch of a machine, which would (upon trial) answer the proposed purpose, have combined to obscure the solution of that much agitated question—can perpetual motion exist?

The consideration of the imperfect state in which the decision of this question remains has induced me to submit the following proposal:—

"That all those who understand the principles of any scheme for perpetual motion forward it with a drawing to the Editor of the Mechanics' Magazine. That the Editor inform his readers, from week to week, of the number of schemes he has received; and that at length they be published all together, in order to set the question at rest one way or the other, up to the present time. But all arguments against perpetual motion, as they absurdly endeavour to prove a negative, should be rejected."

I beg to take this opportunity of stating my knowledge of the truth of perpetual motion *having been accomplished* by magnets placed round a circular box enclosing a steel-vaned wheel,* and also that there is now a machine incessantly at work, without assistance, in the famous library at Stutgard, by which a bar (hung by a pivot through the middle) in an upright position, between two pillars, with a ball at each end, the top one being a little heavier than the one below, continues to vibrate by the top ball alternately falling upon

* This scheme was mentioned in a former Number, but no drawing was given, and the description was not perfect enough to construct one by.

and rebounding from each pillar. How this is performed I am ignorant, as the person who saw it, and described it to me, did not examine it with the eye of a machinist, but was merely eye-witness to the effects.

If any of your correspondents can procure a description and drawing of these contrivances, and will forward them to you, they will prove valuable contributions to the proposed collection of schemes, and will greatly oblige, Your constant Reader,

W. M. D. D.

April 22, 1826.

VARNISH FOR ELECTRICAL RIBBON.

Sir,—Seeing in your Magazine of the 25th May (No. 144, page 58.) an article entitled, "Varnish for Electrical Ribbon," wherein your informant states, that the isinglass and India rubber are to be dissolved in alcohol, I beg leave to correct his error. Isinglass being a gelatine, must be dissolved in an aqueous solution, for spirit will have no effect on it; and India rubber can only be dissolved in ether and different oils, none of which will mix with water: the nature of each being perfectly contradictory. He has also not stated whether the copal varnish is to be made with spirit or oil, it being practicable either way.

I remain, Sir,
Your constant reader,

B. W.

June 5, 1826.

ON TURNING.

Sir,—In Part 31 of your entertaining and instructive Magazine, mention is made of a method of turning screws by an inclined plane, &c. As I do not clearly comprehend the description, and am, though no proficient, an amateur turner, your correspondent will oblige me by explaining himself a little more fully, and more especially if he have time to accompany his description with a drawing. The part I do not understand is, "the rack to work in the teeth of a wheel deriving its motion from the arbor of the lathe." *Quære.* Is arbor the same as mandrell?

In the course of a short time, I intend to make a complete model of my lathe, in order to send to such persons as will, out of pure love to the art, kindly assist me with practical information. For instance, had I a model now ready, I would feel much pleasure in sending it for the inspection of the writer above alluded to, either to his residence, or to your office; having previously affixed to it my humble endeavours of making an apparatus on the plan proposed for the turning of screws. I think this plan of transmitting models of any simple and easily-made machinery would more readily contribute to the acquirement of information, and save much of the pages of your valuable miscellany.

I am, &c.

F. B.

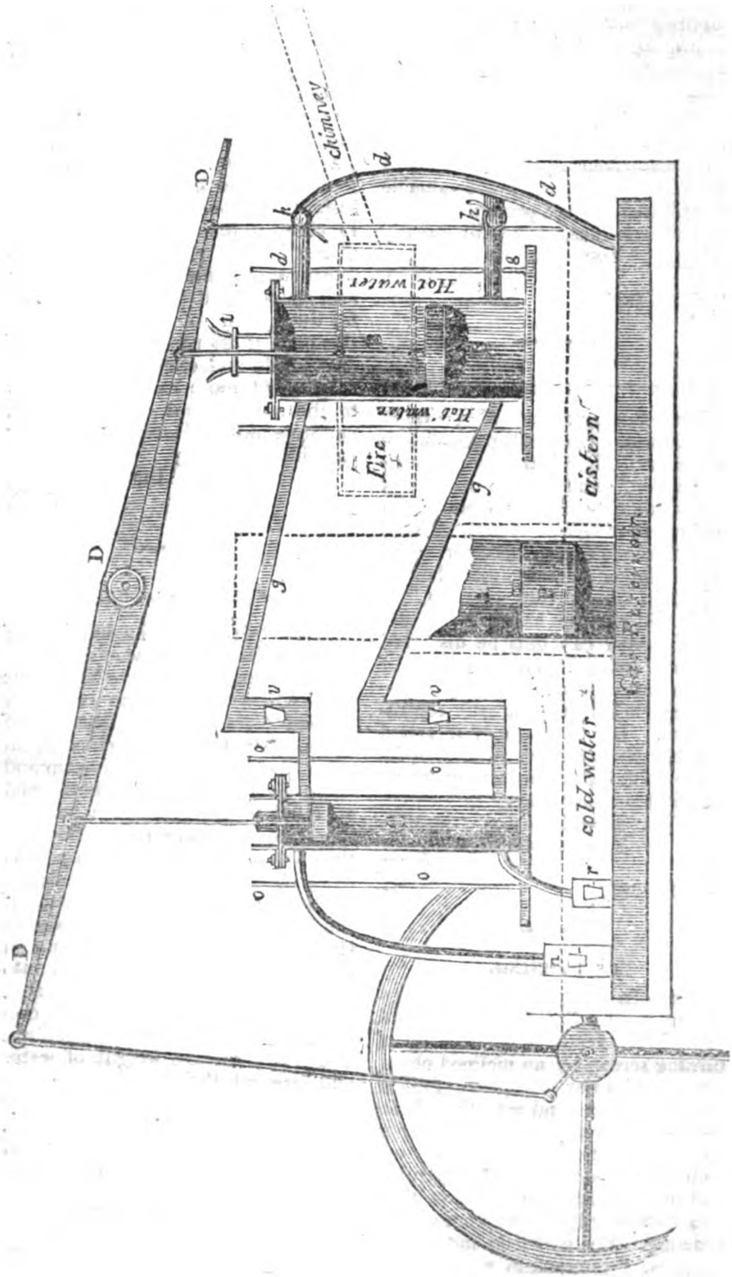
ON PUMP LEATHERS.

Sir,—In reply to the inquiries of T. N. in No. 135, I would recommend the pump leather to be cut out of a whole skin, which has been dressed for the upper leather of shoes. The form to be circular, in order to admit of its moving up and down freely; six inches above, and as much below the joint: he may take the following rule. Suppose the common bore of the pump to be five inches, and the part at the flanch twelve inches, then the diameter of the leather should be about twenty-six inches. This will leave about an inch all round, to be screwed into the joint, and six inches to sink downwards, similar in form to a cullender. There will be slight folds at the joint; but the weight of water will prevent their intercepting the action of the piston. The lower edge of the piston should be bevilled, to make the leather fit tighter; and the valve hole be made about four inches square.

I am, &c.

Z.

OXLEY'S GAS ENGINE.



OXLEY'S GAS ENGINE.

Sir,—As I have been regularly supplied with your useful and interesting Miscellany, since the date of its first publication, I have witnessed, with much pleasure, the development of many very ingenious and useful inventions; some of them, indeed, similar to what I had myself invented, several years before. I now send you a sketch of a Gas Engine, invented by me, a considerable time prior to my hearing either of Mr. Faraday's or Sir H. Davy's proposition for applying Carbonic Acid Gas as a motive power. My attention was drawn to this subject by mere accident. It happened that, as I was taking my usual morning walk down Main-street, in the city of Richmond, in Virginia, I heard a most tremendous explosion, proceeding from a druggist's cellar just by, where they were preparing Dr. Cullen's Patent Magnesia, and Soda Water. They had been charging a strong copper vessel with the Carbonic Acid Gas, for impregnating the aforesaid waters; but the air vessel, made of the strongest copper, burst with such violence as to break and lacerate the man's leg and arm, and also to injure the proprietor. This was in the summer of 1822. A few days after this, I invented the Gas Engine of which I now send you a sketch.

Although I then saw that ice was used to cool the magnesia, and soda water, I do not entertain a thought either of using ice, or of having recourse to artificial freezing mixtures. Ice cannot, at all times, be procured; freezing mixtures would be so expensive as to equal, or perhaps exceed, the expense of fuel for the common steam engine. To render the Carbonic Gas Engine of universal use, I propose to take the difference of 212°, and the common temperature of water, which is generally a few degrees below the temperature of the atmosphere; and this, owing to the very economical plan in which I rarefy or expand the gas, will, I believe, be found one of the cheapest and most compact gas engines that has appeared in your publication.

Description.

A the cylinder of the gas reservoir, in which is P, a plunger, or piston. This piston, over which a small quantity of oil is spread, to lubricate it, and the more effectually to prevent the escape of gas, rises or falls with the increase or decrease of the gas in the reservoir. The cylinder, A, is represented as broken off below the middle, so as not to hide the other parts of the machine; but the dotted line shows its full length. It is surrounded by a case, or outer cylinder, filled with cold water.

BB. is the working cylinder, with its piston. This cylinder is kept at the temperature of 212 degrees, being surrounded by an external cylinder filled with boiling water, and this last-named cylinder is surrounded by a furnace or fire, shown by the double dotted lines.

C. the condensing, or cold cylinder, surrounded by another cylinder *oo,oo*, filled with cold water. The cylinder C is only one-sixth part of the area and contents of the working cylinder, BB. By the action of the piston *q*, the cold gas is drawn from the reservoir, through the valves *n* and *r*, into the cylinder C, and is then forced through the supply pipes *v* and *g*. These supply pipes are continued spirally for three or four coils round the outside of the working cylinder BB, and continue increasing in width to allow of the gas to expand as it enters the working cylinder, where it elevates or depresses the piston accordingly. From the working cylinder, the gas passes through the discharging pipes *k d d*, and *e k d*, and after passing through a spiral worm, or pipe, immersed in a cistern of cold water, is again deposited in the gas reservoir.

I am, &c.

THOMAS OXLEY,
Mathematical Tutor.

Liverpool, 21 April, 1826.

SIR,—The decided negative of Argus to my Query in No. 130, being unattended with any reason, I consider of no value; especially as this man, with his hundred eyes, refers to the valve *n*, at the bottom of AA, as an air-tight valve, when, as it works under water, it is of course only water tight. It receives the pressure of the atmosphere from that water, and prevents any air getting in to destroy the vacuum to be produced in the interior of the upper part of AA. From the concluding part of Argus's letter, he appears to be ignorant that human knowledge is not wisdom. I am, Sir,

Z.

CULTURE OF SILK.

SIR,—Whatever tends to ameliorate the condition of mankind in general, and of our own countrymen in particular, must be a source of congratulation to every feeling mind. Impressed with this sentiment, I am happy to find that efforts are now making to introduce the silk-worm into the Sister Kingdom; and the culture of the white Mulberry Tree, which seems to be so essential to the little animal's existence. I heartily wish success to the attempt, of which I hope, with proper attention, there is but little cause to doubt. By accomplishing this object we shall have the whole manufacture within our own hands, from the production of the raw material to the finishing of the most costly article. This I should suppose will be a considerable advantage to the different manufacturers in the silk trade, independent of the saving to the country at large. It must ever be a matter of the utmost importance to a manufacturing and commercial empire like this, to produce within itself or colonies as much as possible the raw material of the articles of its manufactures, by which it becomes more independent of other States, retains the balance of trade in its own favour, furnishes additional employment to its population, (an object of the most vital importance to the State,) and also increases the national sources of wealth and happiness.

Now, Mr. Editor, I have always understood that the balance of the tea trade with China is against us, as I believe the Chinese take little or nothing from us in exchange, but receive money for their tea; and I have often thought that this very fashionable and necessary article could be much more advantageously produced in some of our own colonies; for instance, in Van Deiman's Land, or New South Wales, which lie in nearly the same degrees of South latitude as China is in North latitude. I am not aware whether the cultivation of this plant has been tried in any of our Colonies; but supposing the thing practicable (and I cannot see why it should not be so), what an immense field would be thus thrown open for the profitable employment of British labour and capital. Why should we continue, year after year, to drain our country of its gold, to give to so unsocial a race of beings as the Chinese? If it should be urged, in opposition to this scheme, that it would infringe the East India Company's monopoly, I reply, that Government might still place its cultivation and importation under any restrictions that they may think proper, or the East India Company may still enjoy the extensive trade thereof, under such regulations as may be consistent with the interest of the State. At this awful crisis in our commercial affairs, some new openings for trade are wanting, as well as employment for our overteeming population. The cultivation and management of this plant, would afford this employment to thousands who would gladly emigrate to a genial climate, where profitable labour can be found; and they, in return, would find new wants arise, for articles with which they would be supplied from their native country. The mutual advantages of such a commerce are too well known to require me to dwell upon. Perhaps some difficulty would arise in procuring a supply of the seeds uninjured; but this, I should suppose, with a little dexterous management, may be got over. I hope our present liberal and enlightened Ministry will turn their attention to this subject, not doubting but that, if they think the plan worth a trial, they will give it that encouragement which will ensure its complete success.

I am, Sir, your humble servant,

T. J.

Hammersmith, April 13, 1826.

THE POOR MAN'S BAROMETER.

SIR,—I have seen many useful devices inserted in the Mechanics' Magazine; and if you think the following description of a cheap Barometer worthy of notice, it is at your disposal:—the whole of the materials of which it is composed may be procured for something less than a halfpenny.

Obtain a piece of thin common whipcord, about two feet long, and having soaked it in a strong brine of common salt, fix it horizontally, by a tack through a knot at each end, to a lime-plastered, brick, or stone wall. From the centre of this cord suspend, by a piece of sewing thread, a small piece of lead, about an inch long, and of the thickness of the tail of a tobacco-pipe. This arrangement being completed, the cord will become sensibly affected by the successive changes of the atmosphere, and the lead will, of course, rise and lower proportionately with these changes. A piece of paper being pasted to the wall, and a mark made upon it when the lead is at the highest, and another when it is at the lowest, the intermediate spaces may be divided into degrees, to correspond with a mercurial barometer. One Mr. Thomas Mapps, clerk of the parish of Pitchley, Northamptonshire, has had one many years, and it is said to be a faithful index of the weather.—[This instrument is properly an hygrometer. Ed.]

IMPROVEMENTS ON MATTHEWS'S SAFETY GIG.

Sir,—The correspondence on Mr. H. Matthews's Safety Gig, in Nos. 98, 104, 124, and 129, of your Magazine, will, I trust, meet the attention of your numerous readers. I think it offers materials for ultimately effecting the desired object; and as the anticipated improvement is one of considerable importance, I venture to offer a few observations, with a desire to assist the cause.

Mr. Matthews sets out in No. 104, with claiming more than his invention is entitled to. It possesses merit, but neither elegance nor perfection. This, however, is pardonable, on reflecting how closely his interests are enveloped in the question. Your Correspondent J. A. has overlooked the circumstance of the shafts falling, while they leave the body of the gig in a horizontal position. This, in my humble opinion, appears to have much merit. The same writer also, in his haste to censure, has overlooked the correct meaning of the article 124, in its allusion to restraining the weight of a horse "moving at a great rate;" taking it as implying strength of shaft, instead of the drop or safety iron. Supposing this to be the argument of the above number, and concurring with it, I hence infer the merit of attaching the safety iron to the body of the gig.

The apparent imperfections of Mr. Matthews's plan are these:—the safety iron is liable to entangle a horse's hind feet when he falls on his side. If the hind feet of the gig forms a pressure or lever upon the shafts, it is evident that the scroll iron must be strained, and that when the horse recovers his feet the body would turn its occupiers out behind. The objection, as refers to rough roads, has been well illustrated by T. A.; but as these are rare in the present times, an occasional jolt would be better than a broken neck, and therefore the *remedy*, though imperfect, is *better* than the *disease*. To the first of my objections I will suggest the possibility of a remedy, in making the scroll iron moveable on a pivot or hinge when it is attached to the carriage of the gig. To the second, I will propose removing that part of the safety irons which descends from the steps, (leaving the remainder as described by Mr. Matthews,) and placing *one* to substitute them, descending from the body of the gig under the splashing or foot-board. To introduce my third suggestion, I must premise, that as the shafts rise or fall the axle partakes of the movement: could not this power and motion be applied by levers and pins, in depressing the safety iron (supposing it pointed) when needed, and elevating obliquely from the point of union to the axle, in the time of safety? The entanglement and sawing would thus be avoided, as also the inelegance. I cannot conclude without referring to the just, though severe, general censure that your Correspondent, in 124, has met with from T. A. The author of the article No. 124 has evidently lost view of that proper feeling which should actuate every one desirous to avail themselves of your pages, for giving publicity to their ideas. T. A. in his censure has conferred a public benefit, though it is to be wished that he had been influenced by a more generous spirit, as then the odium he creates must have proportionably increased.—Warmth of expression, likewise, presents doubts of the sincerity of the motive. I am, &c.

Y. C.

MATCHES TO PRODUCE INSTANTANEOUS LIGHT.

Sir,—One of your Correspondents, in giving a receipt of the composition which forms the peculiar feature of these matches, omitted to state, that the two dry ingredients (the oxymuriate of potash and sulphur) should be mixed together *gently* in a mortar. This caution is necessary, as these two substances, when mixed, form a detonating powder, which explodes by the force of a smart blow. To prove this detonating property, take a small portion of each of these ingredients, (about enough to cover the surface of a small wafer,) and having well mixed them together, put them into a small piece of thin paper, and lay them on something flat, as a flat hearth-stone, or the paved floor of a dry kitchen, and give them a smart blow with a broad-faced hammer. This will produce a sharp quick report, without producing mischief.

These remarks show the necessity of using caution in mixing the ingredients, which ought to be rubbed *gently* together, and not *pounded* by the pestle. Even when rubbing them gently together, some particles will necessarily undergo greater pressure than others; and this will produce a quick and sharp snap; but there is no danger of the whole mass exploding at once.

With the composition I have used sugar and a little water as a paste. Perhaps a less quantity of sulphur than your Correspondent has stated will answer the purpose better. I have found six grains of oxymuriate of potash and three grains of sulphur do very well; but I should recommend nine grains of the oxymuriate, to six grains of sulphur and four grains of white sugar: the whole made into a paste with a little turpentine. The matches should be quite dry before they are used.

F. B.

OF AIR BALLOONS.

The air-balloon is entirely an hydrostatical machine, and consists merely of a bag filled with air, so light, that it, together with the bag, forms a mass, which is specifically lighter than the common air of the atmosphere. A cubic foot of common air is found to weigh above 554 grains, and to be expanded by every degree of heat marked on Fahrenheit's thermometers, about $\frac{1}{8\overline{0}}$ part of the whole. By heating a quantity of air, therefore, to 200 degrees of Fahrenheit, you will just double its bulk, when the thermometer stands at 54 in the open air, and in the same proportion you will diminish its weight; and if such a quantity of this hot air be enclosed in a bag, that the excess of the weight of an equal bulk of common air weighs more than the bag with the air contained in it, both the bag and the air will rise into the atmosphere, and continue to do so till they arrive at a place where the external air is naturally so much rarefied, that the weight becomes equal, and here the whole will float.

The power by which hot air is impelled upwards, may be shown by the following experiment. Roll up a sheet of paper in a conical form, and by thrusting a pin into it near the apex, prevent it from unrolling. Fasten it then by its apex, under one of the scales of a balance, by means of a thread; and having properly counterpoised it by weights put into the opposite scale, apply the flame of a candle underneath, and you will instantly see the cone rise; and it will not be brought into equilibrium with the other, but by a much greater weight than those who have never seen the experiment would believe.

If the magnitude of a balloon be increased, its power of ascension, or the difference between the weight of the included air, and an equal bulk of common air, will be augmented in the same proportion. For its thickness being supposed the same, it is as the surface it covers, or only as the square of the diameter. This is the reason why balloons cannot be made to ascend, if under a given magnitude, when composed of cloth, or materials of the same thickness.

In the year 1766, Mr. Cavendish ascertained the weight and other properties of inflammable air, determining it to be at least seven times lighter than common air. Soon after which it occurred to Dr. Black, that, perhaps, a thin bag, filled with inflammable air, might be buoyed up by the common atmosphere, and he thought of having the allantois of a calf for this purpose; but his other avocations prevented him from prosecuting the experiment. The same thought occurred, some years after, to Mr. Cavallo, and he has the honour of being the first who made experiments on the subject. He first tried bladders, but the thinnest of these, however well scraped and prepared, were found too heavy; he then tried Chinese paper, but that proved so permeable, that the inflammable air passed through it like water through a sieve. His experiments, therefore, made in the year 1782, proceeded no farther than blowing up soap-bubbles with inflammable air, which ascended rapidly to the ceiling, and broke against it.

But while the discovery of the art of aerostation seemed thus on the point of being made in Britain, it was all at once announced in France, and that from a quarter whence nothing of the kind was to have been expected. Two brothers, Stephen and John Montgolfier, natives of Annonay, and proprietors of a considerable paper manufactory there, had turned their thoughts towards this project, as early as the middle of the year 1782. The idea was first suggested by the natural ascent of the smoke and clouds in the atmosphere, and their design was to form an artificial cloud, by enclosing the smoke in a bag, and making it carry up the covering along with it.

Towards the middle of November that year, the experiment was made at Avignon, with a fine silk bag. By applying burning paper to an aperture at the bottom of it, the air was rarefied, and the bag swelled, and ascended to the ceiling. On repeating the experiment in the open air, it rose to the height of about seventy feet.

Soon after this, one of the brothers arrived at Paris, where he was invited by the Academy of Sciences to repeat his experiments at their expense. In consequence of this invitation, he constructed, in a garden in the Fauxbourg Saint Germain, a large balloon of an elliptical form. In a preliminary experiment, this machine lifted up from the ground eight persons who held it, and would have carried them all off, if more had not quickly gone to their assistance. Next day the experiment was repeated in the presence of the members of the academy; the machine was filled by the combustion of fifty pounds of straw, made up in small bundles, upon which twelve pounds of chopped wool were thrown in at intervals. The usual success attended this exhibition; the machine soon swelled, endeavoured to ascend, and sustained itself in the air, together with a weight of between four and five hundred pounds. It was evident that it would have ascended to a very great height, but as it was designed to repeat the experiment before the king and the royal family at Versailles, the cords by which it was tied down were not cut. In consequence of a violent wind and rain, which happened at this time, the machine was so far damaged, that it became necessary to prepare a new one for the time that it had been determined to honour the experiment with the royal presence; and such expedition was used, that this vast machine, of near sixty feet in height, and forty-three in diameter, was made, painted with water colours both within and without, and finally decorated, in no more than four days and four nights.

Along with this machine was sent a wicker cage, containing a sheep, a cock, and a duck, which were the first animals ever sent up into the atmosphere. The complete success of this experiment was prevented by a violent gust of wind, which tore the cloth in two places near the top, before it ascended; however it rose to the height of about 1440 feet; and after remaining in the air about eight minutes, fell to the ground, at the distance of 10,200 feet from the place of its setting out. The animals were not in the least hurt. The great power of these aerostatic machines, and their very gradual descent to the ground, had originally shown that they were capable of transporting people through the air with all imaginable safety; and this was further confirmed by the experiment already mentioned. As Mr. Montgolfier therefore proposed to make a new aerostatic machine, of a firmer and better construction than the former, M. Pilatre de Roziere (whose temerity in a subsequent experiment proved fatal to him) offered himself to be the first aerial adventurer. On the 15th of October, 1783, he rose from the garden of the Fauxbourg Saint Antoine, at Paris, in a wicker gallery, about three feet broad, attached to an oval balloon, of 74 feet by 40, which had been made by Montgolfier, and which also carried up a grate, for the purpose of continuing at pleasure the inflation of the balloon, by a fire of straw and wool. The weight of this machine was 1,600 pounds. On that day it was permitted to rise no higher than 84 feet; but on the 19th, when M. Giraud de Vilette ascended with him, they rose to the height of 332 feet, being prevented from farther ascent only by ropes. Encouraged by the success of these experiments, M. Rozier and the Marquis D'Arlandes first trusted a balloon to the elements; and after rising to the height of 3,000 feet, they descended about five miles from the place of their ascent. They experienced great danger on this occasion, from the balloon taking fire, which, however, they extinguished with a wet sponge.

These balloons raised by fire have, however, not been much used, having given place to the other kind, filled with inflammable air, which, by reason of its smaller specific gravity, is safer and more manageable, and is capable of performing voyages of greater length, as it does not require to be supplied with fuel, like the others.

About this time, Count Zambecari sent up from the Artillery-Ground, London, a small gilt balloon, filled with inflammable air, which, in two hours and a half, reached a spot near Petworth, in Sussex, and would not then have fallen had it not burst.

The first aerial voyage with an inflammable air balloon, was made by Messrs. Charles and Roberts, from Paris, December 1, 1783.

The machine used on this occasion was formed of silk, covered over with a varnish made of elastic gum, of a spherical figure, and measuring 27½ feet in diameter.

Having ascended to the height of about one-third part of a mile, they were carried by the wind in a horizontal direction, and descended in a field 27 miles from Paris, having travelled that distance in two hours. M. Charles then ascended alone, and rose to the height of about two miles, without experiencing any other disagreeable sensation than a severe cold and a pain in his ears, owing probably to the expansion of the dense internal air.

A great many aerial voyages were made in France before it was attempted in England.

M. J. Montgolfier, in 1784, ascended, with six other persons, from Lyons, by a balloon 131 feet high, and 104 broad.

M. Blanchard, in March of the same year, rose to an altitude which is calculated at 9500 feet, and descended in an hour and a quarter, having experienced heat, cold, hunger, and an excessive drowsiness.

M. Bertrand, in April, rose from Dijon, to the height of 13,600 feet, and in an hour and a quarter sailed 18 miles.

Madame Thible, who was the first female adventurer, ascended in

June from Lyons, with M. Fleurant, in the presence of the late King of Sweden, and reached the height of 8,500 feet.

M. Mouchet, in the same month, ascended from Nantz, and travelled 27 miles in 58 minutes.

M. Rozier, in another experiment, reached the height of 11,700 feet, and found the temperature of the air reduced to five degrees below the freezing point.

The Duke de Chartres (Orleans) ascended in July, from the park of St. Cloud, with two other persons.

Vincent Lunardi, an Italian (the first who made an aerial voyage in England), on the 15th of September, 1784, rose from the Artillery-Ground, in London, by a balloon 33 feet in diameter, made of silk, oiled, and painted in stripes of blue and red. He took up with him a dog and a cat; the latter was destroyed, and the dog was almost spent. In his ascent, the thermometer fell to 29, and some drops of water round his balloon were frozen. He ascended about five minutes after two o'clock, and arrived at Collier's Hill, five miles beyond Ware, in Hertfordshire, at 25 minutes after four.

M. Roberts and Hullin, in the same month, sailed from Paris to Arras in six hours and a half.

Mr. Sadler, of Oxford, was the first Englishman who ascended with a balloon. He constructed one himself, with which he arose from Oxford on the 4th of October; and a second time on the 12th, and sailed 15 miles in 18 minutes.

M. Blanchard and Mr. Sheldon ascended from Chelsea on the 16th of the same month; and Mr. Sheldon having alighted about 14 miles from that place, M. Blanchard pursued his journey alone, and landed near Rumsey, in Hampshire.

Mr. Harper, on the 4th of January, 1785, ascended from Birmingham, and sailed to the distance of 57 miles in an hour and 20 minutes.

M. Blanchard and Dr. Jeffries, on the 7th of the same month, crossed the Channel between Dover and Calais, by means of a balloon; but had such difficulty to keep it above water, that they were obliged to throw away every thing they had with them.

Mr. Crosbie ascended from Dublin, on the 19th of the same month, with such rapidity, that he was out of sight in three minutes, and descended at the verge of the sea.

Count Zambecari and Admiral Sir Edward Vernon, on the 23d of March, sailed from London to Horsham, a distance of 33 miles, in less than an hour.

Mr. Sadler and Mr. W. Windham, on the 5th of May, ascended from Moulsey-Hurst, and descended at the conflux of the Thames and Medway.

Mr. M'Guire, on the 12th of May, having ascended from Dublin, was carried with great velocity towards the sea, into which he descended, and was taken up by a boat, when on the point of expiring with fatigue.

M. Pilatre de Rozier and M. Romain, on the 15th of July, ascended from Boulogne, with an intention of crossing the Channel, but their balloon, being a *Montgolfier*, or fire-balloon, took fire at the height of 1200 yards, and they fell to the ground and were dashed to pieces.

Mr. Crosbie, on the 19th of July, again ascended from Dublin, intending to cross the Channel, and land in England; but he fell into the sea, and was with great difficulty saved from being drowned.

Major Money, on the 22d of the same month, also ascended at Norwich, and experienced a similar mischance. He was driven out to sea, and fortunately snatched from death by a revenue-cutter.

M. Blanchard, in August, made an aerial voyage from Lisle, to the distance of 300 miles, before he descended. He had also a parachute attached to his car; with this he dropped a dog, which descended gently and without injury.

(*To be continued.*)

MANUMOTIVE CARRIAGE.

Sir,—In looking over Part the 30th of your valuable Magazine, my attention was attracted by an "Idea of a Manumotive Carriage," (in No. 119) by W. B., and a *pretty idea it is.*

In the first part of his communication he ridicules the description of a self-acting carriage, by J. M., which, as I have not investigated it, I will not attempt to defend; but I think that, after amusing himself at the expense of the ideas of others, he should, at any rate, have taken care not to have exposed *himself* to the like ridicule, by publishing such an absurd *idea* as I will presently show his to be.

In explanation of his machine (if it be worthy the name) he says, "the rider turns round a large wheel of 30 teeth, by a screw with a handle, a tooth each turn of the handle; *this turns a pinion of six teeth*," and so on all through. The larger wheels act on the smaller in every instance, until at length he shows, that the wheel of the carriage makes no less than *sixty* revolutions, while the large wheel, acted upon by the screw, is making *one*, thereby evincing that, according to the laws of mechanics, of which W. B. seems totally ignorant, there must be applied in power to the first wheel, 60 times the resistance to be overcome in the weight and friction of the vehicle. Notwithstanding which, he very modestly winds up his sum of *pretty ideas*, by asserting that "I have thus shown how a man may, by the assistance of a screw, easily propel a carriage. The screw will enable him to raise 288 cwts. so that, *leaving out of the question the power gained by the combination of wheels*, a man may overcome a weight and friction equal to 288 cwt." Your Correspondent has most certainly left out of the question the power *lost* (but which, by a trifling error, he terms gained) by the combination of wheels, and thereby *loses* himself in, I fear, an irrecoverable degree, for I have not here taken at all into consideration the *immense* friction caused by the eight small wheels, substituted (by some other strange *idea*) in the place of two more large ones; and that too, forsooth, according to his own account, for the purpose of *saving* what is thereby created in an almost interminable degree.

I am, Sir, (hoping I don't intrude,) an *old* Correspondent, though with a *new* name,

PAUL PRY.

London, 12th April, 1826.

RELATIVE WEIGHT OF DIFFERENT SIZED SHOT.

SIR,—In reply to the letter of Mr. Thompson, in page 75 of your Magazine, permit me to say, that if a vessel were filled with shot shaken together, so that they might occupy the least space, their position would not be that which he has supposed; namely, that each sphere might be circumscribed by a cube; but it would be such that the centres of four spheres in contact with each other, would be in the four angles of a tetraedron, of which the linear edge or length would be equal to the diameter of each of the spheres; consequently the solidity of each sphere must not be compared with the solidity of the cube in which it might be inscribed, but with the solidity of a parallelopiped, of which the three dimensions are respectively equal to the length, breadth, and height of the tetraedron. These quantities are therefore equal to unity, the natural sine of 60 degrees, and the natural sine of 45 degrees: the diameter of the sphere being also unity. It was on this principle that I deduced the result which I communicated in Vol. 5. p. 221; namely, that if a vessel, containing 100,000 cubic inches, be filled with equal spheres of any given size, the quantity of solid matter contained in the vessel will be 74,048 inches, and consequently the vacant space will be 25,952 inches.

I remain, Sir,

Your obedient servant,

M. S.

June 6, 1826.

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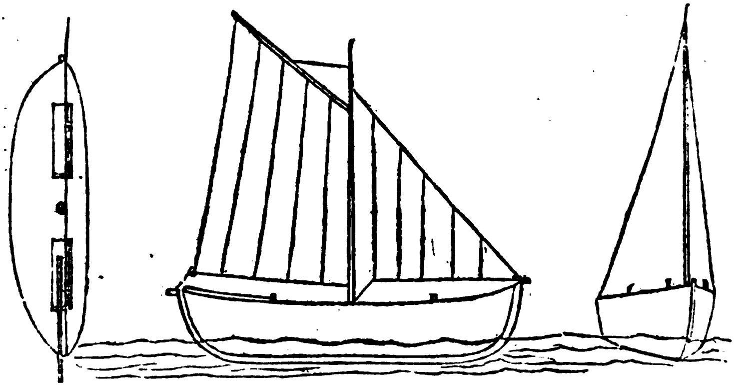
PROPOSED NEW CONSTRUCTION FOR A BOAT.



SIR,—It has often occurred to me, that the consideration of the pressure of a vessel in sailing being on the side, that a construction to meet that pressure should not have met with more attention, with the view of giving her more bearing on one side, to be used as a lee-side, by means of which she would obtain greater power of propulsion in proportion to the resistance she made in passing through the water. The idea, perhaps, may have first arisen from perusing in Anson's voyage an account of the construction of the flying proa of the Ladrone Islands: the *principle* of which, I consider, may be extended with great advantage to a solid or single vessel, without the frame or outrigger of the proa. I think it is not improbable, that the effect of a construction to meet this pressure might be much more advantageous to swiftness of sailing than at first sight appears likely to result. For by extending the bearing the greater length of the vessel, and having a straight side, or nearly so, comparatively, there would be at once the greatest bearing any body or vessel is capable of having; while, by its straightness, the resistance would be considerably diminished. In a vessel thus constructed, sailing, in point of advantage, would be confined to one side; and its form would not be so uniformly strong as an equal-sided vessel, nor would it sail so well where the advantage of equal sides was required, as in tacking and readiness in short boards or narrow waters. From weakness of form, this shape could not be made on a large scale; but its construction might be rendered quite safe in packets or fishing vessels. *It* is to be particularly noticed, that the lee-side, or bearing of the vessel, on which the pressure of sail, or the power or force moving the vessel, acts, is extended to the greatest length of the vessel by the straight-sided form, and the bearing is increased by the length. And it is to be further observed, that another advantage will result from the greatest bearing being extended the length of the vessel, instead of the diminished bearing of a rounded side; which will admit of the vessel sailing more upright, or as much so as is possible for a body with a pressure on one side to sail.

In working a vessel of this description, both ends must be alike to preserve the advantage of the lee side, so that either end may sail foremost. To do this, the sail must be shifted with its foot towards either end, accordingly as it is to be made the foremast. This can be executed very conveniently, either by a lug-sail and fore-gib, or sprit-sail and fore-gib, by lowering the lug or brailing the sprit-sail. The gib-sail must be lowered and brought forward, or there must be two gibs, one at either end; the one to be lowered and the other hoisted, as the ends are alternated forward and aft. *In* large runs, or open sea, the vessel would wear instead of tacking; but in short boards, or tacks, or to serve momentary purposes, it is proposed that the vessel be worked on either side, as an equal-sided vessel. This would be awkward in appearance; but necessity must be the rule to guide us: and certainly in using the windward side of the vessel as the lee, all the disadvantages of the bilging side, or bend, would be experienced, and what velocity was gained on the lee-side would be lost on the windward-side, when used as the lee. The only expedient, or set-off, against this disadvantage would be, that vessels of this construction, being of no great size, might have oars or sweeps substituted in narrow channels.

The next consideration, and not the least important, is whether such an irregular-shaped vessel would be safe and sea-worthy? To this we answer, that we are ready to admit of the unfavourable appearance of the construction; and this results from the irregularity of the sides, which necessarily implies, that there would be an irregularity of motion, and consequently a strain throughout the vessel on her timbers and planks. We think, however, the evil is more imaginary than real. The mast bearing on the lee-side would be the greatest probable evil, or danger, in consequence of its weight and leverage; but this partial strain might be provided against, if requisite, by substantial construction, which would affect her prejudicially only as regards rowing: in sailing, the effect would be of secondary consideration.

This construction is, as we have before stated, in some measure sanctioned by the flying proa of the Ladrone Islands; but the frame-work and narrow boat, being in every respect objectionable, have been avoided. The general principle of the lever of a windward-side against a narrow lee-side, is alone preserved; and this we have adopted, or applied, to a solid or single boat, ballasted; the weight of which, acting against a lengthened or extended bearing, and diminished resistance of a straight side, will have a similar effect to that which results from the proa. Our idea is, that by the same principle, we shall gain a better sea-boat, and a more capacious and serviceable vessel. We would propose, that the breadth should be proportioned a little less than a third of the length; and that the lee-side should be one fourth of her breadth; giving three widths of the lee-side for the windward. Some projection on the lee-side will be requisite, to sustain the greater length of the straightness, or narrowness of the lee-side; also for some bend, or round, to resist or throw off the water; and as a little bearing against the weight of the mast. Experience, however, may vary these proportions. We suggest a strong longitudinal division to be made in the middle of the boat, of the nature of a bulk head, or partition, to keep the ballast from shifting; as this is of the *utmost* consequence as regards the safety, in preventing too much weight or pressure on the straight side of the lee; and her sailing, by keeping the portion of the ballast on the windward-side fixed. We further propose as flat a floor, particularly in small vessels, as can be well constructed for a sharp built vessel; and an auxiliary keel, or cradle, on the windward-side, half way between the keel and side. This last is of the greatest use in keeping her upright on taking the ground, and of some service in enabling her to keep well up to the wind. After these remarks, we shall now observe, that having premised the proposed shape as an experiment only, a trial will determine its practicability or success; and we think there are sufficient reasons for attempting it.

A small model, formed on the proposed construction, has been made by the writer; and there is nothing indicated by the effect of the model placed in water against the proposed construction answering; whilst the effect of the bearing of the lee-side, as far as can be judged by such imperfect means, promises success. If, therefore, Mr. Editor, any person of respectability be really disposed to make the experiment, and be desirous of seeing the model, I send you privately my address.

I am, &c.

WARPING OF LAND.

From the Transactions of the Society of Arts.

The process of warping was first practised, it is said, about the middle of the last century, on some land in the neighbourhood of Howden, on the Humber. Not only the waters of the Humber itself, but the Trent, the Don, the Ouse, and other rivers which contribute to form that estuary, are, near their mouths (especially during spring tides) filled with very muddy water. This mud is not brought in from the sea, for the Humber is clear at its mouth; nor does it originate from land floods, for these are observed always to injure the warp or deposit; it therefore arises from the action of the tide-water on the beds of soft shaly clay which form the bottom of the Lincolnshire marshes, and in which, in all probability, the estuary of the Humber has been excavated. All the embanked lands on these rivers being on a lower level than spring-tides, are capable of being warped, which consists in surrounding the land intended to be so treated with a substantial bank, and then letting in the tide water, and allowing it to remain on the land till it has deposited nearly the whole of its mud. Thus the old soil is benefited by the addition of new, or an entirely fresh soil is laid on the surface of the old, according to the thickness of the deposit, or the length of time that the warping is persevered in.

The usual mode of warping is to dig a main canal, or trunk, having a sluice towards the river, and to divide the lands on each side of the drain, by means of banks, into compartments of from ten to twenty acres each, and to make an entrance sluice to each compartment, together with one or more return-sluices, called cloughs. During the spring-tides, in the months of August, September, and October, the sluice of the main trunk being opened, the tide water enters it, and is distributed by the lateral entrance-sluices to as many of the compartments as may be convenient. When the tide is at its height, each of these entrance-sluices is closed; and as it ebbs, the hydrostatic pressure of the water in the compartments forces outwards the swinging-door of the clough, and thus allows the water to escape into the main trunk, and thence into the river, having deposited nearly the whole of its mud on the surface on the inclosure in which it was penned up. The size of the cloughs should be so adjusted as to discharge the whole of the water before the rise of the next tide, otherwise only every other tide can be admitted. By this operation a deposit of silt, of the thickness of from twelve to sixteen inches, may be obtained in one season.

Mr. Creyke having ascertained

that a tract of about 1600 acres of peat moss, in the neighbourhood of Rawcliffe, which produced absolutely no rent, was at a sufficiently low level to be warped, resolved to subject the whole to this mode of rendering it productive; the way in which this was effected was detailed in the following extracts from that gentleman's letters, addressed to the Secretary of the Society:—

Rawcliffe-House, near Thorne, Yorkshire, Nov. 18, 1824.

Sir,—In the neighbourhood of Rawcliffe-House, where I reside, are many thousand acres of peat moss and waste land, which yield scarcely any annual rent, and which I thought (from the experience I had got in improving a considerable quantity of my own land near home) might be improved very much by being warped. I accordingly undertook to warp from the river Ouse 1600 acres; and in August, 1821, a sluice, with two openings of sixteen feet each, and nineteen feet high from the sole to the crown of the arch, with substantial folding-doors, was built and opened; and at the same time a main drain was cut, extending from it two miles and a half, up to the waste land and peat moss: its dimensions were thirty feet wide at the bottom, and ninety feet wide at the surface of the land, and the banks were raised upon the land to the height of ten feet. The ordinary spring tides flow to the height of sixteen feet, where the sluice is built. In the first year 429 acres of waste land were embanked, in order to be improved; and on it was deposited, in the course of that year, a fine alluvial soil, of the average depth of near three feet. This allotment was sown with oats and seeds in 1823, and the seeds were either mown or depastured in 1824; and it is now sown with wheat, which looks very promising and luxuriant. No part of this allotment of 429 acres yielded any rent previous to this improvement, and now no part of it is let for less than thirty-five shillings per acre. The expense is twenty-one pounds per acre. I am proceeding with two other allotments, containing a greater number of acres in each, of which, when finished, I will send you an account, if this be honoured with the approbation of the Society.

I am, Sir,
&c. &c. &c.
Ralph Creyke, Jun.

A. Aiken, Esq. Secretary, &c.

Rawcliffe-House, March 24, 1825.

Sir,—I beg leave to acknowledge the receipt of your letter, dated 1st March. I trust that I shall be able to satisfy the committee that my claim for the large gold medal is strictly conformable to the terms for which they offer it,—namely, "for an account of method superior to any hitherto practised, of improving land lying waste."

The superiority consists in creating a fine deep rich soil, more effectually, upon a larger scale, and in a shorter time, than has hitherto been practised. According to the usual practice, the tides were only admitted during the months of August, September, and October; in mine they are admitted all the year round. The sluice was not more than five feet wide; mine has two openings of sixteen feet wide. The main drain was only twelve feet wide; mine is ninety feet wide. Not more than fourteen acres were embanked in one piece; I have enclosed five hundred acres in one compartment. Formerly not more than one and a half feet of deposit was obtained; I have got from three to four feet in the same time, upon the increased quantity of land. No levels used to be taken for the formation of the banks; the whole of my embankment has been laid out by the spirit level. Scarcely any inlets used to be made for the purpose of spreading the tide-water quicker and more equally over the surface of the land within the embankment, as well as for the more speedy return of it upon the ebb; in my practice innumerable inlets are formed for this purpose. It is quite impossible to give a detailed account for the arrangement of these inlets; they must, in all cases, vary with the shape and different levels of the land embanked, and on that account no exact statement of cost can be given;

it is, however, very considerable. The width of the inlets varies from fifty feet to three feet, the depth from seven feet to one foot.

There is much more difficulty in the interior management than any other part; the knowledge of it can only be acquired by practice and close observation. There is likewise a very considerable annual expense in the repairs of the main drain, more particularly of that part near the sluice. A loss of one thousand pounds was experienced the first year, owing to a breach of the bank of the main drain. In my first letter I named 429 acres, at that time growing a fine luxuriant crop of wheat: I now beg to add 500 acres more, at this moment in a state of preparation for being sown with oats and grass seeds this spring; and that 600 acres more will be finished in the course of the present year.

I am, Sir,
&c. &c. &c.
RALPH CREYKE, Jun.

A. Aiken, Esq. Secretary, &c.

Queries sent by the Secretary to Wm. Creyke, 1st March, 1825; with that Gentleman's answers.

1. Expense of erecting the sluice, divided into labour and cost of materials; the nature of such materials, whether brick or stone?

The sluice is built of stone of large size, backed with brick; the foundation was well piled with 550 piles, thirteen feet long, squaring eleven inches, upon which were firmly secured very strong beams; upon the beams the whole space upon which the sluice was built was planked with four-inch deals, another set of beams were placed crossways, and then a second floor of three-inch plank. Sleeting piles were driven the whole length of the wood-work, both fronting the river and next the main drain; a wall is also erected from the sluice to the river, to protect the bank from being injured. The cost of the sluice 4800*l.*; the cost of the wall 300*l.*; 340*l.* more for a residence, and stone for materials, for the person attending upon the tides, &c. &c.

2. Expense of the main drain?

The expense of the main drain, being three and a half miles land, was 7350*l.*, exclusive of the purchase of the land 4682*l.*; the dimensions of it were ninety feet wide at the surface of the land, eleven and a half feet deep, and thirty feet wide at the bottom; at the width of nine feet from the edge of the main drain is placed the bank, the base of which is sixty feet, and the height ten feet; the bank is made as strong as possible by puddling. The main drain is used as a canal, and is found of great benefit to the lands adjoining.

3. Length, and other dimensions, and materials of the embankment to retain the water on the land to be warped, and cost of the same?

The length of the embankment to retain the tide-water must depend upon the quantity of land embanked; these banks must be well puddled, and made with the greatest care. The dimensions of our banks are thirty-two feet at the base, ten feet high, and six feet wide at the top. The cost of them three shillings per floor of twenty poles.

4. Elevation of the peat moss above low-water at neap tides?

The level of the peat moss varies very considerably; the lowest parts of it are not more than four feet above low-water mark; the highest as much as thirteen feet above low water mark.

5. Did the peat undergo any operation of levelling, &c. previous to the water being let in upon it?

The peat moss will, in the first instance, settle very considerably, by the drainage produced by the cutting of the various inlets; and afterwards by the pressure of the soil deposited; it undergoes no levelling.

6. Was the water let on every spring tide, or how many tides? How long did it remain on the land? How long was it in flowing off the land before the next spring tide was admitted?

Every tide is admitted during the spring tides, and occasionally during the neap tides; care should, however, be taken, not to admit any tides when it blows strong, as the banks are subject to great injury at those times, and the warp does not deposit, from the agitated state of the water, which returns from the land with the ebb. In the river Ouse, at the point where the sluice is erected, the tides flow to their height in three hours, and ebb nine hours. The height is from eighteen feet to fourteen feet.

7. Are there any seasons of the year, or other circumstances, that affect the amount of the silt deposited?

The water in the river will at times be so much affected by land floods, in very rainy weather, that it is not worth admission; in dry weather the amount of silt is nearly the same; in the hotter months the proportion of salt in the silt is greater than at other times.

Certificate.

Saltmarshe, near Howden, Yorkshire.

We, the undersigned, two of His Majesty's Justices of the peace for the County of York, and residing in the neighbourhood of the peat moss and waste grounds alluded to in a letter from Ralph Creyke, Jun. Esq. to the Secretary to the Society for the Encouragement of Arts, &c. &c., dated 18th November, 1824, do certify, that we have seen the said peat moss frequently previous to the improvement by warping, at which time it was of little or no value, and produced no rent to the owners; that we have seen it since the warping was completed; and it is now in a state of cultivation, and capable of producing the most abundant crops of corn, grass, and every other kind of produce.

Given under our hands the 24th Nov. 1824.

PHILIP SALTMARSHE.
ROB. DENISON, Jun.

ON AIR BALLOONS.

(*Concluded from p.* 95.)

Mr. Baldwin, on the 8th of September, ascended with Mr. Lunardi's Balloon from Chester, at 40 minutes past one, and after ascending to the height of nearly four miles, he descended at 53 minutes after three.

Mr. Lunardi, on the 5th of October, 1785, made the first aerial voyage in Scotland. He ascended from Edinburgh, and landed at Cupar, in Fife, having traversed a distance of fifty miles over sea and land in an hour and a half.

M. Blanchard, on the 19th of November, ascended from Ghent, to a great height, and landed at Delft, having cut away his car, to lighten the balloon, which was descending too rapidly, and held fast by the cords, which then served as a parachute.

Mr. Lunardi, on the 25th of November, again ascended at Glasgow, and travelled a distance of 125 miles. He says, that being overcome with drowsiness during his voyage, he lay down in his car, and slept for about twenty minutes.

M. Blanchard, in August 1788, made his thirty second voyage from Brunswick.

The rage for aerostatic experiment now almost entirely subsided; and the French were the only people who paid any attention to it during the period of the late war. The principal improvement has been, the addition of a large parachute, or umbrella, suspended below the balloon, by means of which, the aeronaut may come down very gently and in perfect safety, should any accident happen to the balloon, so that he should be forced to quit it.

Lately the public has been entertained by several aerostatic voyages made from London, by M. Garnerin, in one of which he descended by means of the parachute. We shall give a brief description of them.

At five o'clock, on the 28th of June, 1802, Mr. Garnerin ascended from Ranelagh Gardens, accompanied by Captain Sowden. The weather was very boisterous. In three quarters of an hour they landed, and found themselves four miles beyond Colchester, which was at the rate of 70 miles per hour. They experienced considerable danger in alighting, owing to the violence of the wind; but they met with no material injury.

On the 3d July, he again ascended from Lord's Cricket-ground, accompanied by Mr. Locker, and descended at Chingford, in Essex, passing a distance of nine miles in one quarter of an hour. They descended in perfect safety.

On September 21, Mr. Garnerin ascended alone from St. George's-parade, North Audley-street, Grosvenor-square, for the purpose of descending in his parachute. He went to the height of 8000 feet before he cut away the parachute, to which he was suspended. His descent for the first thirty seconds was astonishingly rapid. The parachute then expanded, and came down steadily; but it soon began to swing; and this motion increased to such a degree, that all were alarmed for the safety of the aerenaut. When it came near to the earth the swinging motion decreased, and he alighted without any injury. The velocity with which he came to the ground, was the same as if he had leaped from a height of four feet.

Since the last mentioned ascents, aeronautic excursions, by Messrs. Sadler, Green, Graham, and others, have been so numerous that we conceive it would be deemed superfluous were we to enumerate them. We may, however, state, that notwithstanding the extraordinary nature of the discovery of air balloons, it has not yet been applied to any useful purpose. The machine may be elevated or lowered at pleasure, by throwing out ballast, or letting out some inflammable air; but no means have yet been found, by which it can be steered in any other direction than that of the wind. This has prevented it from being applied to the purposes of travelling; nor have we acquired by its means any addition to our knowledge of the atmosphere, owing partly to the recentness of the discovery, and partly to a deficiency of philosophical knowledge in most of the adventurers.

The agreeable stillness and tranquillity aloft in the atmosphere, have been matter of general observation. On arriving at a considerable height, great cold has always been experienced; and clouds have been passed through, which contained sometimes snow, and sometimes lightning. The view of the country below, is said to be inconceivably grand.

Upon the whole, considering the number of voyages that have been made, but few accidents have happened; and these were commonly owing to the bad construction of the apparatus. The balloon seems, when properly managed, to be quite as safe as any other species of conveyance.

On the Mode of Constructing and Filling Balloons.

There are, as has been already mentioned, two kinds of balloons; those raised with heated, or rarefied air, and those filled with inflammable air.

The best forms for balloons, are those of a globe, and an egg-like figure. Fire balloons, or those raised by heated air, if very large, may be made of linen, or silk, and must be open at bottom, having a hoop round the opening, from which is suspended the grate for the fuel, which is best of straw, or other light combustibles. Small balloons of this kind may be made of tissue paper, having a wire round the bottom. Two cross wires may support in the centre of the opening a little cup, with some cotton and spirits of wine, the flame of which will rarefy the air, and raise the machine.

Large balloons for inflammable air, must be made of silk, and varnished over, so as to be air-tight. To the upper part of the balloon there should be fitted a valve, opening inwards, to which a string should be fastened, passing through a hole made in a small piece of wood, fixed in the lower part of the balloon; so that the aeronaut may open the valve when he wishes to descend. The action of the valve is effected by a round brass plate, having a hole about two or three inches diameter, covered on both sides with strong smooth leather; on the inside there is a shutter of brass, covered also with leather, which serves to close the hole: it is fastened to the leather of the plate, and kept against the hole by a spring. To the lower part of the balloon a pipe is fixed, made of the same materials with the balloon, which serves to fill it by.

The car, or boat, is made of wicker-work, covered with leather, and well-varnished, or painted, and is suspended by ropes proceeding from the net which goes over the balloon. This netting should cover the upper part, and come down to the middle, with various cords proceeding from it to the circumference of a circle about two feet below the balloon. From that circle other ropes go to the edge of the boat. This circle may be made of wood, or of several pieces of slender cane bound together. The meshes of the net should be small at top (against which part of the balloon the inflammable air exerts the greatest force), and increase in size as they recede from the top.

The inflammable air for filling the balloon is procured by putting a quantity of iron-filings, or turnings, with some oil of vitriol diluted with water, into casks lined with lead. From the top of these casks tin tubes proceed, which unite into one that is connected with the silk tube of the balloon.

Balloons cannot be made smaller than five or six feet in diameter, of oiled silk, as the weight of the material is too great for the air to buoy it up. They may be made smaller, of thin strips of bladder, or other membrane, glued together. The best for this purpose is the allantois of a calf, which is the membrane which encloses the fœtus in the womb. With this they may be made 18 inches in diameter.

THE DANCING FOUNTAIN.

FROM THE CHEMIST.

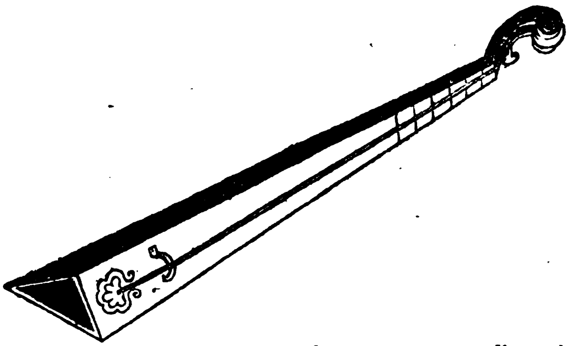
Sir,—I believe you English are so satisfied with yourselves, that you never inquire into the knowledge of others, and are consequently more ignorant of the discoveries and amusements of other people than any other nation on the face of the earth. I see by an early Number of The Chemist, that one of your great philosophers amused his pupils in Edinburgh by exhibiting to them a hollow brass sphere balanced on a jet of of water, "and made to play up and down in a very striking manner," as a novel and curious experiment.

Sir, this has been practised time out of mind in my country, (which is Germany,) and in Holland, and in a much more amusing manner than that described by the Professor. You know, Sir, that fountains, or what you call *jets d'eau*, are very common on the Continent, and there it is the practice to have them in our gardens, and within little temples, and when one is found in such a convenient situation, our boys and girls know how to amuse themselves in the manner your Professor taught his pupils.

They take pieces of cork, which they cut into various shapes, like the figure I send you, which is the representation of one that I made when I was myself a boy, and they either paint them or clothe them lightly. Within what you call the seat of honour a hollow sphere or ball, made of very thin copper or brass, is fixed, and these little figures are then placed over a perpendicular jet d'eau, and there do they dance and turn round like what you call "*merry go mads.*" Your Professor, who taught this to his scholars, as a novel experiment, is known to have been a great traveller, and I have no doubt that he has seen, a hundred times, little figures dancing on the top of a stream of water, both in Germany and Switzerland. I hope, Sir, that you will give insertion to this letter, that the boys of my country may have the honour which is due to them, for having forestalled the English philosophers.

I am, Sir,
Your very obedient humble servant,
EIN DEUTSCHER.

MARINE TRUMPET.



SIR,—Among the instruments described under the article *Music*, in the Encyclopœdia Londinensis, is the following:—

"The Trumpet Marine is an instrument consisting of three sides, which form its triangular body. It has a very long neck, and one single string, very thick, mounted on a bridge, which is firm on one side, and tremulous on the other. It is struck by a bow with one hand, and with the other the string is pressed or stopped on the neck by the thumb. See fig. 8.

"It is the trembling of the bridge, when struck, that makes it imitate the sound of a trumpet, which it does to that perfection, that it is scarcely possible to distinguish the one from the other; and this is what has given it the denomination of trumpet marine, though, in propriety, it be a kind of monochord. Of the six divisions marked in the neck of the instrument, the first makes a fifth with the open chord, the second an octave, and so on for the rest, corresponding with the intervals of the military trumpet.

"The trumpet marine has the same defects with the real trumpet, viz. that it performs none but trumpet notes, and some of those either too flat or too sharp. This Mr. Fr. Roberts accounts for (Phil. Trans. 1692), by premising the common observation of two unison-strings; that, if one be struck, the other will move; the impulses made on the air by one string setting another in motion, which lies in a disposition to have its vibrations synchronous to them; to which it may be added, that a string will move not only at the striking of an unison, but also of that of an eighth or twelfth, there being no contrariety in the motions to hinder each other. Now, in the trumpet marine you do not stop close, as in other instruments, but touch the string gently with your thumb, by which there is a mutual concurrence of the upper and lower part of the string to produce the sound. Hence it is concluded, that the trumpet marine yields no musical sound but when the stop makes the upper part of the string an aliquot part of the remainder, and consequently of the whole; otherwise the vibrations of the parts will stop one other, and make a sound suitable to their motion, altogether confused. Now, the aliquot parts, he shows, are the very stops which produce the trumpet notes."

I have troubled you with the preceding quotation as I am desirous of ascertaining, through the medium of your Magazine, whether an instrument similar to the one above described be in existence. If in the affirmative, what are its exact dimensions? and what is the size of string, &c. used? as, in the representation of it (plate 21), these particulars are omitted.

On inquiry, some few years ago, at an old established music-shop in London, I was given to understand that a trumpet marine had once been in their possession, but they neither knew what had become of it, nor how to describe it.

I am, Sir, yours truly,

S——.

June, 1826.

ON THE CONSTRUCTION OF FIRE PLACES.

BY DR. ARNOTT.

During my attendance lately in some cases of pulmonary disease, while considering how best to attain the important objects of uniformity of temperature, and the prevention of draughts or currents of air in the apartments to which the patients chiefly confined themselves, a simple means occurred to me, which, on trial, perfectly succeeded. It is an addition easily made to any fire-place; and as its uses are important to the health and comfort of all the inhabitants of cold climates, I am happy to suggest it to the public.

It is simply a glazed metal framework, or window, placed before the fire, and coming in contact with the chimney-piece and hearth all round, so as perfectly to cut off communication between the room and the fire-place, and the fire is fed with air brought by a tube from without.

Completely to understand the effect of it, it may be remarked, that of the heat produced by the combustion of fuel in a common fire-place, a part radiates into the room as the light does, and the remainder ascends the chimney with the smoke. That which finds its way into the room, contrary to common apprehension, is probably not more than a fourth part of the whole heat produced; but even less than this would be sufficient to preserve in the room the desired temperature, could it be all retained. The great current of air, however, in the chimney, carries this heat again quickly with it, (for it is the warm air of the room passing away,) and a chimney of the ordinary proportion, and with the ordinary velocity of the smoke, will allow the whole air of the apartment to pass out by it in less than half an hour.

The glazed frame, then, described above, will prevent, it is evident, the heat when once received into the room from again escaping from it, as it now does, with the air ascending in the chimney; and although the glass is some obstacle to the radiation of the heat from the fire in the first instance, the disadvantage is much more than compensated by its retaining agency afterwards.

One of our rooms as now constructed and heated, may be compared to a vessel of water of similar shape, with a hole near its bottom, through which the water is constantly running off, while an attempt is making, at the same time, to warm its contents by heat radiating inwards, from the hole and around it. The hottest water would always get out first, being nearest to the opening from whence the heat came; and to keep the vessel full, this would be replaced by fresh cold water entering by one or more openings in the circumference. It would require a powerful heat indeed, to raise much the temperature of such a vessel; and it is evident, that no degree of heat so admitted could warm the contents uniformly.

It may be supposed that I have underrated the proportion of caloric which radiates from a fire into the room, compared with that which ascends into the chimney, in calling the former only a fourth part of the whole produced; but the following considerations, without new experiment, may probably be accounted decisive of the question. Mr. Leslie, in his experiments on heat, found that a metallic vessel of water, of medium temperature, suspended in the air, lost about half its caloric by radiation, and half by contact with the air. At a higher temperature, however, on account of the increased velocity of the air, caused by its greater expansion, or in an artificial current of air, without higher temperature, it lost much more by contact than by radiation. Now, in a fire are found the two circumstances of extreme heat and great velocity, and to these is added a third, of much greater importance than either, *viz.* the surface of contact being exceedingly increased by the air passing between the pieces of coal, while the surface of radiation, *viz.*, the external surface remains the same. It is a thing not sufficiently adverted to in the management of our fires, that the heat given into the room, is proportioned rather to the extent of burning surface presented towards the room, than to the depth of the fire, the intensity of the heat backwards, and the quantity of the fuel consumed. I have been trying experiments, with a view to ascertain the proportions exactly; of which, however, I have not as yet had time to prepare an account for publication; but as the general result, I may state, that a tile or sheet of iron, laid on the back part of the fire, so as to cover it closely, and to prevent combustion except in front, rather increases than diminishes the radiation of heat towards the apartment, and much less fuel is consumed.

In constructing the glass frame proposed, a part must be made to open, to allow the putting on of coal, and stirring of the fire. The air to feed the fire may come from an opening in the external wall, by a tube concealed behind the wainscoat. In the case where it was first tried, a useless chimney happened to pass by the side of the fire-place, and a brick taken from between them, gave admittance to the air. In whatever way the object be accomplished, we should have it in our power to admit more or less air, so as to regulate the combustion at will, as in the common furnace. The room may be ventilated by a small opening near the ceiling, either into the chimney or into the stair-case, to be made open and close to the degree required. The heated air tubes now commonly connected with fire places, are pecularly adapted to this plan, and with it produce the greatest possible saving of fuel; and the method of supplying coal to the fire from below it, or in any other way that secures the combustion of the inflammable gases contained in the coal, which I hope may soon become general, has the same utility here as in other cases.

The advantages of the plan may be shortly enumerated as follows:

1. The nearly perfect uniformity of temperature in the air throughout the room, renders it a matter of indifference in what part the company sit.

2. The total prevention of draughts, or currents of air, which are inevitable in our rooms, as now warmed, because the fire must be supplied with air from the doors or windows. It is almost needless to mention, that a great portion of the winter diseases of this climate are occasioned by these currents acting partially on our heated bodies.

3. The saving of fuel. Less than half the usual quantity will generally be found to keep the apartment in the most comfortable state.

4. The raising the temperature of the house generally; for were all the chimneys thus closed with respect to the apartments, although fires were lighted but in a few, any degree of heat once generated in the house would be long retained.

5. It completely prevents smoke or dust, a circumstance which alone renders it extremely valuable in many cases; and with it there is no danger of fire.

In these particulars are comprehended all the advantages of the close stoves of continental Europe, so superior to ours in economy, and in the degree and uniformity of the temperature produced, with what many will call a very great additional one, that of seeing the fire; and it avoids their disadvantage, of giving a burnt or sulphury odour to the air of the apartment. It should not be forgotten, that at a very moderate expense, the change described may be made on all our common fire-places. —*Journal of Sciences and the Arts.*

OF CHRONOMETERS.

In the United States Gazette of the 8th inst. is a statement taken from Snowden's New York Advocate, of what is denominated "a curious discovery" upon the variation of chronometers. It appears that Mr. Harvey, of London, by repeated experiments, has ascertained that the density of the medium in which a chronometer is placed, has a sensible influence upon its rate; in other words, that a chronometer constructed in London, which is nearly on a level with the sea, would undergo an alteration of rate from a difference of atmospheric pressure alone, if transported to Madrid, Mexico, or any other place, much above the level of the place where it was constructed.

The cause will be found in the balance. All chronometers that are adjusted by screws, will vary in their time, according to the experiments of Mr. Harvey. These screws having large heads, one on each side of the balance, their line crossing the centre, and the loadings, the line of which crosses that of the screws at right angles, make four projections from the rim; these, in consequence of its velocity, strike the atmosphere with great relative force. The effect produced is, that in a more elevated situation, or less dense medium, than that in which the chronometer was adjusted, its motion will be faster, and so on the contrary, in a lower or heavier atmosphere.

A chronometer drops from 125 to 150 times in one minute, according to the calculation of the train; and a free, accurately made scapement, with a force of main spring in proper accordance with the weight of the balance, will always give that balance an entire revolution, at least to every drop. The subscriber at this time has one made by Bissett, Royal Exchange, that throws its balance a revolution and a third, which gives it an action equal to two hundred complete circles in one minute. When it is considered that the loadings of this balance present a flat, and the screws for adjustment, a round projecting surface to the atmosphere, and that all are upon its periphery thrown back and forth at the above rate, it will be readily perceived that different densities will, in some degree, affect the action, and consequently the time of the chronometer. In order to avoid such variation, it will be found necessary to abandon the loading, and the screws at present used for bringing chronometers to adjustment. Even the arms of an ordinary balance ought to be considered as an objection, where there is so much accuracy required as in a navigating time-keeper. Suppose the balance to be turned out of a solid piece of metal, and instead of being crossed out into arms, turned down very thin and left unbroken between the rim and centre: when perfectly true upon its pivots, its active motion will not create the least atmospheric resistance.

It will doubtless be said, that to give up the spiral spring, and the compensating balance in segments, would be sacrificing too much to avoid the disadvantages of the surrounding medium. But let it be recollected, that the compensating balance, when it does act, is more apt to derange than to regulate the time. The subscriber, in one instance, knew a very expensive chronometer, with the compensating balance in segments, to lose from its usual rate ten seconds in six hours, when exposed to a temperature of five degrees below the freezing point; when, by another time keeper, the effect of the frost upon the hair, or pendulum spring, was found to produce at the same exposure a gain of only two seconds; consequently, its balance produced a variation of eight seconds. The writer has frequently observed, in adjusting a chronometer, and also duplex watches with chronometer balances, that when the cut in the screw-heads was brought nearly to a line with the motion, that by turning the screws outwards, until their cut was precisely parallel with the action, instead of losing they would gain upon their rates; evidently, because the atmosphere was struck by a smaller body.

Time-keepers might even be regulated, with some degree of accuracy, by asmopheric resistance alone. Suppose two thin pieces of metal were attached to each side of the balace, in such a way as to be moved round, in order to present their edges to the motion; the quickest action would then be produced, and the slowest when the sides were carried against the opposing medium. The changes necessary to find the time, could be brought about by turning the edges to the different degrees from a horizontal to a vertical position. The atmosphere operating thus powerfully, the result of the ingenious Mr. Harvey's experiments upon its different densities may reasonably be considered a settled fact. That it is altogether the balance of the chronometer which is affected, seems no less an undoubting conclusion.

BENJAMIN F. BAKER.

Philadelphia, March 28, 1826.

REVEALING THE SECRETS OF TRADE.

[It is some time since our impartiality was appealed to on the subject of this article, by a letter signed S. N. L., the insertion of which was postponed till we could "accompany it with such observations as might prevent the injury it seemed otherwise calculated to produce." We are still of opinion that the writer's views are extremely erroneous, and that the working classes would lose more than they would gain by the system of secrecy which he advocates; but it appears to us, on second thoughts, that it will be dealing fairer by our Correspondent, and acting more conformably to our usual practice, to give a place to his argument, by itself in the first instance, and to leave to some of our other Correspondents the opportunity of showing in how far it is faulty. Our object has been always rather to excite and encourage discussion among the readers of the Mechanics' Magazine, than to indulge in any self-display of our own; and while that course of conduct has been so unequivocally approved of as it has been, we have no inducement to deviate from it. It may be proper to add, that the following letter, though differently subscribed from the one to which we have just alluded, appears to be in the same hand-writing, and is only preferred to the other as it may be considered to present the latest views of the writer on the subject.—EDIT.]

SIR,—In the first Number of your very excellent Magazine I have noticed two Inquiries, which, I think, might as well have been omitted: one for a plan, offering to the best one guinea. I think this is unfair, as it is taking out of the hands of those who get their living by it, their bread: not that I would oppose giving such a trifling job to a young fellow who is beginning the world, when the sum would be a consideration to him, and merely employ him when he has a little leisure time on his hands. This I would not at all object to; on the contrary, I would put such a thing in his way: but I object to it on the principle that men who can afford to pay for these things in a handsome way, come to your pages in order to get it done at a *cheap* rate—here is the rub: and of this I do complain as a serious evil, and which I think should be put a stop to, which can only be done either by your refusing such applications (unless the inquirer satisfied you of his intentions) or by every one refusing to answer such.

While I am on this point, I would also notice to you another grievance, by which the secrets of a man's trade are exposed by inquiries indiscreetly answered, from a mistaken notion of liberality. I would oppose the introduction of such queries and answers on almost the same principle as before stated. Many persons in the wealthier circles of life are amateur mechanics; some from a laudable, and others from a despicable motive; some to employ rationally their time, and who liberally pay for what they want without endeavouring to dive into the mysteries of the arts they practice; others, and I know it to be a fact, do it in order to *save their pockets*. Now, I would not object to queries generally, on speculative and uncertain points, but to those which lay open some of the arts which are valuable, I would most decidedly oppose—and I press it upon the mechanics who read this valuable work, whether it is for their *own interest to impart to a stranger* their secrets. To each other it may done, but not publicly, so that every silken lord may have its benefit. I know I may by these strictures lay myself open to a charge of contractedness of spirit; but this I despise, for we are not, by any overstrained civility, and a little highflown talk, to be driven from those opinions which are founded on common justice and common sense. Did my time permit, and were it at all necessary, I would not hesitate a moment giving a list of queries allowable and non-allowable; but this I leave to the heads of those whom it more nearly concerns, and who surely will not be backward in supporting those interests on which the getting of their bread depends. Be not deceived, I would say, nor led astray by the false reasoning of those who wish to mislead you by canting about "narrowness, illiberality," and the like. Would such arguments for one moment weigh with a tradesman, were a gentleman to ask him where the manufacturer lives who supplies him with goods? The person who asked such a question would be laughed at for his folly, and reproved for his want of sense. The cases are parallel: I only ask for a corner in your excellent Magazine, of which I am a constant reader, for these few lines, merely to record my opinion, as a single individual, on the case, and then let the subject take its own course. With many wishes for your prosperity,

I remain, Sir,

Your most obedient servant,

VIATOR.

JAMES FERGUSON'S NOTIONS OF MATHEMATICS.

Professor Stewart observes of Ferguson, "I remember distinctly to have heard him say, that he had more than once attempted to study the elements of Euclid, but found himself quite unable to entertain that species of reasoning. The second proposition of the first book he mentioned particularly as one of his stumbling blocks at the very outset; the circuitous process by which Euclid sets about an operation which never could puzzle for a single moment any man who had seen a pair of compasses, appearing to him altogether capricious and ludicrous. He added, at the same time, that as there were various geometrical theorems of which he had daily occasion to make use, he had satisfied himself of their truth either by means of his compasses and scale, or by some mechanical contrivances of his own invention. Of one of these I have still a perfect recollection; his mechanical or experimental demonstration of the 47th proposition of Euclid's first book, by cutting a card so as to afford an ocular proof that the squares of the two sides actually filled the same space with the square of the hypothenuse." Ferguson is not the only person, we believe, who has felt a similar difficulty. Mr. Wallace, in his "Elements of Geometry," or "Compendious Demonstration of the first Six Books of Euclid," a work well deserving the notice of all practical students, candidly observes of this great master of demonstrative science,—"His reasoning, though beautiful and convincing, is long and laborious, full of repetitions, and not unfrequently employed about such propositions as might either be taken for axioms or very shortly discussed. By abstracting the science too much from the sensible objects to which it owed its origin, he sometimes leaves the mind in doubt about the reality of its conceptions." Even Euclid himself was on one occasion at a loss to *demonstrate* what was nevertheless *true in point of fact*.

In laying down his "Elements," he comes, in the 17th of his first book, to prove that any two angles of a triangle are less than two right angles. The plan of his work required that he should demonstrate the converse of the same proposition, namely, that two straight lines will meet and form a triangle with a third line whenever the sum of the two angles which they make with the third line is less than two right angles. But of this proposition he could find no demonstration, and he was accordingly obliged to set it down in the form of an axiom, or rather postulate, which, although not proved, might with perfect safety be assumed in the subsequent part of geometry. Nor have the efforts of geometers, continued incessantly for more than two thousand years, been able to supply the defect, till at length M. Legendre, by the application of algebraic functions, to prove the properties of parallel lines, has presented some approximation towards it. More than an *approximation* we cannot venture to call it, when so able a mathematician as Mr. Leslie contends that functional demonstrations are entitled to no regard whatever in geometry. C.

PRIZE CHRONOMETERS.

In reply to Mr. Smith's inquiries as to Prize Chronometers, we submit the following :—

In the reign of Queen Anne, the British Parliament passed an Act, offering a reward of 10,000*l*. for any method of determining the longitude within the accuracy of one degree of a great circle—of 15,000*l*., within the limit of forty geographical miles —and of 20,000*l*., within the limit of thirty such miles, or half a degree, provided such method should extend more than eighty miles from the coast. The hope of obtaining this reward stimulated a watch-maker, named Harrison, to be indefatigable in his endeavours to effect the required improvement, which eventually led him to apply the principle of the opposite expansions of metals to a watch, to effect a self-regulating curb, for limiting the effective length of the spiral pendulum-spring, to correspond to the successive changes of heat and cold, which changes were then known to alter the force of this spring, and the momentum of the balance.

After Harrison had, by his industry and perseverance, obtained the large reward, the act was repealed, and another substituted, offering separate rewards to any person who should invent a practical method of determining, within circumscribed limits, the longitude of a ship at sea: for a time-keeper, the reward held forth to the public is 5000*l*., for determining the longitude to or within one degree; 7500*l*. for determining the same to forty geographical miles; and 10,000*l*. for a determination at or within a half a degree. This Act, notwithstanding its abridged limits and diminished reward, has produced several candidates; of whom Mudge, the two Arnolds, and Earnshaw, have had their labours crowned with partial success.

ON RAREFIED AIR AND WATER.

Sir,—A reader of your Magazine, and a practical mechanic, being in conversation the other day, a subject was started upon which they do not exactly agree. It was on the nature of steam. If, therefore, you will insert the following Queries, it will be considered a favour, as doubtless some one of your numerous correspondents will favour them with a reply.

Are rarefied air, and rarefied water, the component parts of steam? If so, is it rarefied air or rarefied water, that gives to steam its expansive force?

R. S.

MR. FRANKLAND'S LATHE.

Sir,—Can any of your Correspondents give me a description of an expensive Lathe, which was a few years ago in the possession of a Mr. Frankland, of Meintham, not far from Worthing, Sussex, or inform me where it is? He was a gentleman extremely partial to mechanical pursuits, and the lathe to which I have alluded was, I believe, made under his directions, at a vast expense—I have heard, 1100*l*. A few days ago, I was told that it would *turn a landscape;* but as the communicant knew little about lathes or ornamental turning, he could not tell me how the object was effected. I can only imagine that Mr. Frankland invented some complex chuck, of the excentric kind, by which one might, on the lids of a box, or other box, cut out a simple and easily traced drawing, such as a plain building, with something like a tree standing by it.

I am, Sir, yours, &c.

V. B.

INQUIRIES.

Sir,—Having repeatedly occasion for covered copper wire, for electro-magnetic experiments, you will very much oblige me, and probably many others engaged in similar pursuits, if you can make us acquainted with the process used in the manufacture of bobbin-wire, and where it is made? This being covered iron wire, is, of course, unfit for electro-magnetic experiments.

I am, Sir,
Your obedient servant,
A Subscriber.

Sir,—Allow me to ask, through the medium of your excellent Magazine, whether it is possible to make any sort of cloth (as ticken, &c.) water-tight; that, when made into a bag, it may hold any kind of liquid? I should be very glad to know the best and cheapest method to obtain it. I am, Sir,

Your obliged, humble servant,
Jupiter.

Nuneaton, June 3, 1826.

CHARTOMETER.

Sir,—I should feel particularly obliged if any of your Correspondents would inform me (through the medium of your valuable miscellany) of the construction and use of the Chartometer.

I remain, Sir,
Yours respectfully,
A. G. F.

CYCLOIDAL CHUCK.

Sir,—A Correspondent, in the 72d Number of your work, gives a plan of a Cycloidal Chuck; if he, or any of your other Correspondents, would, through the medium of your useful Magazine, inform me where I can get such a one made, and of the cost, he would much oblige,

Sir,
Your humble servant,
Amicus.

Hereford, June 3, 1826.

P.S. Any information respecting this beautiful art will be acceptable to others as well as myself, who am only an amateur.

INQUIRIES OF CORRESPONDENTS.

What is the best varnish, or composition, for applying to carriage harness, to prevent its cracking, or otherwise injuring the leather? It is requested to be stated what ingredients are used; how the composition is made; and what is the best mode of applying it.

A recipe is requested for making what is vulgarly called Thieves' Vinegar.

In what manner should a Correspondent proceed to re-gild the frame of a favourite old looking-glass?

A recipe is requested of a cement for mending broken china.

Communications (post paid) to be addressed to the Editor, at the Publishers', KNIGHT and LACEY, 55, Paternoster-row, London.

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Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 148.] SATURDAY, JUNE 24, 1826. [Price 3d.

CAPTAIN JEKYLL'S

PORTABLE VAPOUR BATH.

[To the Editor of the Mechanics' Magazine.]

SIR,—There is, in Dr. Jamieson's Dictionary of Mechanical Science (now publishing), under the head "Bath," a Portable Vapour Bath, mentioned as being the invention of Captain Jekyll, a sketch of which is given, but unaccompanied with any explanation. The sketch represents a man sitting upon a chair near the fire, on which is placed a vessel, from the top of which proceeds a tube, conveying the vapour to the floor beneath the chair, where a vessel resembling a saucepan, a box, &c. appear to be placed; the tube is lost sight of near the bottom of this vessel, but is seen again rising perpendicularly from the floor, in front of the chair, and held in the hand nearly opposite the breast of the figure, where it terminates. The person is covered with a long robe, fastened round the neck, and falling loosely round the chair upon the ground. It is drawn to appear transparent, for the purpose of discovering what it encloses.

Probably some of your numerous readers, who may be acquainted with the mode of admitting and regulating the vapour in this bath, will be kind enough to supply the deficiencies of "Dr. Jamieson's Dictionary," and, through your valuable Magazine, make known to the public the means of obtaining in this (apparently) very convenient and cheap manner, an article of the most extensive usefulness.

I remain, Sir,
Your constant subscriber,
J— V—.

We feel pleasure in being able to present our Correspondent, and subscribers generally, with a sketch of Captain Jekyll's Portable Bath, together with the following description of the apparatus :—

"This apparatus consists of an air-tight kettle, with a safety-valve, and a pipe that carries the steam under the chair of the bather into a box, containing any aromatic or medicated materials which may be deemed necessary. The stop-cocks of this steam-box are regulated by the bather with a rod, as is seen in the prefixed sketch; and, as there is a large cloak or blanket (made transparent in the sketch, to show the apparatus), the steam comes in contact with every part of the body."

BALLOONING.

Sir,—On witnessing Mr. Green's ascent in his balloon, it became a subject of discussion amongst some friends, of no very great physiological research, whether or not a balloon would, under any circumstances, ascend to such a height as to cause it to burst. Those who were for the affirmative of the question contended that, if a common balloon were *completely* inflated with gas, and secured so that no portion of it could escape through any aperture or the pores of the covering, and that it were permitted, unaccompanied by a car or other appendage, to ascend, that it would rise into an atmosphere of so rare a nature, that the expansion of the gas would cause it to burst; this conclusion was adduced from, and maintained upon, the following assumed data, viz.—that if the air at the surface of the earth were pressing on all sides of the balloon with a power of ten pounds per square inch, that there must be exercised also by the gas inside an equal power of resistance, or, in other words, a tendency to expansion on every square inch equal thereto. Upon the balloon ascending a mile high, it was assumed that one-tenth of the external pressure would be taken off, consequently placing the relation of the internal expansive power and the external pressure as 10 to 9, and for each successive mile of ascension the internal and external powers would change their relations by the following scale :—

At the surface of the earth.		Internal or expansive power.	External pressure.
	0	10	10
Miles high	1	10	9
	2	10	8
	3	10	7
	4	10	6
	5	10	5

consequently, at five miles high, upon the data assumed, there would be a power exercised within to burst the balloon of ten pounds per square inch, and an external or counteracting power of only five pounds per square inch, being an excess of five. By those who were on the negative side of the question, it was contended that this reasoning was inapplicable, for the balloon could never, of itself, rise into an atmosphere of sufficient rarity for the expansion of the gas to be at all adequate to such an effect: expansion might take place in some trifling degree, but as it could never rise so high as to get into an atmosphere of any thing like the rarity of the gas itself (on account of the weight of the material enclosing it), that therefore the denser atmosphere by which it would be always surrounded would check the expansion, and prevent the bursting of the balloon.

As the question (should it not have been determined by fact) may admit of some philosophical argument, allow me to beg the favour of your giving it a place amongst the inquiries in your useful Magazine.

I am, Sir,

Your obedient servant,

INDICATOR.

June 8, 1826.

ANCIENT VASES.

(*Continued from page* 61, *No.* 144.)

We shall place in the first class those vases in which the colour of the clay is natural, without glaze or other coating, or painting. Of this kind are some vases which were dug up at Cumæ, as well as near S. Agatha Sothorum, along with others of a black colour.*

In the second class, we shall place those in which the natural colour of the clay is somewhat heightened by their having a very thin glaze or coating.†

To the third class, belong those vases which have been manufactured of clay intermixed with black matter. These vases are found, either simple, that is, without ornaments and paintings; or decorated with ornaments, either impressed or in relief; or they are painted with a white or yellowish colour. Of this description are many of the vases dug up, not only in Lower Italy, but also in the districts of ancient Etruria.

To the fourth class belong those vases whose clay is evidently covered over with a black glaze or coating. Like those of the third class, they are either simple, or with ornaments either impressed, or painted with a white, yellowish, or red covering.

The fifth class may contain those vases, in which, upon a basis of clay, either of the natural colour, or with a somewhat brighter glaze, there are ornaments or painted figures of a black colour, sometimes with impressed lines. These vases, which have been dug up in various places, although they commonly go by the name of Sicilian, are either simply painted with black, or ornamented with figures, in which the red and white colours are covered over with black; of which kind some exquisite vases have been found, as for example, in the vicinity of Pæstum.

To the sixth class we shall refer those painted vases, the most common of all, which have figures and ornaments either of the natural colour of clay or somewhat heightened, the general ground, however, and some lines, being black; some of them are of more simple construction, others are ornamented with white, red, yellowish, or dusky colours.

The seventh class includes those vases of rarer occurrence, in which the ground is black, and the figures, which are red, are laid upon a white colour covering the black, the lines being impressed so as to penetrate to the black ground.‡

The eighth class we shall appropriate to those very rare vases, commonly but falsely called Egyptian, in which the ground is yellowish, and the paintings of a coffee-colour, which, however, do not cover the ground perfectly, there being sometimes a covering of white and red colours. These vases, found in Lower Italy, correspond, in so far as regards the colour of the clay and paintings, with others discovered in Greece, one of which, that had been dug up at Athens, is preserved in the Museum of our University, having been presented to it by the celebrated English traveller Hawkins.

SECT. II.—*Of the Composition of Vases, commonly called Etruscan, in detail.*

1. *Qualities of the Materials.*—The vases described in the preceding section are formed of a fine clay, which is impregnated with iron, and consequently reddens more or less by the action of fire, but whose qualities differ in the different varieties of those vases.

The finer substance of the better sort of painted vases, is that of which the vases with a simple black coating, or those entirely black, are composed, the specific gravity being in proportion to the degree of fineness. The whole of these vases are indeed very light, but more especially the finest kinds; and in them also there is considerable difference with regard to this quality. The vases of Nola seem to exceed the rest in lightness; and by this general quality, in fact, the truly antique vases may readily be distinguished from all imitations of them.

Certain differences are also to be ob-

* Sul metodo degli Antichi nel dipingere i vasi. Due Lettere del Canonico Andrea de Jorio al Sig. Cav. M. Galdi, p. 4.

† Jorio, loc. cit. p. 8.

‡ Jorio, loc. cit. p. 5.

served in the colour of the materials. In the more valuable kinds, it sometimes approaches to brick-red, but its most common tint is yellowish-red. In the coarser kinds, the colour of the clay is usually paler than in those of finer texture.

I cannot, however, agree with those who are of opinion that a red pigment has been added, in order to increase the intensity of the colour;* for this reason, that the internal colour of the mass agrees perfectly with that usually observed in ferruginous clay that has undergone the process of roasting, and the fractured surface exhibits no inequalities in regard to colour.

In the finer vases there are no heterogeneous parts, nor is any admixture, as of sand, for example, observable. They have been manufactured either of clay in the natural state, if it had been pure, or carefully prepared by washing.

The colour of those vases which are decidedly black, has, without doubt, been produced by the admixture of some black substance, and not by the natural colour of the clay, or by the action of vapours. Upon accurate examination, yellowish particles, together with small black shining grains, are observed in the black mass; from which it may be supposed that the mixture has not always been perfectly equal. The celebrated Brochi detected minute scales of mica in the substance of the black vases found in the ancient sepulchres of Etruria.†

According to the chemical analysis of Vauquelin, a hundred parts of the mass of those vases usually called Etruscan, contain—Silica, 53; Alumina, 15; Lime, 8; Oxide of Iron, 24.‡ This quantity of iron, it may be remarked, is singular, and is probably not so great in the whole of these vases.

2. *Conformation of the Vases.*—The vases commonly called Etruscan, seem, without exception, to have been moulded on the wheel;§ the invention of which is, without doubt, of the greatest antiquity, as has lately been ingeniously demonstrated by the investigations of my friend Ritter.|| That the whole of these vases were, in reality, formed by the wheel, appears to be proved by the following considerations:—1. Because no other forms are seen in them, but such as can be produced by the wheel; no vases of such a form as to present an oval in their transverse section, or exhibiting other curves deviating from the circle, which could only be produced by the aid of moulds or other means. 2. Because traces of the wheel often occur, especially on the inner surface of the vases, as well as beneath, on the base, and in other parts not so carefully smoothed as the rest. 3. Because, on the other hand, no marks are ever observed, from which it might be inferred, that these vases have been fabricated by a more complex and artificial method; for example, no seams, which it is difficult to avoid when moulds are used.

Vases are more or less accurately shaped. The finest kinds, turned with the greatest care, and ornamented with paintings, are exact in their dimensions, with thin walls, and a smooth surface, having no marks of the wheel; from which it may be conjectured, that, after the vases had been formed in the wheel, some processes had been adopted for smoothing the surface, perhaps not unlike those which are applied by our own potters to the same purpose.

It is unnecessary for us to enter in this place upon a full account of the particular forms given to these vases, as they have been described and delineated with sufficient accuracy, in many works on the subject. The variety is not less to be admired than the elegance of the forms, although in this respect also some differences are observed between the more exquisite vases and those of inferior quality, between the Grecian vases and those of Etruscan origin.

According to their forms, four principal classes of vases may be distinguished. 1. *Vases properly so called.* They differ greatly in size and proportion of parts. The mouth is either much greater than the diameter of the body, or is of the same size, or smaller. In this manner, it is often furnished either with a lid, or with a cup or funnel-shaped process. The body is usually ovate, or approaching to this form, or bell-shaped, or calyciform: of these principal forms there are, however, innumerable varieties. Vases occur either simple, or furnished with handles, of which there are two, or three, or sometimes four, and these are affixed to the lip, or body, or lower part of the vase.—2. Vases, commonly called *Præfericula* by the ancients, which are usually furnished with a single handle.—3. *Vasa unguentaria,* with a long narrow neck.—4. *Pateræ* or *Goblets,* which have commonly two handles.

There are certain parts in vases which have not been formed along with the body upon the wheel, but have been

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* Antiquités Gauloises et Romaines, par C. M. Grivaud, 1807, p. 137.

† Osservazioni sulle vernici usate dagli antichi sulle stroviglie di terra; lettera del Sig. Brocchi al Sig. Dodwell. Biblioteca Italiana, t. vi. 1817, p. 457.

‡ Millin. loc. cit. p. 7, No. 47.

§ First letter addressed to M. Millingen by M. Rossi. Millingen, Peintures Antiques, iii.

|| Die Vorhalle Europäischer Volkergeschichten, p. 237.

made separately, and afterwards joined to the body. Of this kind are, 1. The handles, with which vases and goblets are frequently furnished; 2. A prismatic base, instead of the common round one. This, however, is of a very rare occurrence in vases: I have seen an instance of it in a vase of Grecian origin, in the Royal Collection at Naples. In these parts I have found no indication of their having been formed in moulds: they seem, without exception, to have been made by the hand and instruments.

3. *Composition of the Plastic Ornaments of Vases.*—The plastic ornaments which we find upon vases, have been made by the wheel, or in some other way. Of the former kind are all those simple ornaments, whether raised or impressed, with circular outlines, which surround certain parts of vases, as, for example, the upper margin, or ball of the lid, which have, without doubt, been formed, in a way similar to that employed by our potters, by means of certain instruments.

To the plastic ornaments not prepared upon the wheel, belongs the raised work, which is sometimes, though rarely, seen in the principal part of vases, and more commonly on the handles. Some black Etruscan vases, preserved in the public collection at Florence, are furnished with raised ornaments on the principal part or body. Two large vases, of elegant form, are encircled by vine tendrils. Others of them have raised figures of animals. Some, again, with a narrow neck, are terminated by vine-leaves. In others, there are rounded raised lines, which rise from the bottom to the bulging part of the body, or descend to it from the neck. The handles are ornamented in this way, not only in the black Etruscan vases, but also in the painted ones of Grecian origin. They are often terminated by heads or entire figures, beautifully imitated, or are made to assume the form of twisted serpents, or are marked with depressed or raised lines.

It is a question whether these ornaments have been made by means of moulds, or simply by the hand. From the inquiries which I have made in regard to this matter, I am inclined to think, that all those plastic ornaments have been formed with the hand, by means of simple instruments, and not by moulds, as is now practised. 1. Because no marks of moulds, no seams, for example, are to be observed; 2. Because small differences are commonly found in ornaments of the same kind: the heads or figures of handles, for example, in the same vase, differ a little; the excavated or rounded lines in the same part have not always the same dimensions. In the latter pottery-work of Roman origin, on the contrary, the use of moulds may commonly be observed.*

Impressed ornaments also sometimes occur, especially in the black Etruscan vases. They consist either of impressed lines or dots. Ornaments of this description may easily be formed by instruments similar to those which are used in making seals. The differences, however, often conspicuous in those ornaments in the same vase, appear to me to prove that they have not been made in this way, but by means of a hard stilus. In one part of the ornaments, for example, the number of dots is greater than in another, or the dots in one row are a little nearer than in another. I have remarked the same of the letters which are sometimes seen on Grecian vases. Upon examining them, it clearly appears that they have not been inscribed by instruments similar to those used in cutting our seals, but also by means of the style. Among the Romans, in later times, stamps, or seals with elevated letters, as on coins, were very frequently impressed upon earthen-ware, such as bricks, vases, and lamps.

4. *Baking of Vases.*—The whole of the vases of which we speak are baked, but in different degrees, never more, and generally less, than our best pottery-ware. According to the opinion of the celebrated Chaptal, which agrees with the above, the heat applied for baking may be estimated at seven or eight degrees of Wedgwood's pyrometer.† We never find the argillaceous mass converted into glass, nor the smallest indication of fusion; there is never, therefore, any resemblance to the stone-ware of the present day.

The finer painted vases are universally more baked than the coarser, and of the latter, those which are entirely black are the least baked; the different degrees of baking being estimated by the difference in hardness, sound, and porosity; the latter of which is known by the different degrees in which the mass absorbs water.

It is the general opinion of all who have written on the composition of antique vases, such as Grivaud,‡ Rossi,§ Hirt,|| and Jorio,¶ that the painted vases

* Givaud, Antiquités Gaul. et Rom. p. 137.

† Chaptal, Notice sur quelques Couleurs trouvées à Pompeia, Mém. de la Classe des Sciences Mathem. et Phys. de l'Institute de France, 1808, p. 335.

‡ Ant. Gaul. et Rom. p. 126.

§ Millingen, Peint. Ant. p. 5.

|| Boettiger's Griech. Vasengemälde, Bo. 1. Heft. 3, p. 28.

¶ Sul. Met. d. Ant. nel Dipingere i Vasi, p. 19.

of antiquity have been manufactured in the same manner as our finer modern pottery-ware; that after being first baked, the paintings have been applied, and the whole submitted again to a greater heat.

From the vases themselves we cannot now learn whether they have been once or twice baked; but from any investigations, with regard to the nature and composition of the paintings, it seems to me more probable that the whole have been once strongly baked, by which they have acquired the necessary degree of hardness and fineness, and at the same time preserved their porosity, and that the colours have afterwards been spread over them by a lesser heating.

5. *Composition of the Paintings.*—In a disquisition regarding the mode in which the colours may have been applied, the following subjects demand investigation:—1. The nature of the pigments; 2. The mechanical mode in which they are laid on; 3. The operations used after the pigments have been applied.

None of the vases are overlaid with the vitreous substance which we call *glaze*, either joined with the colours, or separated from them. The vases which are entirely black, have no coating different from the mass, and the lustre of the surface is produced by the substance of the vase itself, as we shall presently show. Other vases are furnished with a simple black coating, which, however, has no resemblance to the glaze of our earthen-ware, but is more like varnish.* Painted vases either show in certain parts a surface of baked clay, or there is a very thin, pellucid, varnish-like coating of clay, by which the colour of the clay is heightened a little, so as to have a dusky or dark red appearance.

A black colour, corresponding with the black coating of some kinds, is very common in the paintings of vases. Other colours appear much more rarely and less extensively applied.

This black colour, therefore, we shall examine first, as being, of all things connected with vases, in so far as regards art, the most worthy of accurate investigation. It is usually of a pitchy tint, sometimes passing into brown, or, when thinly applied, appearing even of a coffee colour. It seldom passes into livid or green, which I have observed, however, in some vases of the Florentine and Roman collections. The lustre of the colour is of various degrees of brightness, sometimes it is scarcely apparent, and is always more like that of varnish than of glass. In other respects, also, the black coating is always dissimilar to glass: when minutely examined, however, with the microscope, it has the appearance of being fused.* It is of different degrees of thickness, seldom so great as to be sensible to the touch. The black coating is firmly adherent to the surface, although it does not penetrate into the clay, nor is conjoined with its particles by fusion. Its adhesion is firmer in the finer vases than in those of coarser quality. None of those cracks or fissures are seen in it, which frequently occur in the glaze of earthenware.† It is not dissolved by acids or any other fluid. I have exposed fragments of painted vases for a long time to the action of nitric and muriatic acids, but never observed any effect produced upon them. It even sustains a considerable heat without injury,‡ and it may be exposed for a long time to the blowpipe, without undergoing any distinct change. When the condensed flame was directed toward part of the paintings for some time, I have observed that the nearest parts of the clay were covered over with a black exhalation; but I cannot say whether this exhalation be produced by a sublimation of the pigments. The black varnish is sometimes covered over by a white exhalation when burnt, the production of which may perhaps be explained from the decomposition of its substance. More accurate investigation, however, has shown me, that the white colour arises from the burning of the calcareous particles intimately conjoined with the surface of the vases, and cannot be ascribed to the ashes of the varnish.

(To be continued.)

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* Jorio, who has made very accurate observations regarding the paintings of vases, aptly compares the black varnish to China ink; loc. cit. p. 5.

* That the black coating has the appearance of fusion, has been justly observed by Chaptal.—Mem. de l'Inst. 1808, p. 234.

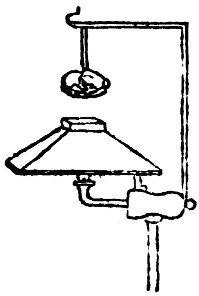
† Boettiger's Griech. Vasengemalde, Bo. i. Heft. 3. p. 27.—Millingen, Peint. des Vases Ant.; loc. cit.

‡ Millingen, Peint. des Vases Ant., p. 7, No. 27.

FRAGRANT LAMPS.

EXTRACTED FROM "THE CHEMIST."

SIR,—Perhaps you may thank me for the following little account of a method of preserving the air of apartments comparatively pure, and at the same time of dispersing a pleasant fragrance through them.



By means of a wire fixed to one side or at the back part of the lamp, according to its nature, and bent at right angles, so as to be a few inches above the top of the flame, a piece of sponge is to be suspended. This is to be soaked in a mixture of best vinegar and water, and squeezed nearly dry before it is hung up. By this means the vinegar is constantly dispersed through the apartment, and gives a very fragrant smell. It would probably be *very useful in manufactories and close workshops*, and is of course as easily applicable to gas as other lights. It costs very little, for the same piece of sponge has served me a whole winter. It must be occasionally re-immersed in the water and vinegar, and then will be found to give out a great quantity of soot, which otherwise fouls the air of the apartments.

I am, Sir,
Your obedient servant,
EIN DEUTSCHER.

SENSIBLE BALANCE.

The following description of a very delicate and, apparently, very useful Balance, is taken from a letter written by Dr. Black, to James Smithson, Esq., and inserted in the Annals of Philosophy, N.S. x. 52.

"The apparatus I use for weighing small globules of metals, or the like, is as follows:—A thin piece of fir-wood, not thicker than a shilling, and a foot long, 3-10ths of an inch broad at the middle, and 1½-tenths at each end, is divided by transverse lines into 20 parts, *i. e.* ten parts on each side of the middle. These are the principal divisions, and each of them is subdivided into halves and quarters. Across the middle is fixed one of the smallest needles I could procure, to serve as an axis, and it is fixed in its place by means of a little sealing-wax. The numerations of the divisions is from the middle to each end of the beam. The fulcrum is a bit of plate-brass, the middle of which lies flat on my table when I use the balance, and the two ends are bent up to a right angle, so as to stand upright. These two ends are ground at the same time on a flat hone, that the extreme surfaces of them may be in the same plane; and their distance is such, that the needle, when laid across them, rests on them at a small distance from the sides of the beam. They rise above the surface of the table only one and a half or two-tenths of an inch, so that the beam is very limited in its play.

"The weights I use are one globule of gold, which weighs one grain, and two or three others which weigh one-tenth of a grain each; and also a number of small rings of fine brass wire, made in the manner first mentioned by Mr. Lewis, by appending a weight to the wire, and coiling it with the tension of that weight round a thicker brass wire in a close spiral, after which the extremity of the spiral being tied hard with waxed thread, I put the covered wire in a vice, and applying a sharp knife, which is struck with a hammer, I cut through a great number of the coils at one stroke, and find them as exactly equal to one another as can be desired. Those I use happen to be the 1-30th part of a grain each, or 300 of them weigh ten grains; but I have others much lighter.

"You will perceive, that by means of these weights, placed on different parts of the beam, I can learn the weight of any little mass, from one grain, or a little more, to the $\frac{1}{1200}$ of a grain. For if the thing to be weighed weighs one grain, it will, when placed on one extremity of the beam, counterpoise the large gold weight at the other extremity. If it weights half a grain, it will counterpoise the heavy gold weight at five: if it weighs 6-10ths of a grain, you must place the heavy gold weight at five, and one of the lighter ones at the extremity to counterpoise it; and if it weighs only 1, or 2, or 3, or 4-100ths of a grain, it will be counterpoised by one of the small gold weights placed at the first, or second, or third, or fourth division. If, on the contrary, it weigh one grain and a fraction, it will be counterpoised by the heavy gold weight at the extremity, and one or more of the lighter ones placed in some other part of the beam.

"This beam has served me hitherto for every purpose; but had I occasion for a more delicate one, I could make it easily, by taking a much thinner and lighter slip of wood, and grinding the needle to give it an edge. It would also be easy to make it carry small scales of paper, for particular purposes."

Mr. Smithson observes, that the rings, or small weights, mentioned above, have the defect of their weight being entirely accidental, and consequently most times very inconvenient fractions of grains, and recommends instead, that the weight of a certain length of wire be ascertained, and then the length of it taken, which corresponds to the weight wanted; when fine wire is used, a set of small weights may thus be made with great accuracy and ease. This is a process, the value of which is well known to the philosophical instrument-maker.

NEW PRESS DRILL.

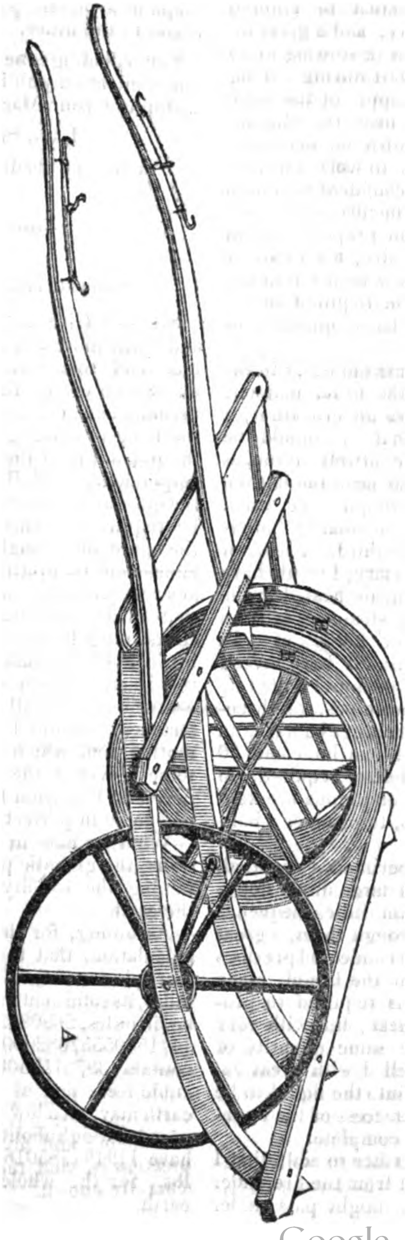
[To the Editor of the Mechanics' Magazine.]

SIR,—You will oblige me if you will give a sketch in your valuable Magazine of the inclosed Press Drill. It is intended to follow the ploughs, by being drawn by one horse down the furrows. The end wheel, A, is the guider-wheel, and runs upon the swath where the horse walks; the two wheels, BB, follow the furrows after the two ploughs, and press the sod and the soil firmly together, so that no seed can be lost or wasted betwixt the sod and the soil, which is the case if not pressed. Its principal use is in light soils, and it is found, by all who have used it, one of the most valuable utensils in farming.

JAMES CHAMBERS.

P.S. I will give you in my next, and very soon, a description of one upon a more enlarged scale; and beg leave to say, that they have been in use in this county from four to five years, to very great advantage; so much so, that even 25 per cent. increase in a crop has been produced. I am able to give full testimony of this to those who have used them; and my motive for this insertion is, that they may be more generally known.

NEW PRESS DRILL.



NAVIGATION BY STEAM.

Sir,—Great as the improvements have been in the construction of the steam-engine, it must be allowed that much difficulty, and a great inconvenience, arises in stowing away fuel sufficient to last during a long voyage, for the supply of the large fire required to heat the engine-boiler, and to furnish the necessary quantity of steam to work the machinery. I feel confident that this most important difficulty may be obviated, and beg to propose a plan by which, I conceive, a very small quantity of fuel may be made to answer every purpose required in the generation of a large quantity of steam.

Instead of heating the water in the large boiler, in the usual manner, by an immense fire underneath it, I would suggest that it should be heated partially or entirely, by means of steam admitted near the bottom of the liquid, through very small pipes from another smaller boiler, requiring only one-third, or less, of fuel; and, if necessary, I would have this small boiler again heated in the same manner, by steam-pipes from another boiler or kettle of still smaller dimensions. I have myself seen several tuns of liquid boiled by three small steam-pipes, of three-quarters of an inch in diameter, in the short space of one hour and 20 minutes, which before required, on the old plan, an enormous fire kept up for *nine* hours, to produce a boiling heat.

In the first experiment I saw tried, the pipes were of large dimensions; and as the steam in consequence passed slowly through them, a great part of it became condensed previous to its passage into the liquid, and a longer period was required to produce a boiling heat; but with very small pipes, the same quantity of steam was propelled with great rapidity and force into the liquid to be boiled, and the success of the experiment was most complete.

I have only further to add, that I conceive the flue from the fire under the small boiler might pass under the larger boiler, so as to give additional heat to the latter; and that the small steam-pipes in the experiment above stated, were in the shape of syphons, passing from one vessel to the other.

You will oblige me by making this communication public, through the medium of your Magazine.

I am, Sir,

Your very obedient servant,

W. H. B.

MOVING THE GLOBE.

Sir,—"Give me a fixed point, and I will move the earth!" was the bold and somewhat presumptuous expression of Archimedes, the mathematician of Syracuse, to Hiero, the King of Sicily; and, admitting the possibility of the fact, your Correspondent, T.M.B., has proposed the question—How long a time would be required to effect this, through the space of a single inch? I will endeavour to gratify him with an answer, premising, at the same time, that in the calculation, which of course must be a very unwieldly and intricate one, I shall make free with the fractions both of miles and of centuries, and shall assume the instrument required to effect this motion, and which I shall suppose to be a lever of the first order, to be perfectly free from friction, gravity, and to be in perfect equilibrium.

What we have in the first place to do is, the gigantic process of ascertaining the solidity and weight of the earth.

Assuming, for the sake of easier calculation, that the earth is a perfect sphere, of the diameter of 8000 miles, its solid content will be found to be, in miles, 268083200000; in yards, 1471540555763200000000; and to contain 39731595005606400000000 cubic feet; and as a cubic foot of earth may, on a low estimate, be supposed to weigh about 300 lbs., we shall have 11919478501681920000000000 lbs., for the whole weight of the earth.

Now, it is a known and universal principle of mechanics, that the velocity of the moving power is to the velocity of the power to be moved, in the inverse ratio of those powers; or, in other words, what you gain in weight you lose in swiftness. Suppose, then, the globe of the earth to be suspended by one of those golden chains so beautifully described by Homer,* to one end of a perfectly straight and inflexible lever, and to be counterbalanced at the other end by a weight of 30 lbs., it will be found, on the authority of Adams' Lectures on Natural Philosophy, that the powers of a man can move that weight with a velocity of about 10000 feet in an hour; applying this, by some combination of pullies and wheels, to our lever, we shall find that, to raise the earth one inch, our moving power of 30 lbs. must pass through a space of 3310936250467200000 feet, which, at the rate of 10000 feet in an hour, will give us the same number, diminished by four cyphers, for the number of hours required for such a motion. But the number of working hours in a year, at the rate of ten hours per day, and omitting Sundays, is 3120, and those in a century will be 312000; therefore, if we divide the space expressed by the last-named number by 312000, we shall find that 1611975161755, or more than one billion and a half of centuries will be required, on the most favourable supposition, to move the earth one inch!

Perhaps some of your readers may wish to know the length of the lever required for this experiment: I have attempted to calculate it. Supposing the lever to be in inches, and the fulcrum to be 30 inches from the point of suspension—and I really feel afraid to lay before your readers the result—it appears to be inconceivably longer than the distance of the planet Herschell from the sun, and almost to vie with the distance of the nearest fixed star.

A paper like this, entirely designed to instruct and amuse your readers, can hardly be expected to become serious in the conclusion: but it is scarcely possible to contemplate the result of this calculation without being elevated with sentiments of high astonishment at the amazing power of the Creator! Truly may he be said to hang the earth upon nothing; for this vast fabric (with "all its load, rocks, waters, woods,"*) is whirled thro' the regions of space, and that with most perfect regularity of adjustment, with the almost inconceivable velocity of more than sixteen miles in every second of time!

I am, Sir,
Your obedient servant,
CHARLES ISHERWOOD.

Brotherton.

NAVAL ARCHITECTURE.

SIR,—On reading an article by T. W., on Naval Architecture, in your 126th Number, I could not but observe the variety of ideas, concerning the qualities of national ships, entertained by the writer, and which, I believe, are very general among some particular classes; as mine are somewhat different, should you think them worthy an insertion, they are at your service.

As I entered the navy only in 1801, I make no pretensions to age; my observations, however different from those of T. W., may induce further investigation, at least I hope so; I shall, therefore, be as concise as possible. It was in the last generation a commonly received opinion, that the French ships sailed better than ours; but as people attended more to facts than opinions, it was usually observed that, in chasing, ours excelled them in speed before they captured them, of which a few score instances might be adduced, and those French ships in our navy are not remarked as superior sailers in general—I say in general, for exceptions must be expected with their vessels, as with those of all other nations.

* "I fix the chain to great Olympus' height,
And the vast world hangs trembling in my sight!"
Iliad, 8th Book.

* Milton—Paradise Lost, 6th Book.

La Juste, a 74-gun ship in our service, was a prime sailer, but that good quality was counterbalanced by her almost water-logged condition; the pumps were obliged to be going almost constantly, for if let alone twelve hours, her magazine would have been under water. I have sailed with many French ships in our fleets, and I never remarked the excellence of this quality as peculiarly belonging to them, and our fleets, in chasing, have, like single ships, generally overtaken the enemy.

It is an opinion among some now, that the ships of the United States of America are superior to ours in model and workmanship; I cannot yield to this idea more than the former. When Commodore Truxton was cruizing before Algiers, about twenty-five years ago, in the President, I sailed in company with that vessel, but we remarked no very superior qualities in her, except her magnitude as a frigate. I also sailed in company with the Essex, on her return to the United States, in 1802, for some days, but a two-decker of ours beat her. I acknowledge that Admiral Sawyer's squadron chased that of the United States, and on coming up, both were becalmed: the chased* here had an advantage over the chasers, using a novel kind of exertion to escape, by carrying out a-head a contrivance somewhat like an umbrella, made chiefly of strong canvass; then warping to it, then carrying it out again, and repeating the process, also at the same time towing as much as possible by boats. None of the chasers could do this, as the stern guns of the enemy could operate against our tow-boats; but, from the nature of the case, our guns could do nothing with their tow-boats. Even with such advantage on their side, it was doubtful whether they would have escaped at all, till a breeze arose, which took them long before we could catch it, and so they finally got away; but not, I conclude, by their superior sailing altogether.

When Commodore Rogers, in the President, was chased into New York, the English ship gained on him considerably; but the fog coming on, our ship thinking he had altered his course, did so accordingly in the pursuit, but when the fog cleared up, it was found that the English vessel had a mistaken object a-head, for the President had kept a direct course during the fog. I do not think, from this, that the Yankee ship was entitled to any praise for superiority of sailing. I do not recollect any Yankee vessel chasing one of ours, of equal size, and coming up with her; but this I know, that the Macedonian frigate, now in their service, is esteemed a prime sailer, and the Yankees are very proud of her good qualities, as superior, in general, to any of their other vessels. When we captured the President, I never heard any thing more of her good sailing qualities till now, by T. W. From the two last observations, I think a little prejudice interferes, in some trifling degree. The Essex was overtaken in a very short time and distance, although she made every effort to escape; and on being come up with, made a last attempt in crowding too much sail; but even that was in vain, for a top-mast was sprung by so doing.

The Plantagenent was a seventy-four cut down—an experiment to match in size, instantaneously, the large class of United States' frigates; but the fact itself shows the case which T. W. complains of, viz. that the timbers must be too large for the size it was then reduced to; for every one must know, that if a three or two-decker should be cut down to a one-decker, that is, a frigate by immediate requisition, the timbers of such frigate would not be the same size as those of the same sized frigate purposely built as such: thus, by T. W.'s own rule, of being over-timbered, is not to be wondered at. This temporary experiment, however, had its advantages, though not perhaps all that were expected by

* The "chace" would be a more nautical expression, but I use this for the generality of your readers, as being by them more easily understood.

every one at that time, consequently razees are not common now. Nor can I see that the United States' navy is more effective than ours in durability of timber, for, by their own accounts, the dry rot made havoc with them, as with us. The Java, built about 1812 or 1813, had the dry rot, and was pronounced decaying in 1816. In others, much salt was put within the planking, as an experiment, to avoid that evil. I do not know whether the Java was built of live oak (*quercus sempervivens*), or not.

I think it would be invidious to select any one good sailing vessel as a specimen of the superiority of that nation over all others as to ship-building; we could do the same to all, especially in frigates and smaller vessels. I could name the Portuguese sloop of war which conveyed the Ambassador to Plymouth, and from thence proceeded to Havre-de-Grace, in the year 1813, at the rate of about fourteen miles an hour betwixt these two places, whose distance was certain; but for this I should not pronounce the Portuguese as the best ship-building nation in the world, for every nation could single out one. I speak generally, but shall only add one fact which I think rather curious, and shows the respective knowledge of the *theory* of ship-building of England and the United States, and offers, I think, a just comparison, it is this:—In 1812 the Yankees found that swift-sailing ships of war, to capture and immediately destroy only the English merchant ships, would "*strike at the vitals*," as they termed it, of English commerce, for to carry them into their blockaded ports was entirely out of the question. For this reason, the utmost skill and science were sought for which the United States' nation could afford in ship-building. A fine sloop of war, *i. e.* a small frigate, as the landsmen would term it, was ordered to be built for this particular purpose; nothing was to be spared in materials or equipment; the best of every thing was procured —judgment, science, and knowledge; it was to be the completest model of naval architecture in existence, and woe to England, and English commerce, after this went to sea. She was completed with all speed; and while lying at Boston, all the amateurs of naval architecture went to see "the completest thing of the kind ever built;" she was more than praised by all—puffed and lauded as an inimitable production, the world's wonder, beautiful as useful; the Yankees spoke of her as if she was to outsail the wind. The command was given to Captain Bainbridge, nephew of Commodore Bainbridge, who had captured a British vessel; prime officers and men were selected for the occasion. After lying in state, as a curiosity in science, for the inspection of the curious in naval architecture, great was the crowd to behold this paragon of skill go to sea;—off she went, with the full expectations of the Yankees, to humble Old England, and, at the same time, to astonish its inhabitants by the wondrous effect of Yankee displeasure, and to exhibit a specimen of their superior talents in the art of ship-building, compared to decaying Old England. But the British frigate Orpheus was cruizing in the vicinity, and getting sight of the Yankee, gave chace immediately—this was, I think, the second or third day after the Yankee had left port. Finding the Orpheus was too dangerous a companion to be pleasantly near, the Yankee commenced her specified announced privilege, of running from every thing she did not choose (*i. e.* could not) capture; or, in other words, showing her boasted infallibility. Both vessels now put their sailing qualities to the test—the Yankee made every exertion to escape, the Orpheus every exertion to overtake. The Orpheus approached so rapidly, that the Yankee hove overboard two guns, to aid her velocity; but the Orpheus still approaching, two more were thrown over; yet all in vain, for the Orpheus in a very short time came within range of gun-shot, when the Yankee struck her colours without firing one of her remaining guns.

and thus terminated the short history of this Yankee prodigy. I was near the place at the time, and had all the newspapers from Boston and its vicinity, and was highly entertained with the puffs of this wonder while building. So ashamed were the Yankees of this, that in *their* history of the war, purporting to describe every capture from and by the enemy, this only was entirely omitted. I have stated this last case to show, that the theory and practice of ship-building by the United States is not superior to that of England, as many would have us believe, and that numerous readers are led away by *their* puffs, rather than absolute facts.

Being a lover of science, and also of truth, I hope your valuable publication will be the means of eliciting the actual state of every case discussed in it.

Remaining, Sir,
Your well-wisher,
S. TODDINGTON.

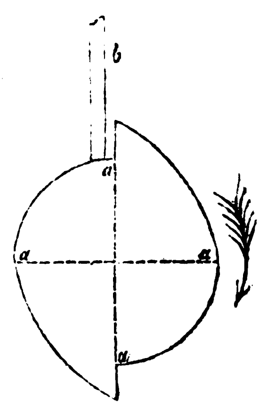
PERPETUAL MOTION.

SIR,—Permit me to ask Mr. Bevan, who so ably combats the "phantom" Perpetual Motion, whether he thinks it would have been better for the science of mechanics that the idea had never been entertained? If not, whether he conceives that the period has now arrived for discarding it; the beneficial effects which it may have been capable of producing, having been all produced? or whether his view of the subject is only to the extent, that *more* good would be derived by an inquiry into, and communication of matters of fact, similar to those which he favoured us with in your last Number.

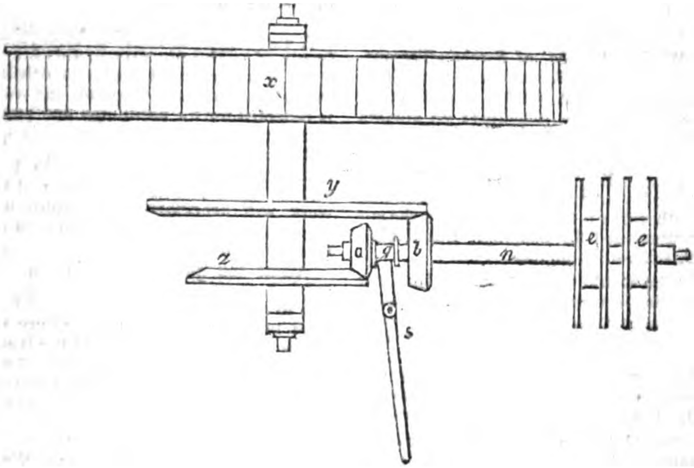
I am, Sir,
Your very obedient servant,
PHILO-MONTIS.

MACHINE FOR RAISING COALS, ORES, ETC.

I see in your Magazine, No. 133, a plan and description of an improved machine for raising coals, ores, &c. Having examined the ingenuity of it, for which I give your Correspondent (Mr. B. N.) great credit, I find that this improved machine is only capable of performing its work to a certain extent, so much so, that the pit or shaft cannot be sunk any further than the length of the longest arm of the crank wheel will allow, or that the size of the rope-barrel must be altered twice or thrice previous to the getting down to the depth required, which, I think, would be a very expensive job. Had the machine been constructed, so as to obviate any alteration in it, and to have allowed the pit or shaft to be sunk to any depth, without altering the machinery, then I think the machine would be a very valuable one, and might be put in practice with every certainty of success. The method of setting the water on and off the the wheel, might be put in practice without any doubts of its performing the work assigned to it; only I would advise, that the wheel with the two excentrics for raising the rod, *b*, be allowed to move round one-fourth of a revolution previous to the excentric taking place, as in the following sketch, which would allow the water-wheel to work with her full power a longer space of time.



I beg leave to hand you a plan of a Water-Machine, which obviates all the objections I have stated above, and I doubt not of its practicability (should you think it, and the above remarks, worthy of a corner in your valuable Magazine).



Explanation.

The water-wheel, *x*, moves in one direction, and carries on its axis two bevelled wheels, *y* and *z*, working into their respective pinions, *a* and *b*, and are kept constantly in gear, they being loose on the axis, *n*, which carries the rope-barrel, *e e*. The motion of the rope-barrel, *e e*, can be reversed, by the introduction of a sliding clutch, *g*, being placed betwixt the two pinions *a* and *b*. The lever, *s*, is represented laying hold of the clutch, *g*, working into the pinion *a*, which can be removed with great facility into the pinion *b*, to reverse the motion of the rope-barrel *e e*.

The pinions *a* and *b* move each with the same velocity.

I am, Sir,
A constant Subscriber,
Z. Y. X.

NEW PATENTS.

William Wood, of Summer Hill Grove, Northumberland, Gent.; for an apparatus for destroying the inflammable air (which is commonly known by the name of fire damps) in mines. Dated April 22, 1826.—Six months to enrol specification.

John Petty Gillespie, of Grosvenor-street, Newington, Surrey, Gent.; for a new spring, or combination of springs, for the purpose of forming an elastic resisting medium. Dated April 25, 1826.—Six months.

Samuel Brown, of Eagle Lodge, Old Brompton, Middlesex, Gent.; for improvements on his former patent, dated Dec. 4, 1823, for an engine or instrument for effecting a vacuum, and thus producing powers by which water may be raised and machinery put in motion. Dated April 25, 1826.—Six months.

Francis Halliday, of Ham, Surrey, Esq.; for an apparatus or machine for preventing the inconvenience arising from smoke in chimneys, which he denominates a wind-guard. Dated April 25, 1826.—Six months.

John Williams, of the Commercial-road, ironmonger and ships' fire-hearth manufacturer; for improvements on ships' hearths, and apparatus for cooking by steam. Dated April 27, 1826.—Two months.

William Choice, of Strahan Terrace, auctioneer, and Robert Gibson, of White Conduit Terrace, builder, Islington; for improvements in machinery for making bricks. Dated April 27, 1826.—Two months.

Charles Kennedy, of Virginia Terrace, Great Dover-road, Surrey, surgeon and apothecary; for improvements in the apparatus used for cupping. Dated April 29, 1826.—Six months.

John Goulding, of America, but now residing in Cornhill, London, engineer; for improvements in the machines used for carding, stubbing, slivering, roving, or spinning wool, cotton, waste silk, short stapled hemp and flax, or any other fibrous materials or mixture thereof. Dated May 2, 1826.—Six months.

Arnold Buffum, late of Massachusetts, America, but now residing in Jewin-street, London, hat-manufacturer, and John M'Curdy, of Cecil-street, Strand, Esq.; for improvements in steam-engines. Dated May 6, 1826.—Six months.

Sir Robert Seppings, of Somerset-House, London; for improvements in the construction of fids or apparatus for striking top-masts and top-gallant-masts in ships. Dated May 6, 1826.—Six months.

William Fenner, of Bushell-rents, Wapping, carpenter; for an improvement in machinery or apparatus for curing smoky and cleansing foul chimneys. Dated May 6, 1286.—Six months.

Alexander Allard de la Court, of Great Winchester-street, London, Esq.; for a new instrument, and improvements in certain well-known instruments, applicable to the organ of sight. Dated May 6, 1826.—Six months.

Joseph Schaller, of Regent-street, ladies' shoemaker; for improvements in the construction or manufacture of clogs, pattens, or substitutes for the same. Dated May 6, 1826.—Six months.

Edward Heard, of St. Leonard, Shoreditch, chemist; for a certain new composition or compositions, to be used for the purpose of washing in sea and other water. Dated May 8, 1826.—Six months.

Levy Zachariah, jun. of Portsea, pawnbroker; for a combination of materials to be used as fuel. Dated May 8, 1826. —Six months.

NOTICE

TO OUR

READERS AND CORRESPONDENTS.

A question of law having been raised in regard to the property in this Magazine, KNIGHT and LACEY, its original Publishers, to whose exertions the work is indebted for its usefulness and popularity, were obliged to suspend its appearance for two weeks; but, under legal advice, they are now enabled to publish the Numbers in arrear, and the work will henceforward be continued with various improvements, and with renewed vigour.

About the question in dispute the public have no interest; but it is important to state, that arrangements have been made to sustain and restore the credit of the Publication; and the Numbers now in preparation will exhibit numerous improvements and discoveries, which will command the approbation of every original subscriber to the work.

All KNIGHT and LACEY'S Agents, in town and country, will supply the Numbers as usual, at Three-pence each; and their liberal attention to the interests of the work is earnestly and anxiously solicited.

The complete Monthly Part will be ready, as usual, on the last day of the month, at One Shilling, including the Weekly Numbers of the month.

Our Subscribers will please to observe, that the spurious Copies of Numbers 146 and 147, published in another quarter, must be cancelled, and, in order to have the work perfect, must be replaced by the edition of those Numbers, which will be ready for delivery in a few days, at 55, Paternoster-row.

Part XXXVII., price One Shilling, will be ready for delivery to the Trade on Friday, June 30th.

THE SUPPLEMENT TO THE FIFTH VOLUME, *containing the Title, Preface, and a copious Index to the Volume, together with a Portrait and Memoir of the celebrated* WILLIAM EMERSON, *will be ready for the Magazine parcels.*

Volume V. complete, in boards, in the course of the following week.

Communications (post paid) to be addressed to the Editor, at the Publishers', KNIGHT and LACEY, 55, Paternoster-row, London,

Printed by *Mills, Jowett,* and *Mills* (late *Bensley*), Bolt-court, Fleet-street.

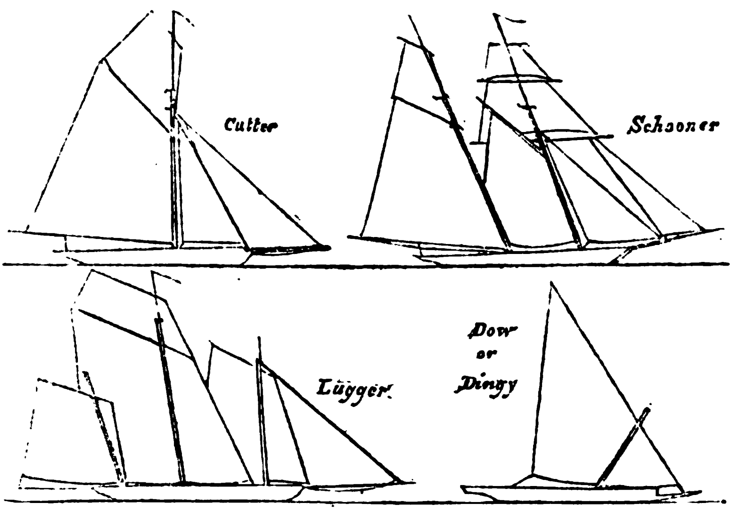
Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

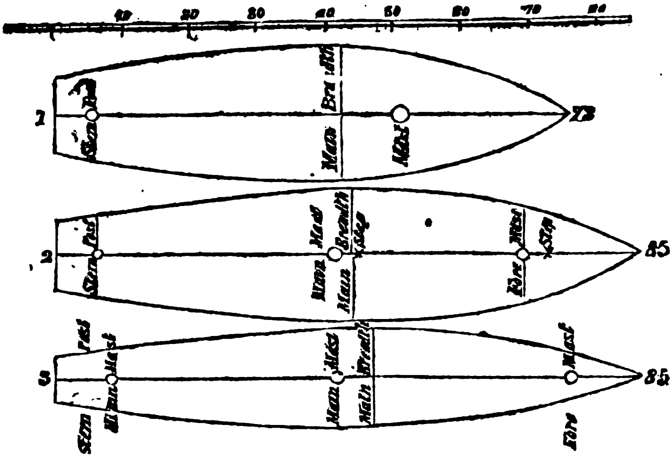
No. 149.] SATURDAY, JULY 1, 1826. [Price 3d.

"In the career of discovery, many consider as impossible whatever has not yet been executed. 'No man ever attempted such a thing,' says a pusillanimous mind. This observation, which is an insurmountable obstacle to the timid and the shallow, is an encouragement and a pledge of success to the man of superior genius, patience, and courage."

NAVAL ARCHITECTURE.



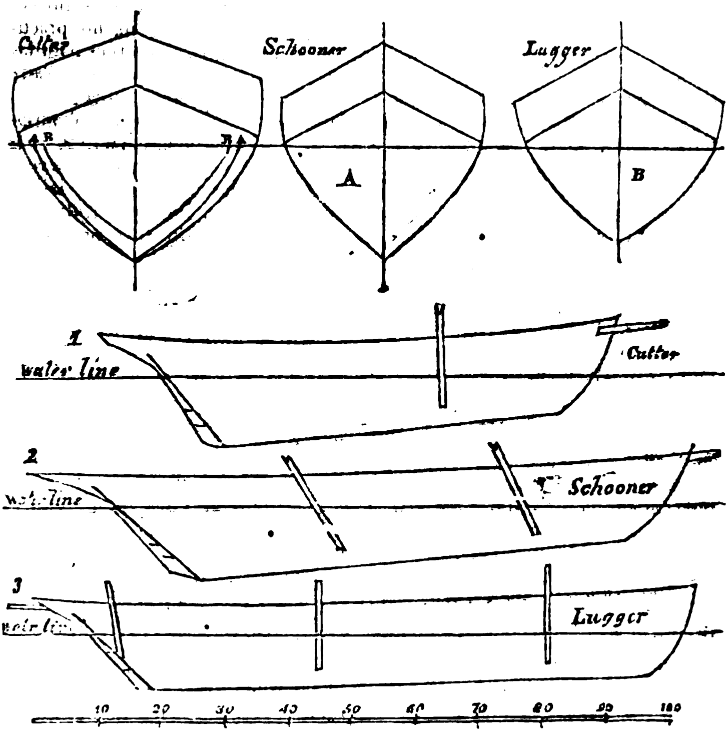
Sir,—I before took occasion to offer you such observations as I felt might, in some degree, tend to the improvement of naval architecture, and at the same time to give such representations as I thought might render those observations more clear, in the hope that some one more competent to the task would be induced to aid me in my suggestions or point out my errors; and I cannot refrain from again expressing my regret that Mr. Meson should have discontinued his valuable publication. I, however, observe in your publication, Part xxxiii. page 277, an article under the signature of Spectator, wholly condemning my humble observations, without pointing out any principle beyond that of reference to a Gravesend or Sheerness passage-boat, or a river fishing-smack, and setting it down as certain that Mr. Meson and myself are one and the same person, or, at farthest, College mates. It so happens, unless through your useful publication, I never heard Mr. Meson's name, either as a naval architect, or in any way connected with naval affairs; and as to Mr. Spectator's further conclusion, of my being no practitioner, it is equally correct with his others, having been at sea nearly forty years, during which time I commanded almost every description of vessel calculated for fast-sailing, viz. cutters, luggers, schooners, brigs, and ships from 420 to near 1000 tons, and some of them being the most renowned sailers.



I think I may be permitted to tell Mr. Spectator that he is still further mistaken with regard to the description of vessel he so much extols as perfection. I presume he alludes to either the Earl Spencer, a Gravesend boat, or the Joliapis, a Chatham one, which, no doubt, of their class, are the best for the navigation of the Thames or Medway; but, if placed in competition with our Hastings cutter, a modern yacht, or a Western pilot-boat, they would speedily be distanced at sea, under any circumstances of wind or weather. Mr. Spectator also should be reminded, that Dover is more distinguished for large lug-sail boats than cutters.

I have not the least doubt but that the builders to whom he alludes are men of science; but valuable as such attainments unquestionably are, they are, without practice, much deficient of consummate knowledge. I hope, therefore, after saying thus much to Mr. Spectator, that he will be induced to favour us with some genuine specimen of his own ingenuity, without handing over to us the productions of others, as I conceive your columns should be more devoted to improvements than controversy.

It is generally admitted that great doubts exist as to what particular form of vessel is best calculated for fast-sailing, at the same time possessing all the necessary requisites for evolution and safety as a sea-going vessel; I therefore consider, that great pains should be taken to set this question at rest. We almost all know that the good qualities of any vessel materially depend upon the management of those accustomed to it; but, for the sake of mere illustration, I annex



the exterior forms of three different descriptions of vessels, known for their fast sailing, viz. an English cutter, an American schooner, and either a French or an English lugger, nearly of the same tonnage, according to the present erroneous way of determining it, and leave them to the judgment of Mr. Spectator, or others, to decide which would be most likely to excel. This, under all the circumstances of their forms, length, breadth, depth, draught of water, &c., must occasion some doubt, and, I trust, produce an answer, after which I shall trouble you with my own opinion on the subject.

I remain, Sir,
Your obedient servant,
AN OBSERVER OF NAVAL IMPROVEMENT.

June 9th, 1826.

ON DRAINING OF LAND.

SIR,—As you have inserted in the Mechanics' Magazine an article on the subject of Draining Land, and as your Correspondent, C, has described the mode of effecting it in that part of the country wherein he resides, I trust that a description of the methods resorted to here, will be equally applicable to your pages.

Draining of land, like other good things, is liable to abuse; and land may be so drained as to render it almost worthless, though, if proper measures had been taken, it would have rendered it highly beneficial. Land-draining may be distinguished into two kinds: 1. Furrow, or surf-draining, which is usually performed upon clay-land with a solid subsoil; and 2, Bog-draining. In the first, or furrow-draining, the evil to be removed is wet furrows. Sometimes three or four feet of land is spoiled on each side of furrows from stagnant waters, either on or near the surface. The mode of operation in this case is, to strike out a main drain across the close, giving it as much fall as possible, to the best outlet that can be found. This main drain should be dug as near at right angles with the furrows as the nature of things will admit. It should be upwards of three feet deep, and contain an aperture sufficiently large to carry off the water that may fall into it from the several minor drains. The minor drains are made down such of the furrows that require to be drained, each being at the commencement a foot wide and a foot deep. A cut is afterwards made, about three inches wide and nine inches deep, with a tool made on purpose: this is called a *grip* or *chad*, and is filled with straw, thorn, stone, tile, &c.; a small quantity of stubble straw is then laid upon these materials, and the earth is filled in. Upon sward land, this furrow-draining is sometimes effected with turf alone. In this case, the drain is made a little deeper, and the turf being laid upside down upon the chad, it will endure for many years. This furrow or surface draining, I conceive, might be made a substistute for water-trenches. It would save the land occupied by such trenches, give to the field a much more cleanly appearance, and render the land less liable to be parched in summer.

In the second, or bog-draining, it will be necessary to consider the nature of the disease before we attempt the cure. A bog is a piece of land in which a quantity of stagnant water is mixed with the earth, whereby it is made to bring forth rushes, and other productions of little value. Bogs are in general found upon low grounds, by the side of a hill, or in their immediate neighbourhood.—Turnip-land, loose limestones, and, indeed, all loose sub-soils, are particularly adapted to imbibe the wet; as, under such soils, there is usually a stratum of rock, more or less. From these hills the water descends to a lower situation: if it flows freely, it is called a spring; but if it percolates through, and becomes mixed with the earth, it forms a bog. The origin of the spring, or bog, may be at a considerable distance, as will appear evident from the following:—A gentleman in this neighbourhood had a pond dug upon a clay land, but when it was finished, the water found an aperture through the bottom, and sunk into the earth with a rattling noise, either into the interstices of a rock, or other loose materials. Though the water was very considerable, especially after heavy rains, or a great fall of snow, there was neither spring nor bog near the place; there was, however, a great way off, a very fine spring, where the water was no doubt discharged.

The usual way of draining a bog, is to make an opening round the upper part, to intercept the water as it descends from the higher grounds, and prevent its percolating the land to be restored. This opening, or drain, is frequently made in the shape of either of the letters C, T, and L; but the shape, of course, varies with the circumstances. I have seen drains of this description from three to twenty feet in depth. The drain should be dug until a solid clay bottom is obtained; as, otherwise, there will be danger of the water penetrating the earth, and forming a bog in a still lower situation. Bogs are frequently caused by the underground passage of the waters from the higher lands being intercepted by a vertical stratum of clay: this stratum causes the waters to assemble and overflow, as water overflows a dam. A circumstance of this kind occurred to a man residing in the vicinity of this neighbourhood. He made a half-moon drain above the bog to be cured, but it had not the desired effect. He then cut a drain through it, but his efforts were ineffectual; at last, he saw that the water issued from below; and having bored to a considerable depth, the cure was effected.

The materials used by us, straw, thorn, stone, tile, &c., have been already mentioned, and the application of the two first to the grip or chad in furrow-draining has been fully described; it, therefore, only remains for me to point out the mode of applying the stones and tiles. The stone used is of two kinds, rubble-stone and rock-stone. The rubble-stone is gathered off turnip lands, &c., and thrown into the chad, for furrow-draining, which should be at least six inches wide, and eight or nine inches deep. The chad being thus filled, is covered with a layer of straw, and the ground filled in. It is also sometimes used for bog-draining; but, in this case, the drain rarely exceeds three feet in depth. Rock-stones are at times walled and covered in the manner described by C.; but far more frequently are set slanting, about a foot up, against each bank, and have others filled in between them, as hollow as possible. These are covered with a layer of straw, and finally by the earth. However beneficial the several materials above-mentioned may have been, they have, within the last twenty years, been almost superseded by draining-tiles. Draining-tiles should be well burnt, and ring well when struck by the knuckles. Of these, there are three sizes—the large, the medium, and the small; each being one foot long, and of the shape of a horse-shoe. The width of the small size is about 2½ inches, the medium four inches, and the large six inches. The superiority of these tiles arises, first, from the expedition with which they may be laid (an experienced drainer being able to lay a mile in a day); secondly, from the drains not being so liable to spoil, or be choked by moles and rats; and thirdly, from their exceeding durability. An old drainer told me but a few days since, that he has often laid a thousand within the hour, which is equal to fifteen chains of work.

I am, Sir,

Your humble servant,

R— S—.

Kettering, Northamptonshire,
June 3, 1826.

CERTAIN PROCESSES IN THE ARTS.

We have much pleasure in presenting to our readers the two following articles, communicated by a gentleman in Glasgow to the Editor of the American Journal of Science and Art.

Singeing of Cotton Stuffs by the Gas Flame.

The manufactories here are generally closed against strangers, but I have obtained access to two of them, which are highly interesting. I believe the process of singeing muslins by means of the gas flame, has been described in our publications. Within a year past, it has been brought to a great degree of perfection here. The process by which these fine textures were passed over red-hot cylinders uninjured, was sufficiently astonishing; but one is ready to doubt the evidence of the senses, when he sees a web, which is so delicate as to be transparent, subjected to the direct operation of flame, two or three times in succession, and with no change but an improvement in beauty.

The machine on which the operation is performed, consists of an upright frame, sustaining two large rollers, one on each side at the bottom, and two pairs of rollers, like those of a rolling-mill, immediately above these, at the top. Between the upper rollers the gas-pipe passes the whole length of the frame, thickly set with openings, serving as burners, so that there appear to be from 50 to 100, in the space equivalent to the breadth of the cloth. In performing the operation, the muslin is placed upon the lower roller, on one side. The web is then passed between the pair above, which serve to keep it smooth, and prevent irregularity of motion over the gas burners to the opposite pair of rollers, and is attached to the lower roller on the opposite side. It is then drawn over the flame by the motion of the roller, originating in a steam-engine, and communicated by drums and bands in the usual manner. It was not found sufficient merely to pass the muslin over the flame, and therefore another contrivance was added, of great ingenuity, which renders the operation more surprising. A pipe passes above the cloth in the same direction as the gas pipe, with longitudinal slits and openings to a main pipe above, corresponding nearly to the gas-burners. This is connected with the receiver of a large air-pump, which is kept in motion by the steam-engine. A partial vacuum is thus maintained at the openings of these tubes, and the flame from the gas-burners is drawn forcibly upwards, so that it passes directly through the meshes of the muslin, and is seen as distinctly above the web as below. This contrivance also serves to carry off the smoke produced by the burning fibres of the cotton, which was formerly very disagreeable and even distressing. The finest muslins are passed through this machine twice, one for each side, and the coarser four times. They rarely take fire, although the motion is by no means rapid, and the improvement in the smoothness and texture is obvious to the most inexperienced eye. In passing over the flame, it is sustained by bands of fine twine, at the distance of an inch from each other; and it is surprising to observe, that after passing for months in succession over the flame, they experience no change but the accumulation of tar from the gas.

Bleaching Powder, Sulphuric Acid, Alkalies, &c.

I was much interested in the manufactory of Mr. Charles Tennant, near this town, whose personal liberality and intelligence are not less gratifying, than the results of his ingenuity. The original object was the manufacture of the bleaching-powder, now so extensively used; but he has combined several others with it, in a manner which materially contributes to the success and profit of the whole. The buildings of the establishment cover a space of five or six acres. One large section is devoted to the manufacture of sulphuric acid. The nitre, instead of being combined with the sulphur in this operation, is placed in a separate portion of the furnace, and its gas is evolved by the heat of the burning sulphur. There are thirty furnaces, and an equal number of leaden chambers, seventy feet in length, twenty in breadth, and sixteen in height, for the condensation of the acid, which appear as if they were competent for lodging the inhabitants of a village. A large part of this acid is employed in the production of chlorine, for the use of the manufactory, and is therefore condensed only to the degree necessary for this process. The remainder is rectified by distillation in platina retorts. There are nine of these vessels, holding 50 gallons each, and weighing 500 or 600 ounces. Their value cannot be estimated at less than 2500*l.* each, or 22,500*l.* for the whole, and yet it is believed to be more economical than to employ the perishable vessels of lead. Mr. Tennant informed me, that they appear to suffer no diminution or decay, but are liable to bend and break, from the intensity and continuance of the heat. The whole produce of sulphuric acid is about 12,000 gallons weekly.

The next process in order is the formation of the chlorate of lime. There are 15 or 20 leaden retorts for the evolution of the chlorine, about five feet in diameter, and weighing nearly three tons each. They are heated by steam, and the usual materials are employed for the production of the gas. Within two years, the inconvenient apparatus formerly employed for the impregnation of the lime, has been greatly improved by the ingenuity of Mr. Tennant. The gas from the retorts is passed into six chambers of hewn stone, about 30 feet long, 20 wide, and six high, which are covered with wood, and rendered impervious to the gas by a resinous varnish. The lime is placed in shallow boxes, at the bottom of these chambers. It is agitated during the process by iron rakes, inserted through a box filled with lime, which serves as a valve. The impregnation is generally completed in two days, when the supply is renewed by means of wooden doors, which are locked in. So accurately is every part of the apparatus fitted, that in the building containing these immense volumes of imprisoned gas, there was no disagreeable vapour, and the gas was not so perceptible as it usually is in a laboratory, where a small quantity is forming for mere experiment. The powder, when completely formed, even in large quantities, has no perceptible odour, and thus shows the accurate manner in which the process is conducted.

The remainder of the establishment is employed in turning the residue of these processes to account. The sulphate of soda and potash are converted into the alkaline state by two successive burnings, in union with bituminous coal, and three lixiviations and evaporations. About eighteen tons of subcarbonate of soda, in its purified state, are produced weekly. By two successive crystallizations, it is formed into large rhomboidal, tabular crystals, and surpasses in beauty any specimens of the article I have ever seen produced in the large way. A part of the alkali is taken at an intermediate state, and employed in the last section of the manufactory, in the making of soap. It furnishes the chief supply of this article for this city and the surrounding country. Some idea may be formed of the extent of this establishment, from the fact, that it requires a daily supply of 60 tons of coal and twenty tons of lime; and the completeness of the parts is quite as surprising as the magnitude of the whole. It is only doing justice to the proprietor to state, that it is the result of individual enterprise and ingenuity, operating at first on a small scale.

ON FIGURES.

SIR,—If some of your learned Correspondents would undertake to write a series of papers, explaining the science of Figures, in a plain and familiar style, as free from technicals as possible, it would be a most valuable and acceptable piece of information to a numerous class of your readers. Seven-eighths of the operative mechanics have never been farther in figures than from Multiplication to the Rule of Three; one half of the remaining eighth farther than fractions, and the remainder, with very few exceptions, farther than the end of Walkingame's School Arithmetic. Such being the case, the utility of devoting a page weekly to the above purpose, is strikingly obvious. To what purpose is it, Mr. Editor, of writing instructions in Greek, when the person who is to be instructed is ignorant of Greek? And to what use is the working algebraically a problem, when the person who is to be profited by its solution is ignorant of algebra? The object of every author should be to make himself thoroughly understood by those to whom he is writing; but without the characters he writes in be understood by those persons, his object is defeated, and his writing is unprofitable and useless.

I am, Sir,

Yours respectfully,

PHILO-TWIST'EM.

Chatham.

HANCOCK'S INVENTION FOR COOLING BOILING WORTS IN BREWING.

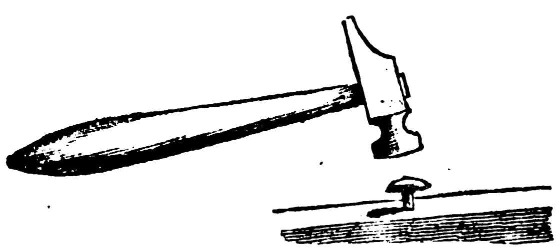
Wiveliscombe, Somersetshire, June 7, 1826.—Therm. 68°.

SIR,—Through your extensively circulated Publication I would wish to communicate to your correspondents, and the public, an invention of a Mr. Hancock, a very ingenious and intelligent man, who has paid great attention to the art of Brewing, and the mode by which its various processes may be condensed and facilitated. I visited Mr. Hancock's brewery this morning, and witnessed an experiment which, to me, appears of vast importance to the science of brewing. It is agreed by all parties, that those who are engaged in extensive concerns of this description find a considerable difficulty in reducing the temperature of their worts to the point necessary for a perfect fermentation; but Mr. Hancock completely obviates these difficulties by the following process:—A leaden pipe, three-quarters of an inch calibre, is encased in another leaden pipe of about double its diameter, and is inserted into the copper or other vessel containing the boiling liquor. These two pipes are coiled around the walls of the building, to preserve a plane of inclination, which will allow the wort or liquor in the minor pipe to escape, at the rate of two hogsheads per hour, and is let off by a stop-cock, whilst the space between the outer and inner pipe is filled with cold water, which passes rapidly through it, and carries off the caloric of the boiling wort or liquor, whose temperature is reduced two degrees below the measure of the atmosphere; thus effecting a diminution of temperature from 212° of Fahrenheit's thermometer to 66°, and cooling at the rate of fourteen hogsheads in seven hours, which could not be effected in double that time by the usual process. We have here an apparatus bold, decisive, and simple, requiring no care, trifling labour, and not likely to be out of repair; and, what is of more consequence, of the cheapest materials. I have been informed that some one has claimed a patent for a very complex machine, designed to cool boiling worts; but the simplicity of Hancock's apparatus must supersede all others liable to have their parts discomposed in the working. Mr. Hancock, who is most liberal in communicating his improvements to the public, will feel obliged by any of your Correspondents communicating their sentiments to him through the medium of your excellent publication.

I have the honour to be, Sir,
Your obedient servant,
HENRY SULLY, M.D.

INSTRUMENT FOR DRIVING NAILS, BOLTS, ETC. INTO TIMBER.

(To the Editor of the Mechanics' Magazine.)



SIR,—The last Number of your excellent Magazine contains a sketch of a crow-bar for drawing nails, bolts, &c. out of timber; the above is a sketch of an Instrument for *driving* nails, bolts, &c. *into* timber. Like the crow-bar, its construction is so very simple, that any explanation would be unnecessary; and having, like the crow-bar, been for ages past in general use, I presume it will be deemed equally deserving of a place in the Mechanics' Magazine.

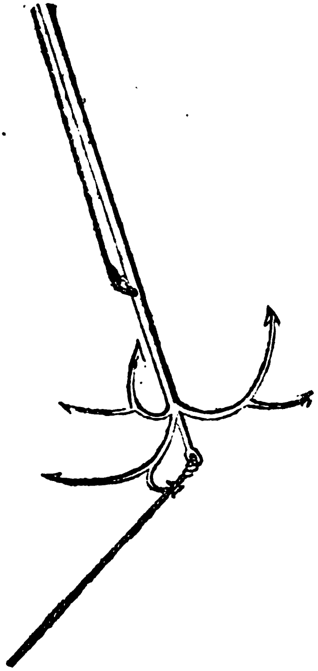
I am, Sir,
Your constant reader,
L. J. F.

June 5th, 1826.

DRAG.

(To the Editor of the Mechanics' Magazine.)

SIR,—I wish particularly to call the attention of your readers to the form of drag now in use, to endeavour to save persons from drowning, as I feel confident that some of them will be able to effect a considerable improvement in it.



The drag represented by the engraving is the invention of a Dr. Cogan, to whom the Society of Arts awarded their gold medal. It consists of three prongs, each divided into two at their extremities, and is furnished with six moveable hooks. The drag has a long pole attached to it, and a cord passes from it through a hole at the top; and there is another cord fastened to its other extremity, to draw it backward when required to be released from roots, weeds, or other obstacles. It is intended to be used in large ponds, or other pieces of water, where no boats are to be had; and even when they are at hand, it is considered greatly to facilitate the recovery of the body.

I remain, Sir,
Your obedient servant,
J— B—.

CHINESE TOWERS.

The Towers called by the Chinese *Taa*, and which the Europeans call Pagodas, are very common in China. In some provinces, says Du Halde, you find them in every town, and even in the largest villages. The most considerable of them all are the famous porcelain tower at Nang-King, and that of Tong-Tchang-Fou, both of which are very magnificent structures. The porcelain tower at Nang-King is, without doubt, the highest and finest in China. It is of an octagonal figure, each side being fifteen feet. It is two hundred feet high, and divided into nine stories, by simple floors within, and by cornices without, which sustain little roofs, covered with green tiles. The outside of the tower of Tong-Tchang-Fou is of porcelain, adorned with divers figures, and the inside is lined with marble, of different colours, and finely polished. By a staircase made in the wall, you ascend to the different stories, and from thence to very fine galleries of marble, adorned with gilt and iron rails, which embellish the projections wherewith the tower is surrounded. At the corners of these galleries hang little bells, which, when moved by the wind, make an agreeable tinkling. In regard to their form, the *Taas* are all nearly alike; being of an octagonal figure, and consisting of seven, eight, and sometimes ten stories, which grow gradually less, both in height and breadth, all the way from the bottom to the top. Each story is finished with a kind of cornice, that supports a roof, at the angles of which hang brass bells; and round each story runs a narrow gallery, inclosed by a rail or balustrade. These buildings commonly terminate in a long pole, surrounded with several circles of iron, hanging by eight chains fixed to the top of the pole, and to the angles of the covering of the last story.

ANCIENT VASES.

(*Continued from page* 118, *No.* 148.)

From an accurate examination it appears probable, that the thin pellucid coating, by which the colour of the clay is rendered brighter or duller, is of the same substance with the black paint of vases, but in a diluted or extenuated state, which was first shown by the celebrated Jorio, the very learned Inspector of the Royal Collection of Vases at Naples.* It may commonly be observed in vases, that this paint has been repeatedly applied, where the colour of the clay had not been completely modified by the first operation, and in this manner also the colour has been changed from dusky to black.† Sometimes single lines occur, in which different degrees of intensity may be observed in the colour.

We shall now inquire into the nature of this black paint. Caylus has ascribed the black varnish to the martial or manganesian earth of glass-works,‡ an opinion which Grivaud has also embraced.|| Le Sage once thought, that the black coating of vases was produced from oxide of lead and oxide of manganese,§ which opinion is not only sufficiently confuted by what I have said above, with regard to the nature of the varnish, but also by the slight degree of baking which the vases have undergone, by which the oxide of lead could not be applied, as Chaptal has also remarked.¶ Scheerer says, that the coating of vases does not consist of metallic substances, but of a certain kind of earth, and that the black colour cannot have been produced by oxide of manganese. Chaptal inclines to the opinion, that vitreous lava has formed the basis of the coating of vases, its natural fusion having been strongly assisted by the addition of some saline substances.** Vauquelin was the first who discovered that the black paint was carbonaceous, and he is at the same time of opinion, that it was prepared from graphite or anthracite.††

From experiments made with the view of investigating this matter, I too have found that the black coating of vases consists of a combustible substance, either carbonaceous or bituminous; with this determination, the abovementioned experiments also agree, inasmuch as it is not dissolved by acids. On throwing particles of the black coating into nitre fused in a platina cup, they burned by sparkling, and were quickly consumed. By this experiment, the singular phenomenon, that a coating so thin should have presented its colour and lustre for so long a period, is satisfactorily explained.

The question regarding the substance from which this black coating has been derived, is more difficult of solution. I cannot give my assent to the opinion of the celebrated Vauquelin, mentioned above. It is shown by the colour and lustre of the paint, that it could not have been prepared from graphite, a substance which has more of the colour of iron, and a metallic lustre. The quality which it possesses of fusing with nitre, as above related, is also against its derivation from graphite and anthracite. If we suppose the paint to have been laid on with a pencil, it may be inferred that its substance had been fluid of itself, or had been reduced to a state of fluidity by means of some other substance. As the appearance of the coating of vases proves its fusion, it may be concluded, that the matter was either fusible of itself, or had been rendered so by intermixture with some other substance. Nor does it seem improbable, that, in order to form this coating, a substance was applied, which either occurred in the different countries in which those vases were manufactured, or was easily procured by commerce.

I instituted various experiments, with the view of determining this substance, which entirely failed, because I followed the common opinion, that the black coating of the antique vases was laid on and burnt in, in the same way as the pigments are in the manufacture of our better sorts of earthen-ware. I applied various carbonaceous substances, vegetable as well as mineral, reduced to a sufficient degree of tenuity by levigation, either by themselves or by means of a fluid, or mixed with fusible substances, to vessels either dried in the air or baked, and these I exposed, after inclosing them in other vessels, to various degrees of heat in a pottery-furnace. These vessels so coated, came, without exception, from the furnace, with red, yellow, or white colours, according to the quality of the clay, and the different degrees of heat. I applied liquid bitumen in other experiments, but with no better success.

When I had almost despaired of accomplishing my object, it occurred to me,

* Sul. Met. d. Ant. nel Dipingere i Vasi, p. 5.

† Jorio, loc. cit. p. 10.

‡ Rec. d'Antiq. t. i. p. 87.

|| Esame di alcune pietre impiegate per fare vasellami. Brugnatelli Annali di Chimica, t. iii. p. 151.

§ Mem. de l'Inst. 1808, p. 335.

¶ Boettiger's Vasengemalde. Bo. ii. Heft. 2. p. 35, 36.

** Mem. de l'Inst. 1808, p. 234.

†† Millin., Peint. des Vases Ant. p. 7.

that perhaps the method which is used for covering iron-work with a black coating, might be equally applied to earthenware. The experiments in which I made use of mineral bitumen succeeded very well. I dissolved asphaltum in naphtha or mineral oil, and applied the solution, by means of a pencil, to earthen vessels once baked and again heated, by which a black coating like varnish, intimately attached to the surface of the vessels, and precisely similar in appearance to the black coating of the ancient Grecian vases, was immediately produced. The degree of heat at which the solution is to be applied, should be such as is sufficient for melting the asphaltum. I exposed the vessels, after the coating was laid on, for some time to heat, by which the naphtha is evaporated, and the varnish is completely dried. Liquid bitumen, applied in the same manner, gives a similar but less bright varnish. The solution of asphaltum by means of naphtha, is also preferable on this account, that very different degrees of saturation may be produced. A thin solution affords a transparent varnish, by which dusky colours are produced, passing more or less into red, according to the different colour of the clay. If the application of this solution be repeated, very different varieties of varnish may be produced, from a brown colour to a perfect black. If a saturated solution be applied, a dull black colour is produced at once.

In the same way that the surface of vessels is covered over with varnish, various figures are painted upon it by means of a pencil. The paintings may be made more perfect, in proportion to the degree of heating which the vessel undergoes; for the varnish enters in this manner the sooner into the pores of the clay, and loses its fluidity, on which account the delineations are more distinct. But the more the vessels are heated, the more quickly must the paintings be applied.

As it is only the outside that requires to be covered with vanish or paintings, vessels may easily be heated for this purpose, by filling them with burning charcoal or hot embers. But if vessels, having little depth, are to be painted within, they must be previously heated in a proper furnace, or among hot cinders.

(To be concluded in our next.)

HYDROSTATICS AND HYDRAULICS.

To the Editor of the Mechanics' Magazine.

Sir,—Herewith I send the commencement of a paper on Hydrostatics and Hydraulics, which, if you think it worthy a place in your Magazine, I propose continuing occasionally.

I am, Sir,
Yours respectfully,
J. M. N.

Hydrodynamics, from Ὕδωρ, "water," and Δυναμις, "power," is properly that science which treats of the power of water, whether it acts by pressure or by impulse. In its more enlarged acceptation, however, it treats of the pressure, equilibrium, cohesion, and motion of fluids, and of the machines by which water is raised, or in which that fluid is employed as the first mover. The science of Hydrodynamics is divided into two branches, *Hydrostatics* and *Hydraulics*. Hydrostatics comprehend the pressure, equilibrium, and cohesion of fluids; and Hydraulics, their motion, together with the machines in which they are chiefly concerned. Archimedes, Nero, Galileo. Torricelli, Pascal, Sir I. Newton, D'Alembert, &c. &c. are among the most celebrated of those who, by their discoveries, experiments, and writings, have contributed to the rise and progress of the science of Hydrodynamics. From the mention of the name of Archimedes, it will at once appear that the ancients were acquainted with some of the laws of this science, though they cultivated it less than any other branch of mechanical philosophy; and it was not till the time of Pascal, about the middle of the 17th century, that it was carried to any degree of perfection.

A better definition of hydrostatics, of which branch of hydrodynamics I first propose to treat, is as follows:—it is that branch of natural philosophy which comprehends the pressure and equilibrium of those fluids which are considered non-elastic, as water, oil, mercury, &c.—the method of determining the specific gravities of substances, the equilibrium of floating bodies, and the phenomena of capillary attraction.

A fluid is a collection of very small particles, cohering so little among themselves, that they yield to the smallest force, and are easily moved among one another. It was universally believed, till within the last sixty years, that water, mercury, and other fluids of a similar kind, could not be made to occupy a smaller space by any external force; and the Florentine experiment, in which a globe of gold was filled with water, and compressed till the water escaped through the pores of the metal, seemed to confirm this opinion. But later experiments prove that this is not the case, and it is now generally admitted that water and other fluids are compressible, though in a very small degree. Since, then, fluids are compressible, they must also be elastic; for when the compressing force is removed they will recover their former magnitude; and hence their division into elastic and non-elastic is equally improper.

The first law of hydrostatics which I shall mention, is, that the surface of a fluid, influenced by the force of gravity and in equilibrio in any vessel, is horizontal, or at right angles to the direction of gravity. But as the direction of gravity is in right lines, which meet near the centre of the earth; and since the surface of the fluid is, as we have just seen, perpendicular to that direction, their surface will be a portion of a spheroid similar to the earth. When the surface has no great extent, it may safely be considered as a plane, but when it is pretty large, as in the sea, the curvature of the earth must be taken into account.

The second law is somewhat similar to the foregoing, viz. that the surface of a fluid contained in any number of communicating vessels, however different in form or position, will be horizontal; but when the communicating vessels are so small that they may be regarded as capillary tubes, the surface of the fluid will not be horizontal. From the attraction which all fluids have for glass, they rise to a greater height in smaller tubes than in large ones, and the quantity of elevation is in the inverse ratio of the diameters of the bores. In the case of mercury, and probably of the other melted metals, the fluid substance is depressed in capillary tubes, and the depression is subject to the same law. But I shall speak of capillary attraction hereafter. This law explains the reason why the surface of small pools in the vicinity of rivers is always on the same level with the surface of the rivers themselves, when there is any subterraneous communication between the river and the pool. The river and the pool may be considered as communicating vessels.

(To be continued.)

UNIVERSITY OF LONDON.

The Plan of the University of London is now so much matured, that the Council chosen to superintend its affairs, deem themselves bound to lay an outline of it before the public, in order that the friends of public instruction may have a fuller opportunity of determining how far the Institution deserves the continuance of their support.

The number and names of the subscribers sufficiently evince the strong conviction of its utility which prevails in the class for whom the Institution is peculiarly destined, and who consult their own interest, as well as that of the public, in contributing towards its establishment.

The City of London is nearly equal in population, and far superior in wealth, to each of the kingdoms of Denmark, Saxony, Hanover, and Wirtemburgh, every one of which has at least one flourishing University. Supposing the annual rate of increase, in the last five years, to have been the same as in the preceding ten, the present population cannot be less than fourteen hundred thousand souls,* of whom there are about forty thousand males between the ages of sixteen and twenty-one, the usual period of academical education. Out of this number it appears to be probable, from the Parliamentary returns of the Property

* By the returns of 1821, the numbers were 1,274,000.

Tax in the latter years of its duration, that from four thousand to six thousand are the children of persons who can easily defray the very moderate expense of their attendance on Lectures in London. It may safely be affirmed, that there is no equal number of youths in any other place, of whom so large a portion feel the want of liberal education, are so well qualified for it, could so easily obtain all its advantages at home, and are so little able to go in quest of them elsewhere. No where else is knowledge more an object of desire, either as a source of gratification, a means of improvement, or an instrument of honest and useful ambition. The exclusion of so great a body of intelligent youth, designed for the most important occupations in society, from the higher means of liberal education, is a defect in our institutions, which, if it were not become familiar by its long prevalence, would offend every reasonable mind. In a word, London, which, for intelligence and wealth, as well as numbers, may fairly be deemed the first city in the civilized world, is at once the place which most needs an University, and the only great capital which has none.

The plan of the Institution will comprehend Public Lectures, with Examinations by the Professors; Mutual Instruction among the Pupils, and the aid of Tutors in those parts of knowledge which most require to be minutely and repeatedly impressed on the memory. It is intended, that the Professors shall derive their income at first principally, and, as soon as may be, entirely, from the fees paid by their pupils; they will hold their offices during good behaviour. Professors will doubtless be found of eminent ability, and of such established reputation, as to give authority and lustre to their instructions, so that the University will not be wanting in the means of exciting and guiding superior faculties in their ascent to excellence, as well as of speedily and easily imparting the needful measure of knowledge to all diligent students. The number of the Professors, the allotment of particular branches to individuals, and the order in which the Lectures ought to be attended, are matters not yet finally settled, and some of them must partly depend, in the first instance, on the qualifications of candidates; others will permanently be regulated by the demand for different sorts of instruction. Some Professorships may hereafter be consolidated; more are likely, in process of time, to be subdivided; many entirely new will doubtless be rendered necessary by the progress of discovery, and by the enlarged desire of the community for knowledge. The Course of Instruction will at present consist of Languages, Mathematics, Physics, the Mental and the Moral Sciences, together with the Law of England, History, and Political Economy; and the various branches of knowledge which are the objects of Medical Education. In the classification of these studies there is no intention to adhere strictly to a logical order, whether founded upon the subjects to which each relates, or on the faculties principally employed on it. Without entirely losing sight of these considerations, the main guide of the Council is the convenience of teaching, which for the present purpose is more important than a scientific arrangement; even if such an arrangement could be well made without a new nomenclature of the sciences, and a new distribution of their objects. A few preliminary observations will explain the grounds of the first choice of subjects for Lectures, and the reasons for assigning, in some instances, boundaries to the province of each Professor.

Some languages will probably be studied only by those whose peculiar destination requires such attainments; and in this department generally, it will be fit to seek for every method of abridging the labour by which the majority are to attain that proficiency to which they must confine themselves. But the structure of human speech is itself one of the worthiest objects of meditation: the comparison of various languages makes each of them better understood, and illustrates the affinity of nations, while it enlarges and strengthens the understanding; even the minute and seemingly unfruitful study of words is a school of discrimination and precision; and in the arts which employ language as their instrument, the contemplation of the original models, not only serves to form the taste of the youth of genius, but generally conduces to expand and elevate the human faculties.

The Mathematical Sciences are so justly valued as a discipline of the reasoning faculties, and as an unerring measure of human advancement, that the commendation of them might seem disrespectful to the public judgment, if they did not afford by far the most striking instance of the dependence of the most common and useful arts upon abstruse reasoning. The elementary propositions of geometry were once merely speculative; but those to whom their subserviency to the speed and safety of voyages, is now familiar, will be slow to disparage any truth for the want of present and palpable usefulness.

It is a matter of considerable difficulty to ascertain the distribution of Physics, a vast science, or rather class of sciences, which consists in the knowledge of the most general facts observed by the senses in the things without us. Some of these appearances are the subject of calculation, and must, in teaching, be blendid with the Mathematics; others are chiefly discovered and proved by experiment; one portion of physical observation relates to the movements of conspicuous masses, while another respects the reciprocal action of the imperceptible particles, or agents, which we know only by their results; a great part are founded on that uniformity of structure, and those important peculiarities of action, which characterize vegetable and animal life. The subjoined division of professorships in this province, though chiefly adapted to the practical purpose of instruction, is influenced by some regard to the above considerations.

As the Physical Sciences aim at ascertaining the most general facts observed by sense in the things which are the objects of thought, so the Mental Sciences seek to determine the most general facts relating to thought or feeling, which are made known to the being who thinks, by his own consciousness.

The sub-division of this part of knowledge would be very desirable, on account of its importance and intricacy; but the close connexion of all the facts with each other, renders it peculiarly difficult.

A separate Professorship of Logic is proposed, not only because it supplies the rules of argument, and the tests of sophistry, but still more for that mental regimen by which it slowly dispels prejudice, and strengthens habits of right judgment.

Perhaps, also, Rhetoric may in time merit a separate Professorship, of which one main object would be, to undeceive those rigid censurers, and misguided admirers, who consider eloquence as a gaudy pageant; and to imbue the minds of youth with the wholesome assurance, that when guided by morality, and subjected to logic, it is the art of rendering truth popular, and virtue delightful; of adding persuasion to conviction; and of engaging the whole man, the feelings as well as the understanding, on the side of true wisdom.

The object common to the Moral Sciences, is the determination of the rules which ought to direct the voluntary actions of men; and they have generally been subdivided into Ethics and Jurisprudence; though the important distinction between these sciences has seldom been accurately traced, still less steadily observed. The direct object of Ethics is the knowledge of those habitual dispositions of mind which we approve as moral, or disapprove as immoral, and from which beneficial or mischievous actions ordinarily flow. In an ethical point of view, actions are estimated good in proportion to the excellence of the state of mind from which they arise. The science of Ethics is co-extensive with the whole character and conduct of man; it contemplates the nature of virtues and duties; of those dispositions which are praiseworthy, and of that course of action which is incumbent on a reasonable being, apart from the consideration of the injunctions of law, and the authority of civil government.

The first object of Jurisprudence (taking that term in an enlarged sense), is the ascertainment of rights, or of those portions of power over persons or things which should be allotted to each individual for the general welfare. The second is to determine what violations of these rights are so injurious in their effects and consequences to society, as to require prevention by the fear of adequate punishment. It is the science which defines rights and crimes; it pre-supposes the authority of government, and is limited in its direct operation to the outward actions of men, as they affect each other. Ethics, though it has a wider scope, contemplates its objects more simply and generally. Jurisprudence, within its more limited sphere, considers its objects in more points of view; prescribes more exact rules, and is therefore compelled to make minute and even subtle distinctions. The confusion of these two branches of Moral Science has contributed to disturb the theory of Ethics, and to corrupt the practice of legislation.

The study of the Law of England has for centuries been confined to the Capital, where alone is a constant opportunity of observing its administration in Courts of Justice, and of acquiring skill in peculiar branches under private instructors. These exclusive advantages of London for the study of the law will be enhanced by combination with lectures and examinations, while systematic instruction in law, and in general knowledge, will be rendered accessible to those branches of the legal profession who are now shut out from them in common with the majority of the other youth of this capital.

The maxims which ought to be observed by independent communities towards each other, and of which the fitness is generally acknowledged by civilized states, together with the usages by which they profess to regulate their intercourse, constitute what is metaphorically called the Law of Nations.

Political Philosophy, which considers what are the rights and duties of rulers and subjects in relation to each other, naturally belongs to the province of Ethics.

In an arrangement which does not affect a rigid method, History and Political Economy may be classed either as parts or appendages of Moral Science. A minute knowledge of History cannot be communicated by lectures. But the outline of General History, directions to the student for historical reading, the subsidiary sciences of Geography and Chronology, together with some information respecting Numismatics and Diplomatics,* and the rules of Historical Criticism will furnish ample scope for one Professor.

The object of the science of Political Economy is to ascertain the laws which regulate the production, distribution, and consumption of wealth, or the outward things obtained by labour, and needed or desired by man. It is now too justly valued to require any other remark, than that the occasional difficulty of applying its principles, and the differences of opinion to which that difficulty has given rise, form new reasons for the diligent cultivation of a science which is so indispensable to the well being of communities, and of which, as it depends wholly on facts, all the perplexities must be finally removed by accurate observation and precise language.

For the studies which are necessary in all the branches of the Profession of Medicine, London possesses peculiar and inestimable advantages. It is in large towns only that Medical Schools can exist. The means of acquiring anatomical knowledge, medical experience, and surgical dexterity, must increase in

* The ascertainment of the age and authenticity of ancient manuscrips, chiefly of public documents, by their written character and other outward marks. The adoption of this technical term from the continental nations seems to be justified by convenience.

exact proportion to the greatness of the town.

At this moment the great majority of those who are called general practitioners, who take no degree, confine themselves to no single branch of the profession; but in whose hands the whole ordinary practice of England is placed, receive their systematic instruction from Lectures in London, during one or two years, while many of them are attending hospitals. The annual average of such students is about seven hundred. Many of the Lecturers have been, and are, men of very eminent ability; and the practitioners thus educated are, generally, most respectable for information and skill. It is no reflection on either body to affirm, that medical education would be improved if the teachers of most distinguished ability who are now scattered over London, were gradually attracted to one Institution, where they would be stimulated to the utmost exertion of their faculties, by closer rivalship, larger emolument, and wider reputation. To what cause but to the present dispersion of eminent teachers can it be ascribed, that the greatest city of the civilized world is not its first School of Medicine?

The young men who are intended for the scientific profession of a Civil Engineer, which has of late been raised so high by men of genius, and exercised with such signal advantage to the public, have almost as strong reasons as those who are destined for the practice of medicine, for desiring that a system of academical education should be accessible to them, where they can be best trained to skill and expertness under masters of the first eminence.

[In our next Number we shall present our readers with an Elevation and Plan of the proposed Building.]

(To be continued.)

NOTICES TO CORRESPONDENTS.

We regret that we should have to announce to C——, the complete failure of the scheme to which he has alluded. We ourselves did witness many of the experiments, and have long since anticipated this result.

The private communication of G. H. merits our approbation. It is unquestionably a subject of importance, and we shall, before long, submit it to our readers.

Communications have been received from—A Yorkshire Farmer—Colin—X.—Valedico Opifex—Indicator—T. C. C.—M. A. Corin—E. B. Palmer—J. S.—A. M. A.—Principia—X. Y. Z.—and Principia. The whole of which will appear in due course.

Our Subscribers are respectfully informed, that the SUPPLEMENT TO VOLUME V., containing the Title, Preface, and Index to the Volume, together with a Memoir and beautiful Portrait of Mr. EMERSON, is now ready, price Sixpence.

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Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 150.] SATURDAY, JULY 8, 1826. [Price 3d.

"We know, or may know, the first point from which each of us starts to arrive at an ordinary degree of intellect; but who can tell where is the other extremity? I am not aware that any philosopher has yet been bold enough to say—here is the limit which man may attain, but which he cannot pass. We know not what our nature admits of our being: none of us has measured the distance which may exist between one man and another. What soul is so base as never to have been warmed with this idea, and not sometimes to have exclaimed with pride:—How many have I already outstripped! How many may I yet overtake! Why should my equal surpass me?"

ROUSSEAU.

MAGNETISM OF IRON.

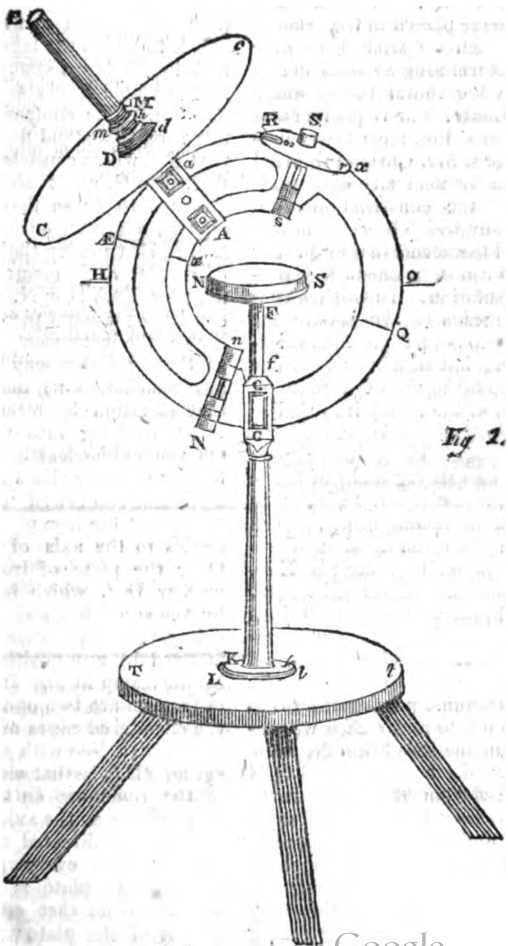


Fig. 1.

ON THE MAGNETISM OF IRON ARISING FROM ITS ROTATION.

For some time previously to his observation and investigation of the phenomena detailed in this communication, Mr. Christie had been engaged in making several series of experiments, with a view to discover the precise manner in which unmagnetized iron acts upon a magnetic needle. For this purpose, he had made use of an iron ball 18 inches in diameter, and also of a shell 18 inches in diameter, and observed their effects on the needle in various positions, as referred to certain planes passing through its centre. The shell and the needle were placed in the relative positions which he wished to give them, by determining a radius and an angle on a horizontal plane, and a vertical ordinate. The requisite computations becoming, from their number, laborious, Mr. Christie resolved to supersede the necessity of them, if possible, by the construction of an instrument, by which he could adjust the iron and the needle in their proper relative positions, without any previous computation. In this he succeeded, by means of the instrument he proceeds to describe in the following manner, but in which it became necessary to make use of a plate of iron instead of the heavy iron shell.

"The instrument is represented in the title page. The principal part consists of two strong limbs of brass: one, SQN, a semicircle, 18 inches in diameter, 2·15 inches broad, and ·3 inch thick: the other consists of two semicircles joined together; S Æ N, 1·2 broad, and ·22 thick, and its outer diameter 18 inches; *s æ n* ·9 inch broad, ·22 thick, and its inner diameter 9·2 inches. S Æ N, *n æ s*, and S Q N are attached to each other by strong brass pins, passing from S to *s* and N to *n*; so that *s Æ n* will revolve about the axis S *s n* N, while S Q N is fixed. S Æ N and S Q N are graduated from Æ and Q towards S and N, as is likewise *s æ n* from *æ* towards *s* and *n*. The semicircle S Q N passes freely through an opening in the support G I, but may be clamped firmly in any position by means of two strong screws, working into the parts G, G′, from the back of the instrument. On the chamfered edge of the opening *g*, in the face of G G′, is an index showing the inclination of the axis S N to the horizon; and on the part K *k* at the foot of the pillar, and attached to it, is an index pointing out on the graduated circle L *l*, fixed on the table T *t*, the situation of the fixed limb S Q N with respect to the magnetic meridian. R *r* is another graduated circle fixed to the movable limb S Æ N; which, by the index at *x*, on the fixed limb S Q N, shows the angle described by S Æ N from the plane S Q N. A very strong brass pin, soldered to the foot of the pillar, passes through the table T *t* and a thick circle of wood, to which the legs are attached, and has below a stamping screw, to fix the whole firmly together in any position. The compass box N′ S′ is fitted on to a stand fixed to the support F *f*, which consists of two parts; *f* fitted to G, and F sliding on a tube attached to *f*; so that the compass may be elevated or depressed. An arm A B. to carry the circular plate of iron C *c*, is connected with the movable limb S *æ* N. The part A *a* consists of two flat pieces, having the limb of the instrument between them, so that the arm may be moved into any position on it, and be fixed in that situation by means of a strong screw working into the face A *a*. On the cylindrical bar B *b*, a short hollow cylinder slides freely, having a circular rim raised ·6 inch from it, to support the iron plate C *c* at right angles to the axis of the cylinder. Over the plate of iron is a wooden washer D *d*, which is pressed on it by the screw *h* working on the short cylinder. The cylinder with the plate is fixed in any position on the arm by the clamp M *m*. In the part A *a* of the arm are two openings *o*, *o′*, on the chamfered edges of which are indexes in a line with the axis of the cylinder B *b*, so that when each points to the same arc on the semicircles S Æ N, *s æ n*, the axis of the cylinder B *b* is directed towards their centre, and every point in the edge of the plate is at the same distance from that centre. As the weight of the plate was a consider-

-able strain on the instrument, a scale to contain a counter-weight was suspended from the ceiling of the room, and the line from it passed through a movable pulley, attached to the arm B *b*, so that the weight might easily be adjusted to relieve nearly altogether the strain of the plate on the arm in any position. The arm was also occasionally supported, and kept steady in its position, by a sliding rod resting on the table T *t*. The compass consists of a circular box, containing a circle of 6 inches in diameter, very accurately divided into degrees, and again into thirds of a degree; and a very light needle, having an agate in its centre, and its point of suspension only ·07 inch above the surface of the needle. The extremities of the needle are brought to very fine points; so that by a little practice, with the assistance of a convex lens, I could read off the deviations very correctly to two minutes, being the tenth of the divisions on the circle. . . . . In the experiments which I had previously made, and in those which I proposed making with this apparatus, I conceived a sphere to be described about the centre of the needle, referring the situation of the iron to a plane, in which, according to the hypothesis I had adopted, it should equally affect the north and south ends of the needle. The line in which the needle would place itself, if freely suspended by its centre of gravity, I considered as the magnetic axis; the points where this axis cuts the sphere, the poles, the upper being the south, and the lower the north pole; and the great circle at right angles to the axis, the equator, being the plane above mentioned. The position of the iron was thus determined by its latitude and longitude; the longitude being always measured from the eastern intersection of the equator with the horizon. The angle which the axis makes with the horizon I considered to be, according to the most accurate observations, very nearly 70° 30′."

"After making a very few sets of experiments with this instrument, I found that it was necessary to attend very particularly to the situation of certain points on the iron plate with respect to the limb, since, with one point coinciding with it, the deviation of the needle, when the centre of the plate was on the meridian, would be easterly, and with another point coinciding, westerly; whereas had the iron possessed no partial magnetism, which was the case I wished to investigate, there would have been no deviation when its centre was on the meridian."

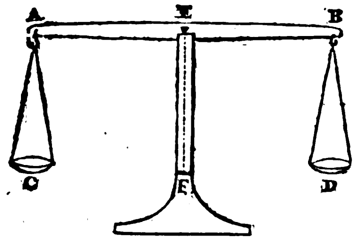
CHEAP AND DELICATE HYDROSTATIC BALANCE.

We extract from the Edinburgh Journal of Science, the following communication from William Ritchie, A. M. Rector of Tain Academy.

"Having been engaged in determining the ratio between the weights and measures used in the counties of Ross and Sutherland, and the new imperial standard, and not having in my possession a balance of sufficient strength and delicacy, I fell upon the following simple contrivance, which answered as well as the finest hydrostatic balance. A balance of extreme delicacy and accuracy, adapted to philosophical experiments, generally costs fifteen, twenty, or even thirty guineas. The expense attending the prosecution of physical science is thus beyond the abilities of those who are best fitted for such inquiries. The person who, by simple contrivances, will diminish the expense of such essential parts of philosophical apparatus, will therefore confer an important benefit on the young inquirer. With this view, I shall present the public with the description of a balance, which may be made for a few shillings, and which will answer all the purposes of philosophical investigation, as well as the finest hydrostatic balance in existence.

"Let a slender beam of wood be procured, about eighteen inches or two feet long, and tapering a little from the middle to each end. Let a fulcrum of tempered steel, resembling the point of a pen-knife, be made to pass through the middle of the beam a little above the centre of gravity.

Similar steel blades are also made to pass through the ends of the beam for suspending the *scales*. The fulcrum rests on two small portions of thermometer tube, fixed horizontally on the upright support, E. F.



"The support has a slit passing along the middle, E F, to play freely between the sides. A small scale made of card, and divided into any number of equal parts, is placed at F, for the purpose of ascertaining the point at which the needle remains stationary. This balance possesses extreme delicacy. It may even be made more sensible than that belonging to the Royal Society of London. I have said nothing of the perfect equality of the two ends, as this condition is not at all necessary to the accuracy of the balance, according to the method of double weighing. To ascertain the weight of any body, place it in one of the scales, and bring the needle to any point, by means of small shot placed in the other scale. Observe the point opposite to which the needle rests, or the middle between its extrême points of oscillation; remove the weight, and put into the scale as many *known* weights as will bring the needle to the same division as before; these weights will evidently be equal to the weight of the body, whether the arms of the balance be equal or not.

"For this simple and accurate method, we are indebted to the sagacity of Borda. It is generally employed by the continental philosophers, and, though somewhat more tedious, is obviously more accurate than the common method. This method is so simple and obvious, that we are surprised it was not discovered as soon as the balance itself was known; yet, as the celebrated Biot justly remarks, philosophers knew the motions of the heavenly bodies, and had actually ascertained the dimensions of the earth, before they knew the method of accurately determining the weight of a body."

SINGULAR PHENOMENON.

When M. Ramond was on the Pic du Midi, he observed his own shadow, and that of his companions, projected on a cloud situated a little distance above them, with a distinctness and an accuracy of outline quite surprising; but what was more astonishing, *these shadows were encircled with glories, shining with the most brilliant colours.* "Those who witnessed the magnificent spectacle," says M. Ramond, "might have supposed that they were assisting at their own apotheosis." Several naturalists, among others Bouguer and the sons of Saussure, have seen this phenomenon; but none of them observed this distinctness of form, which can only be explained by the smoothness of the surface of the cloud upon which the shadow was projected. With respect to the glory, Bouguer supposed it might arise from the decomposition of the light produced by the particles of ice suspended in the cloud. Thus he would say that the rays of the sun being intercepted at the place occupied by the shadow, there is produced at the place a coldness, and the icy particles becoming more numerous there, and on the margin of the shadow, produce the decomposition of the light. M. Ramond, however, objects to this explanation, and considers it as certain, that the cloud on which his shadow was projected, could not, from the temperature of the Pic, have then held any icy particles in suspension.

NEW MANUFACTURE OF GLASS.

M. Legnay has invented a new method of manufacturing glass, without the use of free alkali. He has obtained a *brevet d' invention*, (Patent) in France, and the following is the process

Take 100 parts of dried sulphate of soda, 656 parts of silica, and 340 parts of lime which have been exposed to the air. All these materials must be mixed with much exactness. The furnace and pots are to be heated till full red, when the mixture, in small balls, should be charged into the pot, until the latter is full. The mouth of the pot should be then stopped up, and, with its contents, introduced into the furnace, and as soon as it is perceived that the materials have sunk in the pot, more of the same mixture must be put in, until the pot is filled with a melted vitreous substance. A strong fire must be continued, in order to obtain a complete fusion in as little time as possible. When the fumes diminish, small portions must be taken out at different times, to ascertain whether the glass be sufficiently refined, which generally happens in about 22 hours. This glass is then fit for use; but it may remain double the time in the furnace without risk.

Another mode proposed is, to take 100 parts of well dried muriate of soda, 123 parts of silica, 92 parts of lime which has been exposed to the air, well mixed together, and fused in the way above described: in 16 hours a good glass will be obtained, which will be fit for use for any purpose that may be required.

The preceding information is extracted for *Description des Brevets, &c.* In the *Annales de l' Industrie Nationale*, other proportions are given: viz. 100 dried muriate of soda; 100 slaked lime; 140 sand; from 50 to 200 clippings of glass of the same quality. Or: 100 dried sulphate of soda; 12 slaked lime; 19 powdered charcoal; 225 sand; 50 to 200 broken glass. Again, 100 dry sulphate of soda; 266 slaked lime; 500 sand; and 50 to 200 broken glass.

THE SUN'S LIGHT DIMINISHES COMBUSTION.

The statement, that the sun's light diminishes combustion, has been considered by many a vulgar error; but the following experiments by Dr. Mc Keever, put the matter beyond a doubt.

1. A green wax taper, in sunshine, lost 8¼ grains in 5 minutes.

A white wax taper, in a darkened room, lost 4¼.

	Min.	Sec.
2. In bright sun-shine, a piece of wax taper seven inches long, required to consume it	5	0
In day-light it required	4	52
In a dark room	4	30
3. In the spectrum one inch of taper was burnt in the following times.		
At the end of the violet ray	4	36
In the centre of the violet ray	4	26
In the centre of the green ray	4	20
In the centre of the red ray	4	16

EXPANSION OF GAS.

June 27th, 1826.

Sir,—In answer to Indicator's question, inserted in your last number, I beg leave to observe, that the difficulty arose from the fallacy of one of his assumptions, viz:—that the gas in the interior of the balloon, exercised an expansive power equal to the pressure of the atmosphere without. The fact is, that the gas counteracts the exterior pressure, merely by its density, which is equal to that of the atmosphere.

The gas in question has no tendency to expansion, unless a quantum of heat is introduced greatly above that which is present in its ordinary state. It is true, there have been instances of balloons bursting, but it has been occasioned by the trahition of the cords to which the car is appended.

This question being intimately connected with the subject of expansion, I should be happy to discuss the nature of that property with Indicator, as it affords ample materials for it.

I am, Sir,
An old Subscriber,
Colin

EDDYSTONE LIGHT HOUSE.

SIR,—The following cursory description of the successive building of the Eddystone Light-House, and of the great storm in which the first projector perished, may be amusing to your readers.

The cluster of rocks, called the Eddystone-Rocks, situate in the English Channel, at the distance of about 14 miles from Plymouth-sound, lying nearly in the direction of vessels coasting up and down the channel, formerly proved very dangerous, and many vessels were cast away on them. To guard against these disasters, it was deemed necessary to erect a light-house here; but to effect this in a complete and permanent manner, so as to resist storms and afford light, was a task of extreme difficulty. The rocks are so peculiarly exposed to the swells of the ocean from the south and west, that the heavy seas break upon them with uncontrolled fury. Sometimes, after a storm, when the sea is apparently quite smooth, and its surface unruffled by the slightest breeze, the growing swell, or under current, meeting the slope of the rocks, the sea beats tremendously upon them; and even rises above the light-house, overtopping it for the moment as with a canopy of frothy wave. Notwithstanding this awful swell, Mr. Henry Winstanley undertook, in the year 1696, to build a light-house on the principal rock, for the rest are under water; and in 1700 he completed it. So confident was this ingenious mechanic of the stability of his edifice, that he declared his wish to be in it during the most tremendous storm that could arise. This wish he unfortunately obtained, for he perished in it during the dreadful storm which destroyed it, November 27, 1703. Another light-house, of a different construction, was erected of wood, on this rock, by Mr. John Rudyard, in 1709; which being consumed by fire in 1755, a third, of stone, was begun by the justly celebrated Mr. John Smeaton, April 2, 1757, and finished August 24, 1759, which has hitherto withstood the attacks of the most violent storms.

The dreadful tempest which visited Europe in 1703, spent its main force on the British islands. A strong west wind set in about the middle of November. Instead of subsiding, every day, and almost every hour, increased its force. On Wednesday, the 24th, it blew furiously and did some damage. Its violence was still augmented so much, that on Friday, the 26th, it became awfully tremendous, and the most dreadful consequences were, with reason, apprehended. It was not, however, till Saturday, the 27th, about six in the morning, that it arose to its greatest height. Those who have written any account of its calamity, agree in their testimony, that it exceeded any storm that had happened in the memory of man; or that could be found in any history. The violence of the wind, the length of its continuance, the prodigious extent to which it spread, and the innumerable calamities produced by it, rendered it one of the most awful events in the history of the world, of which we have any knowledge, the general deluge excepted. About 2000 stacks of chimneys were blown down in and about London. The lead which covered the roofs of 100 churches was rolled up and hurled in prodigious quantities to great distances. The devastation spread also through the country; stacks of hay and corn, innumerable, were blown down and damaged. Multitudes of cattle were lost. In one level in Gloucestershire, on the banks of the Severn, 15,000 sheep were drowned. A person set himself the task of numbering the trees that were torn up by the roots; but when he had proceeded through but a part of the county of Kent, he counted 250,000, when he relinquished the undertaking. But the greatest calamities were, as might be expected, on the water. In the River Thames, at least 500 wherries, 300 ship boats, and 200 lighters and barges were entirely lost, besides a much greater number that received considerable damage. The ships destroyed by this tempest were computed at 300. Of the Royal Navy, twelve ships were sunk with most of their crews. The Eddystone light-house, near Plymouth, was, as I have stated, precipitated into the surrounding ocean, and in it perished its ingenious architect. Signals of distress were made, but in so tremendous a sea, no vessels could live, or would venture to put off for their relief.

I am, Sir, an old Subscriber,
Plymouth, June, 1826. W. W.

BOW CHURCH, CHEAPSIDE.

In the spring of 1671, Wren commenced his incomparable work, the Spire of St. Mary-le-Bow, in Cheapside; which is not only his masterpiece in composition, but stands unrivalled in this class of art, as well for its beauty as for its ingenious and scientific construction. The church and spire were finished in 1677. The spire was repaired by the late Alderman Sir William Staines, about 30 years ago; since then, by Mr. Gwilt, senior; and in 1820 by his son, Wm. George Gwilt, after the original design, as left by its great constructor.

This beautiful steeple, like all of Wren's, commences from the ground; unlike many of his tasteless successors, who place them on an apex of a weak pediment. It stands at the north-west angle of the church, and rises nearly plain to a height above the houses. The doors, on the external sides, are enclosed in rusticated niches; the dressings of the doorways are of the Palladium doric, embellished with cherubim and festoons. The clock projects into the street on the north side, and is a handsome as well as a highly useful embellishment to the tower; which is surmounted by a black cornice and well-proportioned balustrade. Each angle is relieved by a pyramidal groupe of bold scrolls, supporting a vase; between which rises a lofty circular stylobate, or continued pedestal, which supports a beautiful circular temple, of the corinthian order; the cell of which supports the upper part of the spire, while it beautifully relieves the columns of the peristyle, as an ever-varying background. This temple is likewise surmounted by a balustrade, from whence spring a series of beautifully proportioned and elegantly carved flying-buttresses, of a highly original shape and construction. These elevate and magically support another temple of a simpler species of corinthian order, forming four porticos of two columns each, the entablature breaking fancifully over them. The whole is surmounted by a very elegant obelisk or spire, supporting a colossal vane, in the semblance of a dragon, of copper gilt, with a red cross under each wing, the emblem of the city. The chasing of this beautiful vane is admirably executed in full relief, and forms a splendid ornament to the city. This immense vane was lowered from its place, under the direction of Mr. H. Elmes, of College-Hill, on Michaelmas-day, 1820; an adventurous young Irishman, of the name of Michael Burke, descended on its back from its situation, 225 feet from the ground, pushing it from the scaffolds and cornices with his feet, in the presence of thousands of spectators. When it was before lowered by Sir William Staines, the worthy baronet, then a young stone mason, was mounted on its back, on a low four-wheeled carriage, in Cheapside, and drawn to the city stone-yard by his men.

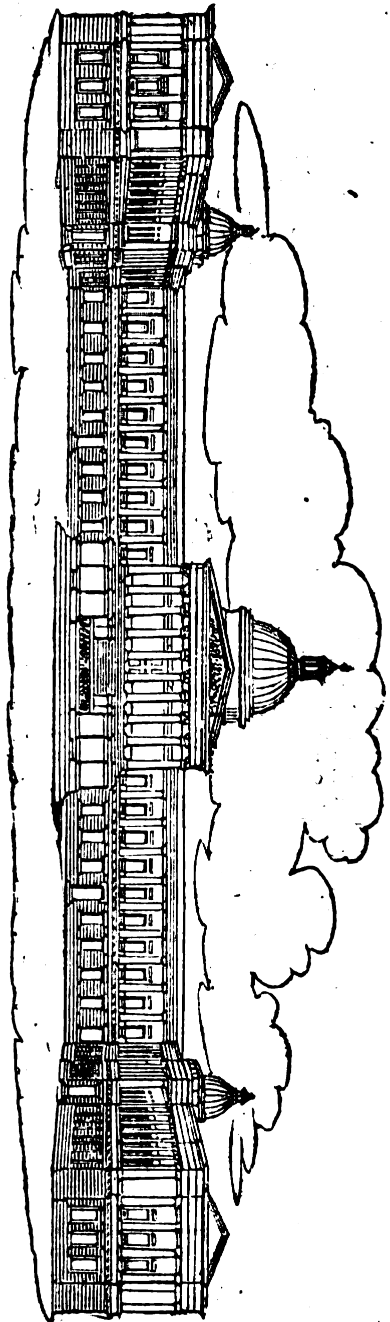
INQUIRIES RESPECTING CIDER.

Sir,—Allow me to inquire of your readers, the best method of treating cider, to render it bright, when not so naturally; and to prevent or correct the harshness or acidity produced by excessive fermentation. Using chalk or lime, as advised in your third volume, page 341, I conceive to be objectionable, in regard to cider; because, malate of lime, which would then be formed, is *soluble*. What would be the effect of drinking that solution, as to health? I also wish for a good receipt for using cider, instead of wort or water, to make pleasant English wine. Some kinds of cider will turn black soon after they are poured into a glass and left exposed. What is the reason of this change? I have tested them for mineral substances in solution, but without finding any.

Your's, &c.
M. A. Corin.

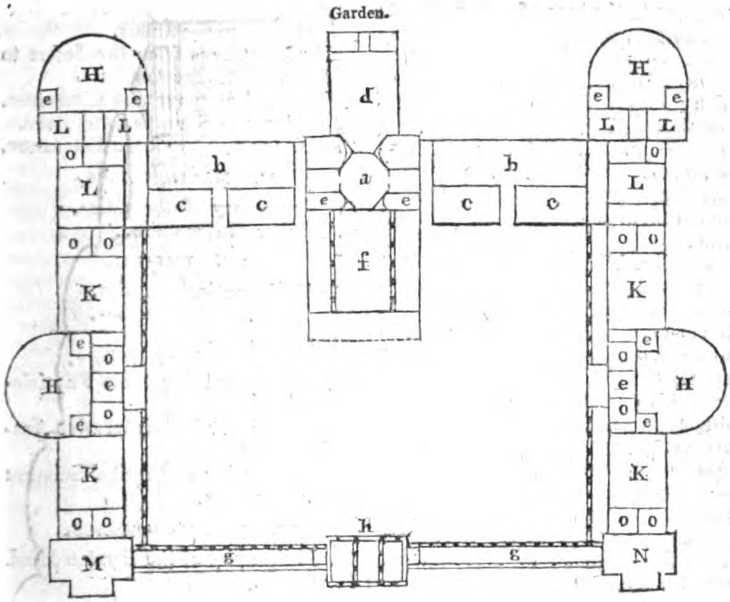
UNIVERSITY OF LONDON.

(Concluded from page 144.)



To the examples which we have before adduced, might be added, the obvious and striking case of commerce, which would be of itself sufficient to show the advantage of bringing literary and scientific instruction to the place where diligence and experience in liberal occupations are acquired. By the formation of an University in this metropolis, the useful intercourse of theory with active life will be facilitated; speculation will be instantly tried and corrected by practice, and the man of business will more readily find principles which will bestow simplicity and order on his experimental knowledge. No where can every part of information, even the most remote and recondite, be obtained so easily as in a city which contains cultivators of all branches of learning, followers of all opinions, and natives of every quarter of the globe.

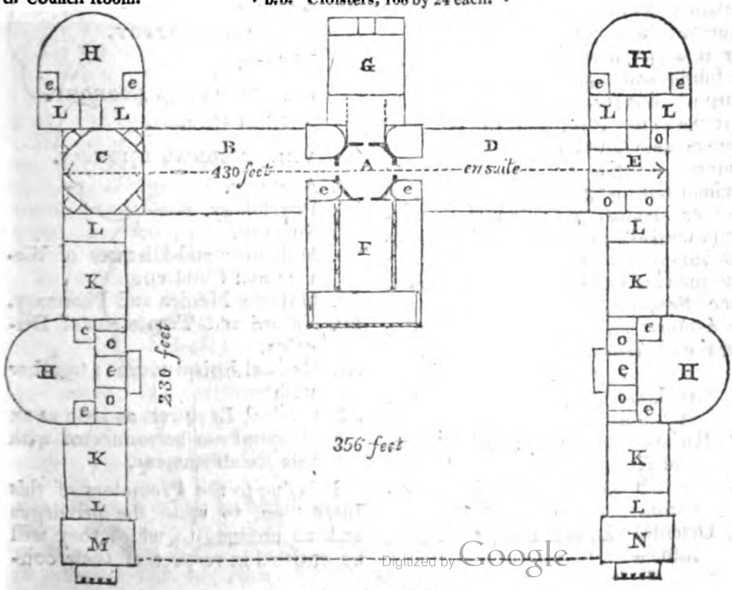
The Council are rather encouraged than disheartened by the consideration that their undertaking rests on the voluntary contributions of individuals, to which, after a season of public difficulty, they now appeal with firmer assurance. They are satisfied, that experience of its advantages will, in due time, procure for it such legal privileges as may be found convenient for its administration; and they are not unwilling that the value of testimonials of proficiency and conduct, granted by the University, should, at least in the commencement, depend on the opinion entertained by the Public, of the judgment, knowledge, vigilance, and integrity, of the Professors. For the good effects expected in other Seminaries from discipline, the Council put their trust in the power of Home and the care of Parents: to whom, in this Institution, which is equally open to the youth of every religious persuasion, the important duty of religious education is necessarily, as well as naturally, entrusted. That care, always the best wherever it can be obtained, will assuredly be adequate to every



Plan of the Ground Floor, extent of Front, 450 feet.

References.

A. Vestibule, 36 ft. in diameter.
B. Museum, 118 by 50.
C. Ditto of Anatomy, 50 by 48.
D. Library, 118 by 50.
E. Ditto continued.
F. Great Hall, 18 by 50.
G. Council Room.
H.H. Great Lecture Rooms.
K.K. Smaller ditto, 44 by 30.
L.L. Examination Rooms.
M. Secretary, &c.
N. Librarian, &c.
O. Professors' Rooms.
a. Subvestibule.
b.b. Cloisters, 108 by 24 each.
c.c. Students' Assembling Rooms.
d. Students' Library.
e.e. Staircases.
f. Sub-hall.
g.g. Ambulatories.
h. Propylœum.



Plan of the principal Floor.

purpose in the case of the Residents in London, who must at first be the main foundation of the Establishment. When its reputation attracts many Pupils from the Country and the Colonies, those means of private instruction, and domestic superintendence, may be adopted, which have been found in other places to be excellent substitutes for parental care.

Finally. The Council trust, that they are now about to lay the foundation of an Institution well adapted to communicate liberal instruction to successive generations of those who are now excluded from it, and likely neither to retain the machinery of studies superseded by time, nor to neglect any new science brought into view by the progress of reason; of such magnitude as to combine the illustration and ornament which every part of knowledge derives from the neighbourhood of every other, with the advantage which accrues to all from the outward aids and instruments of Libraries, Museums, and Apparatus; where there will be a sufficient prospect of fame and emolument to satisfy the ambition, and employ the whole active lives of the ablest Professors; where the most eminent places in Education may be restored to their natural rank among the ultimate and highest objects of pursuit; where the least remission of diligence must give instant warning of danger, and an attempt to pervert its resources to personal purposes cannot fail to cut off the supply sought to be perverted; where the inseparable connexion of ample income, and splendid reputation with the general belief of meritorious service, may prove at once a permanent security for the ability of the Teachers, an incentive to their constant activity, and a preservative of the Establishment from decay.

I. LANGUAGE.

1. Greek Language, Literature, and Antiquities.
2. Roman Language, Literature, and Antiquities.
3. English Literature and Composition.
4. Oriental Literature, subdivided into,—
   A. Languages from the Mediterranean to the Indus.
   B. Languages from the Indus to the Burrampooter.
5. French Language and Literature.
6. Italian and Spanish Literature.
7. German and Northern Literature.

II. MATHEMATICS.

8. Elementary Mathematics.
9. Higher Mathematics.

III. PHYSICS.

10. Mathematical Physics.
11. Experimental Physics.
12. Chemistry.
13. Geology and Mineralogy.
14. Botany and Vegetable Physiology.
15. Zoology and Comparative Anatomy.
16. Application of Physical Sciences to the Arts.

IV. MENTAL SCIENCE.

17. Philosophy of the Human Mind.
18. Logic.

V. MORAL SCIENCES.

19. Moral and Political Philosophy.
20. Jurisprudence, including International Law.
21. English Law, with (perhaps) separate Lectures on the Constitution.
22. Roman Law.

VI. HISTORY.

23. History.

VII. POLITICAL ECONOMY.

24. Political Economy.

VIII. MEDICAL SCIENCES.

25. Anatomy.
26. Physiology.
27. Surgery.
28. Midwifery and Diseases of Women and Children.
29. Materia Medica and Pharmacy.
30. Nature and Treatment of Diseases.
31. Medical Jurisprudence; together with
32. Clinical Lectures, as soon as an Hospital can be connected with this Establishment.

It is due to the Promoters of this Institution, to state the privileges and advantages to which they will be entitled in respect of their contributions, whether by subscription or donation to its funds.

The Deed of Settlement fully provides for the protection of the Proprietors from all liability beyond the amount of the sums respectively subscribed by them. While it confers large powers on the Council, it also interposes every proper check on any irregularity in the exercise of those powers, by the appointment of Auditors, and by General and Special Meetings of Proprietors for the revision of the proceedings of the Council, and the adoption of such new By-Laws and Regulations as in the progress of the Establishment may from time to time be required.

The rights and privileges of the Proprietors under such Deed may thus shortly be recapitulated:—

1. Absolute right of presentation of one Student, in respect of each Share, at such reduced rate of annual payment, and subject to such rules and restrictions as may be prescribed by the Council.

2. Interest on Shares not exceeding £4 per cent. out of surplus income.

3. Privilege of transfer and bequest of Shares.

4. In cases of Ballot, a Proprietor of one Share is entitled to one vote; of five Shares, to two votes; and of ten Shares or upwards, to three votes, with privilege of voting by proxy at Elections.

Donors of £50 and upwards are entitled to all the privileges and advantages of Proprietors, except the transfer and devolution of their interest, and have no more than one vote on any occasion.

In addition, Proprietors and Donors will have the right of personal admission to the Library, and the various Collections of the University.

It is difficult at present to form any precise idea of the annual expense at which the proposed system of education can be afforded; but a confident belief is entertained that it will not be more than £30 per annum, for a Student admitted on the nomination of a Proprietor. In the early period of the Establishment, it is probable that no other Student than those presented by Proprietors can be admitted; and whenever the extended scale of the Institution will allow of a general admission of Students, their annual payments must necessarily be much higher than those required by the Nominees of Proprietors.

A piece of Freehold Ground has been purchased, at the end of Gower Street, for the erection of the proposed Building, and the Council have adopted a design of Mr. Wilkins; a tolerably faithful representation of which is given herewith.

Subscriptions for Shares (on which a deposit of £25 per cent. must be paid) are received either at the Office of the University, 7, Furnival's Inn, or at the Bankers of the Institution, Messrs. Smith, Payne, and Smiths, 1, George Street, Mansion-House, and also at Messrs. Coutts and Co. Strand; and all communications may be addressed to Mr. Coates, 7, Furnival's Inn.

DEFECTS OF TREES.

In the year 1791, Mr. William Forsyth, superintendant of his majesty's gardens at Kensington, published the following composition, for curing injuries and defects in fruit and forest trees, and for which he received a distinguished mark of his majesty's approbation.

"Take one bushel of fresh cow-dung, half a bushel of lime rubbish of old buildings, (that from the ceilings of rooms is preferable) half a bushel of wood-ashes, and a sixteenth part of a bushel of pit or river sand. The three last articles are to be sifted fine before they are mixed; then work them well together with a spade, and afterwards with a wooden beater, until the stuff is very smooth, like fine plaster used for ceilings of rooms.

"The composition being thus made, care must be taken to prepare the tree properly for its application, by cutting away all the dead, decayed, and injured part, till you come to the fresh sound wood; leaving the surface of the wood very smooth, and rounding off the edges of the bark with a draw knife, or other instrument, perfectly smooth, which must be particularly attended to: then lay on the plaster, about one-eighth of an inch thick, all over the part where the wood or bark has been so cut away, finishing off the edges as thin as possible. Then take a quantity of dry powder of wood-ashes, mixed with a sixth part of the same quantity of the ashes of burnt bones; put it into a tin box, with holes in the top, and shake the powder on the surface of the plaster, till the whole be covered over with it, letting it remain for half an hour to absorb the moisture: then apply more powder, rubbing it gently with the hand, and repeating the application of the powder, till the whole plaster becomes a dry, smooth surface.

"All trees cut down near the ground, should have the surface made quite smooth, rounding it off in a small degree, as before mentioned; and the dry powder directed to be used afterwards, should have an equal quantity of powder of alabaster mixed with it, in order the better to resist the dripping of trees and heavy rains.

"If any of the composition be left for a future occasion, it should be kept in a tub, or other vessel, and urine of any kind poured on it, so as to cover the surface, otherwise the atmosphere will greatly hurt the efficacy of the application.

"Where lime-rubbish of old buildings cannot be easily got, take powdered chalk, or common lime, after having been slaked a month at least.

"As the growth of the tree will gradually affect the plaster, by raising up its edges next the bark, care should be taken, where that happens, to rub it over with the finger when occasion may require (which is best done when moistened by rain), that the plaster may be kept whole, to prevent the air and wet from penetrating into the wound."

ANCIENT VASES.

(*Continued from page* 139, *No.* 149.)

Although the black coating produced in this manner upon the surface of earthen vessels, agrees in many of its qualities with the varnish of the antique Grecian vases, and it is not improbable, that a similar substance, and a similar mode of painting, was used in their manufacture; yet the varnish prepared in the manner above described, differs from the ancient varnish in this respect, that it does not resist a very great degree of heat; nor have I as yet succeeded in my efforts to discover, by what means the faculty of sustaining the power of an intense heat could be given to varnish prepared of *asphaltum*. However, it is evidently not impossible, that time may have done something in this respect, which art could not produce.

It is well known, that *asphaltum* and *naphtha* were among the substances known to the ancients, and that they were applied by them to various purposes. Pliny, in fact, relates, that inscriptions made with *Jet* (Gagates) upon earthen-ware, are not effaced.* But, from what we learn with regard to this *Gagates* of Pliny, it is to be inferred, that it was not the *Jet* of modern times, but *asphaltum*; which renders it probable, that the art of making a coating for earthen-vessels of that substance was known to the ancients. The varnish and paintings, indeed, which occur in the sepulchral vases of the Greeks, do not seem to have been applied by the Romans to earthen-ware manufactures; for no traces of them occur among the numerous remains of Roman pottery.† A covering, however, in some respects similar to it, but consisting of vegetable pitch, was used by the Romans in their wine vessels, the preparation of which is accurately described by *Columella*.‡ I do not doubt, that a varnish made from *asphaltum* in the manner above described, and the mode of painting founded upon it, to which the name of Enamelling is applied, might be used with advantage in modern pottery, as for ornamenting vessels, covering tiles, &c.

Besides the black varnish, some other colours are seen in Grecian and Etruscan sepulchral vases; for example, white, yellowish white, red, brown, rarely bluish-green or livid.§ In the

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* Natur. Hist. lib. xxxvi. cap. 34.

† Consult. *Brocchi*, sulle Vernici usate dagli Antichi. *Bibl. Ital.* t. vi. p. 453, 463.

‡ De Re Rustica. Lib. xii. cap. 18.

§ *Hirt*, in Boetticher's Griech Vasengemälden. Bd. 1, Heft. 3. p. 27. *Millingen*, Peint. Ant. p. 5.

vases whose paintings are made of the varnish itself, particular parts only of the paintings consist of these colours; for example, leaves, flowers, architectural ornaments, the drapery of figures, the wings of winged figures, horses, chariots, &c. In other vases, which are evidently covered with black varnish, certain ornaments are sometimes laid in upon it with other colours, especially white. The nature of these pigments is as follows: 1. They are, without exception, opaque, and belong to the paints called in German *Deckfarben*. 2. They seem prepared either from earth or metallic oxides; for example, the white pigments from argil; the red from oxide of iron; the brown from oxide of iron mixed with oxide of manganese. 3. They are not vitreous, but have an earthy aspect. 4. They are not intimately united with the baked-clay; they fall off, and may easily be abraded; they are partly dissolved in acids.* 5. They are usually laid upon the black varnish, which appears evident enough when particles of the paint have fallen off, or are abraded, by which the black varnish is discovered. From these properties, it may be inferred, that antique painted vases have not been baked in the same manner as our earthen-ware is, along with the pigments, but have had the pigments applied to them after being baked.†

We shall now, in the *second* place, speak of the *mechanical method*, in which the varnish and paintings have been applied. All that I have observed with regard to this matter, during a diligent examination of Grecian and Etruscan vases, as well as all that has already been observed by others, agrees well with the opinion expressed above, regarding the composition of the varnish.

Some antiquarians have thought, that the paintings of the Grecian vases have been perfected by the assistance of the moulds to which our workmen gave the name of *Patrones*.‡ Others have supposed, not that the whole paintings, but the ornaments, have been made in this way.|| I cannot, however, give my assent to these opinions. If the figures or ornaments had been perfected by the aid of moulds, vases would undoubtedly be sometimes found in the same place, with the same paintings. But although similar representations are not unfrequently seen in different vases, there have never, in so far at least as I know, been found two vases, whose paintings correspond in every respect, which has already been remarked by *Grivaud*.* If the ornaments, which might have been made by means of moulds more easily than the more diversified and complex figures, be attentively examined, certain irregularities and slight blemishes will often be found, which would undoubtedly have been avoided, if moulds had been applied in the painting of vases.

(To be concluded in our next.)

* *Hirt*, in Boetticher's Vasengem., Bd. i. Heft. 3. p. 27.

† *Grivaud*. Ant. Gaul. et Rom., p. 125.

‡ *Hamilton* was of this opinion, but he afterwards thought otherwise. Boëttiger's Vasengem. Bo. i. Heft 3. p. 46, 58.

|| *Rossi*, First Letter to M. Millingen, Peint. Ant. p. vi.

* *Jorio* Sul Met. d. Ant. nel dipingere Vasi, p. 9.

GEOMETRICAL PROBLEM AND SOLUTION.

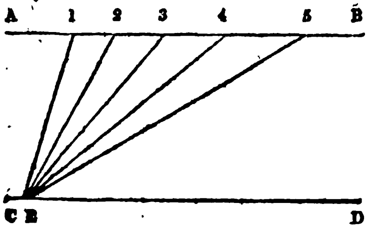
Sir,—As many of the readers of your Magazine may not have an opportunity of perusing Taylor's "*Elements of Thought*," the following extract from that publication, may not be altogether unworthy of your notice. The author is endeavouring to prove, that "many of the first principles of science seem to imply a direct contradiction: they are, apparently, impossible, and yet true; so that, while they demand assent, they baffle the understanding." And I doubt not that very many of your readers will be astonished to find that they *must* believe that, '*Two points or lines may continue to approach each other for ever, and yet never meet!*' But, however startling the proposition may appear at the first reading, it is not the less true, and, with our author, we must sooner or later acknowledge, 'that we are often obliged, by unquestionable evidence, to assent to propositions which not only surpass our power of comprehension, but which seem directly to contradict the plainest truths.'

Your's, obediently,

Edward B. Palmer.

Mutford, Suffolk, May 21st, 1826.

"*Two points or lines may continue to approach each other for* *ever, and yet never meet;*" which may be proved thus :—



The lines A B, C D, may be imagined to be continued *infinitely*; let the line A B, be divided into equal parts.—1, 2, 3, 4, &c. so that these points continued on an infinite line, shall be infinite; let a point E, be taken in the line C D, and lines drawn from it to the divisions in the line A B, as E 1, E 2, E 3, &c. It is evident that the line E 3, is nearer to the line C D than the line E 2, and that the line E 4, is nearer to it than the line E 3. Now these lines, from the point E, may continue to be drawn to the successive division in the line A B, *ad infinitum*; and every succeeding line will be nearer to the line C D, than the preceding line; and yet no line running from one parallel line to another, can ever meet or coincide with either of them; or, in other words, the lines from the lower to the upper line, may continue *for ever* to approach the lower, but can never meet it."—*Page* 95.

To the Editor of the Mechanics' Magazine.

Sir,—The properties of the number 9 are not of such *infinite* service to the man of figures, as J. Key Pringle states; yet, while those properties are given, their *utility* should at the same time be pointed out. For example, since the sum of the digits or significant figures in the products is either 9 or a multiple of 9, if the numbers of a fraction be either a 9 or a multiple of 9, they are *divisible* by 9, which is shewing the *use* of the above property.

Example.

Reduce $\frac{720}{3249}$ to its lowest terms. The sum of the digits in 720 is 9, and 3249 is 18; they are, therefore, both divisible by 9; consequently, $\frac{720}{3249} = \frac{80}{361}$

9 times any multiplicand being 10 times minus *once*, the same, and 99 times equal to 100 times, minus *once*, the same, &c. To multiply, therefore, by *any* number of 9's, annex a cypher for each 9 in the multiplier, from which subtract the multiplicand.

Example.

Multiply 8432 by 9999
then from 84320000
subtract 8432

84311568 product.

To find the product of any number from 12 to 20, by 9 *mentally*.—The units of the first product (as in the multiplication by any other number as well as 9) is the units place of the required product, and the tens place is the *sum* of the tens and hundreds, of the required product, and as in this case, is always the hundreds place, the tens must therefore be lessened by 1: thus, 9 times 19 = 171; for 9 times 9 = 81; that is, 1 for the unit's place, and 8 being the *sum* of the other two places, 1, 7, and 1, are therefore the digits of the product, which may be found in one-third of the time that the reader will be employed in reading these lines.

The following is a curious property of 9.

9 times 98765432 = 888888888; and the division of 888888888, is 98765432.

For the *division* by *any* number of 9's see Russell's Philosophy of Arithmetic, just published by Souter.

Note.—I have lately been endeavouring to find easy methods for reducing fractions to their lowest terms by *inspection*, and have met with little or no difficulty in knowing whether the numbers of a fraction be divisible by 2, 3, 4, 5, 6, 8, 9, 10, 11, and other higher numbers: yet I cannot tell how the terms of a fraction are to be *inspected* for their division by 7. If any of your arithmetical readers will assist me in this, I shall feel obliged.

I am, Sir,
Your's respectfully,
CLYDE.

April 25th, 1826.

CALCULATING BOY.

Mr. Editor,—In No. 137, page 398, of your interesting miscellany, mention is made of another calculating boy, who is about to exhibit his powers before the public. With respect to the first specimen of his skill, with which you have favoured us, I suspect an answer to another question has been given: the true answer will be found to be 455520.

A Subscriber.

ON SOUNDS.

In answer to Philobotanicus, No. 133, page 355, I believe it to be an established opinion, that sound is conveyed through the air in undulations, similar to those produced by the falling of a stone into water, with this exception, that in water the undulations move on a plain surface, whereas in the air they move in a spherical form. Concluding, then, that in the day-time innumerable undulations take place, the passage of one undulation must be considerably retarded by the undulations of other sounds. In the night-time, when the greater portion of noises have ceased, sound is conveyed to a far greater distance; partly owing to the undulations being less retarded by other undulations; in part, because the atmosphere is colder, which is much more favourable to the transmission of sound; and partly, because there is a greater degree of moisture in the air, which moisture acts as a very good conductor. Franklin states, that at a distance of two miles he heard the sound produced by striking two stones under water.

I am, &c.

X.

OF AGE.

Every living thing has its beginning and ending, and undergoes innumerable changes. Thus we see that infancy is weak and feeble; but youth is comely, flourishing, and luxuriant. Manhood is plump, strong, and full of stature; but old age droops, becomes weak, languid, and dry, the sad presages of approaching dissolution. Plants are subjected to the same vicissitudes, and go through the same stages. In their infant, or very useful state, they are small and weak, destitute of flowers and fruit; when more advanced, they wanton in beautiful and shining colours, being the most agreeable, and, as it were, in the joyous spring of life; in summer, being then more plump, firm, and strong, but less splendid, they bear fruit: in autumn, or old age, they droop, grow dry, and wither, returning to dust from whence they came. The ivy, in its first or tender state, has spear-shaped leaves, and bears neither flowers nor fruit. This is that variety, which Bauhine calls *Hedera humi ripens*, "Ivy creeping on the ground." The same plant, when more advanced, bears fine lobed leaves, climbs on trees and walls, and is barren. This variety, Bauhine calls *Hedera major sterilis*, the "Greater barren ivy." In the next, or more mature state, it sends forth three-lobed leaves, and, leaving its props and supporters, it rises by its own strength, and puts on the appearance of a pretty tall tree, being loaded with flowers and fruit. This is the *Hedera arborea*, or "Free ivy." But when old, it puts forth egg-shaped leaves, without lobes. This is the *Hedera poetica*, or "Poet's ivy." Daily experience abundantly shows, that all plants undergo a variety of changes. From the seed spring up tender shoots, which at first resemble small shrubs; these, by degrees, acquire a firm trunk, and bear flowers and fruit; after this, the branches flag, and are covered, as well as the trunk, with moss; first one branch decaying, and then another, till the whole tree moulders away, and *the place thereof* knoweth it no more.

Linn.

EXPERIMENTS IN ELECTRICITY.

Sir,—In the course of pursuing some experiments in Electricity, lately, I wanted to communicate to a friend at a distance the results, and the exact degree of electricity which my machine was capable of exciting; just at this time a thought struck me, which, if it would effect no other end, would at least this. I will describe as briefly as I can my idea.

If a wire rod be exactly balanced on an upright pillar, with a brass ball at each end, and one end of the rod be graduated, a weight being attached to that end, and regulated at different distances, you may ascertain the exact weight which your electrical influence is capable of overcoming, in raising the ball of the graduated end, by approximating it to within the influence of the ball of the conductor.

If you should think the above worth insertion in your excellent Publication,

You will oblige, Sir,

Your obedient servant,

AMICUS.

AGRICULTURAL QUERIES.

SIR,—Not agreeing with your Correspondent Agricola, in your 182d Number, on the propriety of using Machines in Agriculture, I take the liberty of asking, through the medium of your Miscellany, the following questions:—

Would it not be possible to draw our ploughs by steam-engines?

And where is Mr. Michael Barry's machine for digging potatoes to be seen at work?

In your 116th Number, Mr. Ogle has very disinterestedly presented the public with the plan of a reaping-machine. Would he, or the Messrs. Brown mentioned by him, deliver a machine competent to do the work he has stated, under this proviso, that the price be paid on the machine being approved?

As I am desirous of receiving answers to these inquiries, I send you privately my address.

I am, Sir, your's, &c.

A FARMER.

Cardiff.

ON DRESSING POTATOES.

Where these useful roots are boiled for the purpose of feeding swine, or other animals, they should be put into bags or sacks, leaving room for them to swell, and when sufficiently boiled, the sacks should be taken out and left to drain, for the water becomes so strongly impregnated by the poisonous properties of the roots, as to be highly detrimental to animals in general. This will account for the disappointment of those persons, who feed their pigs with potatoes mashed with the water in which they have been boiled. When prepared agreeably to the above direction, potatoes become a most beneficial food for pigs, but they are by far less nutritious in the raw state, for the poisonous qualities not being drawn out by boiling, it counteracts the benefit of the farinaceous qualities of the root.

TO CORRESPONDENTS.

X. Y. Z. is informed that we know nothing of the Subscription for the Bradford Weavers. We refer him to the Committee of the Trades' Newspaper.

Communications have been received from—J. Senhouse—T. C. E.—T. W.—W. C. of Winchester—R. L.—E. C.—A Mechanic—T. C.—and an Old Subscriber. The whole of which shall meet with due attention.

List of Patents in our next.

Several important articles are in preparation for future Numbers, and we assure our Correspondents, that by the continuance of their favours we shall be stimulated to new and increased exertion.

Communications (post paid) to be addressed to the Editor, at the Publishers', KNIGHT and LACEY, 55, Paternoster Row, London.

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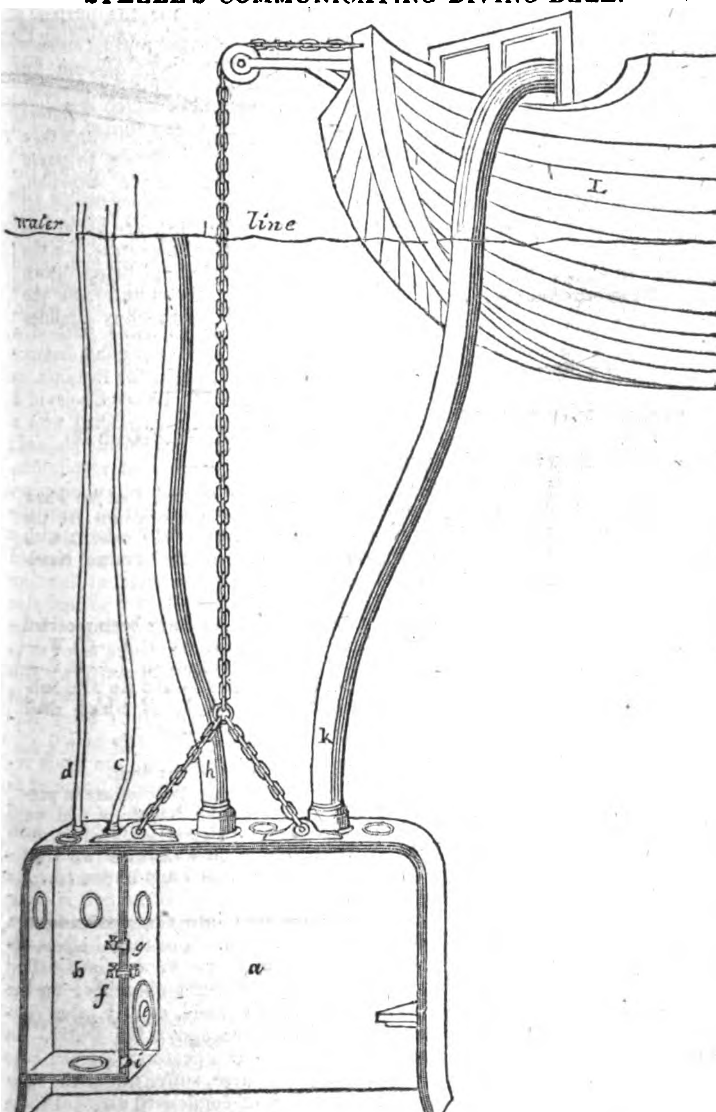
Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 151] SATURDAY, JULY 15, 1826. [Price 3d.

"The particular *aim* of the individual is *happiness* or *well-being*—a result of the development or improvement of his faculties. The general aim of the species, which is at the same time the aim of the sciences, of inventions, and of every man who aspires to real, solid glory, founded on the happiness of his fellow-creatures, is the melioration of the human condition upon earth."

STEELE'S COMMUNICATING DIVING BELL.



Thomas Steele, M. A. of Magdalen College, Cambridge, Esq. has obtained a patent for his Invention of certain Improvements in the Construction of Diving Bells, or Apparatus for Diving under Water.

These improvements consist in combining, what the patentee calls a bell of observation, with the ordinary working bell; and in connecting with this latter an air chamber above the surface of the water, by which means a communication is formed, that enables the persons above and below, to converse together, so as to give and receive orders for shifting the situation of the bell, to lower the grappling-tackle, draw up goods, &c.

The engraving represents a section of the improved bell, the part marked *a*, is the ordinary bell, open at bottom, in which the workmen act, subject to the pressure of the condensed air, as usual, when the bell is under water; *b*, is a close compartment or bell of observation, with glass windows, which has a communication with the atmosphere above, by two pipes, *c* and *d*.

Before the bell is lowered, the director of the work passes through the man hole, *g*, into the bell of observation, *b*, and having closed the man hole air-tight, the bell is allowed to descend, by means of the slinging chain, with the director in the compartment, *b*, and the workmen in the open bell, *a*. When the bell has reached the bottom, the workmen will be subject to the inconvenience of the pressure of the condensed air in the working bell, *a*, but in the close compartment, *b*, the director will be enabled to move about in a common atmosphere, communicated through the pipes, *c*, and *d*, from above.

The director looking out through the windows placed in the sides, the top and the bottom of the bell of observation, seeing the situation of articles lying near the bell, writes upon a slate or other tablet, and holding it up at the window which looks into the working bell, instructs the workmen how to proceed; or if any communication is required to be made with the persons above, he speaks through one of the pipes. Should it be found necessary to give instructions at any length to the workmen, a paper may be passed through the tube *f*, in the side of the compartment *b*, by opening the inner cock, and then closing it, when the workmen opening the outer cock, takes the paper out of the tube, and closes the cock again. If it should be found necessary for the purpose of refreshing the air or ventilating the close chamber, *b*, the cock, *g*, may be opened, and a supply of air taken from the open bell, which is restored by the forcing pump above, through the pipe, *h*. A small aperture, *i*, is made through the lower part of the compartment, *b*, to be furnished with an air-tight sleeve, for the observer to put his arm through, if necessary.

In case one of the workmen should find it necessary to quit the bell, and proceed some distance under water, to gain access to some part of a wreck, which is at a small distance from the bell, such, for instance, as to enter one of the port holes of a ship, he must be furnished with a water-tight hood, enclosing his head; and for the purpose of respiration, this hood must have an air-pipe, forming a communication with the interior of the working bell: such a contrivance is, however, not claimed as new. The improvement therefore proposed, is to adopt a second pipe to the hood, communicating with the chamber of observation, *b*, so as to allow the workmen to converse with the director, and thereby facilitate the business, the pipes being furnished with suitable stop cocks.

The upper part of the figure represents an improvement proposed to be adapted to an ordinary working diving bell; *a*, is the ordinary bell, *h*, is the pipe through which condensed air is to be pumped; *c*, are the chains by which the bell is slung and lowered into the water from a vessel above. To this bell is attached a pipe, *k*, communicating with an air-tight chamber, on the deck of the vessel, or any other convenient place above the water. In this chamber a person is placed, who will, of course, suffer under the same pressure of condensed air that those in the bell are subject to; but the advantage to those in the bell will be, that they are enabled to converse through the pipe with the person above; who, from his situation, can communicate instruction to such persons as are near him. This chamber, has another air-tight chamber, connected with it, into which the person may get through a man hole, and having closed the man hole, so as to render the chamber, still air-tight, he may then open the other chamber, and pass out.

The patentee proposes, as an addition to the last described apparatus, to form a flexible tube of water-proof canvas, or other water-proof material, sufficiently large for a man to pass through; this tube is to be distended by a series of hoops, and being inserted into an opening in the air chamber above, and made fast and air-tight thereto, the tube is to be made fast in like manner to an opening in the working bell, which has been secured by grapples or anchors, for the purpose of forming a ready communication, by means of a rope ladder, between the deck of the ship and the diving bell below.

In order to throw light into the port holes of vessels, or other inaccessible parts, for the purpose of examining between the decks of a wreck, the patentee proposes to construct an optical instrument connected with the diving bell, which shall enable him, by means of a concave reflector and lenses, to throw a strong light from a lamp in any oblique direction. This is not claimed under the present patent, and is not, therefore, particularly described.

In addition to what is above stated, a correspondent has suggested the following. The bell is

1st. *Far more safe*—for instead of depending, as before, upon a system of signals, by strokes of a hammer, there is now invented, not one mode alone of holding conversation with a person above water, but *even a second*.

2ndly. *Far more effective*—As by the construction of Mr. Steele's bell, the bell work can be carried on under the immediate inspection of the directing engineer himself, who can now remain for an indefinite time under water, *at any depth whatever, at which a diving bell can be worked*: without being subjected to endure, even for a moment, the pressure of air in a state of condensation, and at the same time holding constant conversation with the persons above.

The construction of Mr. Steele's patent head-piece, is another application of his principle, for the purpose, not only of detaching men from the bell, *but of enabling them to work within the common diving bell*, (filled, of course, with condensed air) *at depths much greater than can be endured at present.*

We are informed, that a bell has been just made by Mr. Penn, of Blackheath-hill, in which, it is said, Mr. S. intends to make a descent in a short time.

An instrument has been in use for the purpose of viewing objects under water; but Mr. S. by an application of optical principles, has shown the construction of an instrument, not only for viewing them, but for their stronger illumination.

As a subordinate improvement, Mr. Steele, who has had practical experience, recommends the addition of a rim of hemp, or some other tough material, round the bottom of the bell, to diminish the effect of impact, on rocky bottoms, in ground swells, &c. when preparing for blasting, quarrying, &c. &c.

This, the inventor "hopes may become a very powerful instrument in carrying on submarine operations, as it affords a theory, which he ventures to predict, will in time be reduced to practice, of a mode of sending down from the deck to the bottom of the sea, by the same means by which they ascend from the deck to the mast head."

ON THE MAGNETISM OF IRON ARISING FROM ITS ROTATION.

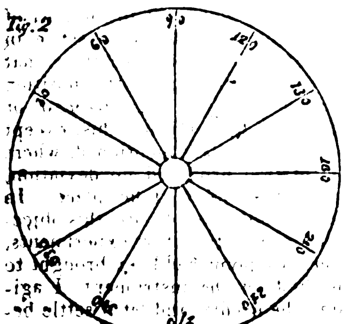
(Concluded from p. 147, No. 150.)

My first object was to find what points on the plate must coincide with the limb, in order that the plate, when its centre was on the meridian, should cause no deviation in the needle; and it was in my attempts to effect this, which at first sight appears sufficiently easy, that I discovered the leading feature in all the phenomena which I am about to describe.

"*General Description of the Phenomena arising from the Rotation of an Iron Plate.*

"In order to find the points which I have mentioned, I adjusted the instrument so that the plane of the fixed limb was exactly in the magnetic meridian, and then brought the other limb into the same plane: the centre of the plate was then on the magnetic meridian, and its plane perpendicular to that plane, as represented in fig. 1, in the title page of our last number. I now made the plate revolve in its own plane about the axis B *b*, and noted very carefully its effect on the needle. In doing this I found that if I placed the plate on the arm, so that a certain point, *c*, for instance, coincided with the plane of the limb, the deviation was different when the same point, by the revolution of the plate, coincided with the limb again. As it appeared by this that the revolution of the plate had an effect upon the needle, independent of the partial magnetism of particular points, I considered that if the plate were made to revolve the contrary way, the deviation ought to be on the opposite side, and this I found to be the case. I will illustrate this by the observations made when I first noticed the effect. The plate was divided at every 30° of its circumference (fig. 2.)

Fig. 2



by lines drawn through the centre, and being placed on the arm, so that 0° coincided with the upper part of the limb, the north end of the needle pointed 10′ east; but when this point again coincided with the limb, by the upper edge of the plate revolving from *west* to *east*, the needle pointed 80′ east: making the plate revolve the contrary way, that is, its upper edge from *east* to *west*, when 0° coincided with the limb, the north end of the needle pointed 28′ west: so that there was a difference of 58′, when every point of the plate had the same position with respect to the needle, according as the plate was brought into that position by revolving from *west* to *east*, or from *east* to *west*. As this appeared extraordinary, I made repeated observations at the time to ascertain that the effect was independent of any accidental circumstances, and found that the results always accorded with the first, the difference caused by the rotation of the plate being however greater or less according to the position of the plate.

"Having fully satisfied myself that, in whatever manner the rotation of the plate might cause this difference, such was really the effect, I next endeavoured to ascertain the nature and degree of the difference, according to the different situations of the centre of the plate. For this purpose I made a great variety of experiments, of which I shall not however here give the details, as I afterwards repeated them in a more convenient manner, and with greater precision; but shall merely point out the nature of them in general, and the conclusions which I at the time drew from them. The instrument being adjusted, and the arm fixed so that the centre of the plate was in the position which I required, I made the plate revolve so that its upper edge moved from *west* to *east*, and noted the greatest and least deviation of the north end of the needle; I then made the corresponding observations when the plate revolved in the contrary direction; a mean of the differences between the two greatest and between the two least

I considered as the effect produced on the needle by the rotation of the plate in opposite directions. Repeating these in a variety of positions, I found that when the centre of the plate was in the magnetic meridian, its plane being always a tangent to the sphere circumscribed about the centre of the needle, the deviation of the needle caused by the rotation of the plate in its plane, was the greatest when the centre of the plate was in the equator, and that it decreased from there towards the poles, where it was nothing;* that when its centre was on the equator, this deviation was the greatest when the centre of the plate was on the meridian, or in longitude 90°, and decreased to nothing in the east and west points, or when the longitude of the plate was 0° or 180°; and that when the centre of the plate was in the secondary both to the equator and meridian, the rotation of the plate, whatever might be its latitude, caused no deviation of the needle. In these experiments, the plate which I made use of was a circular one, 17·88 inches in diameter, and ·099 inch in thickness, weighing 112 oz. The further I had pursued this inquiry, the more I was disposed to attribute the effects I have mentioned to a general magnetic action, arising in a peculiar manner from the *rotation* of the iron; and my next experiments were with a view of ascertaining how far this idea was correct. As similar results might not be obtained with any other plate, I next made use of a plate 12·18 inches in diameter and ·075 inch in thickness, weighing 38·75 oz. and with it obtained results precisely of the same nature, though considerably less in quantity. Another objection which occurred to me was this— that the iron being evidently slightly polarized in particular points, the effect might be supposed to arise from an impulse given to the needle by the motion of these points in a particular direction, and that the directive power of the needle not immediately overcoming the slight friction on the pivot, a deviation might thus arise from the rotation of the plate. Had this, however, been the cause of the deviations, I should have expected that, when the centre of the plate was in the meridian, the greatest effect would be produced with the plate parallel to the horizon, and its centre vertical to that of the needle; but I had seen that the greatest deviation took place when the centre of the plate was in the equator, its plane being perpendicular to it; and the deviation arising from the *rotation*, when the plate was parallel to the horizon, was not a fifth of the deviation when the plate was perpendicular to that plane. Besides it was manifest that if this were the cause, any other impulse would have a similar effect. I therefore made the needle revolve first in one direction, and then in that opposite, by means of a small bar-magnet, and invariably found that it settled at the same point, in whichever direction the impulse was first given, and the results obtained by the rotation of the plate were in these cases of the same nature as before. It was also evident, that if the deviations I have mentioned arose from this circumstance, the needle being agitated after any particular point of the plate was brought to the limb of the instrument, it ought to settle in the same direction, whether that point were brought into this position by revolving from *east* to *west* or from *west* to *east*; but this, except in the cases I have mentioned, where the rotation produced no deviation, was not found to take place. In order wholly to obviate this objection, in all my future experiments, after any point had been brought to the limb of the instrument, I agitated the needle, and let it settle before I noted the deviation.

* I should here mention, that, from the nature of my instrument, I could not make observations at the *north* pole; but as the results, as far as I could observe, were of the same nature on this side of the equator as on the south side, I think I am warranted in concluding, that *at* the *north* pole the results would likewise be of the same nature as at the south pole.

REFRACTIVE POWER OF GASES.

The following table of the refractive power of gases, at the same temperature, and under the same pressure, that of air being taken as unity, is from a memoir by M. Dulong, inserted in the *Annales de Chimie*, xxxi. 154.

	Refractive Power.	Density.
Air	1·	1·
Oxygen	1·924	1·026
Hydrogen	0·470	0·685
Azote	1·020	0·976
Chlorine	2·623	2·470
Oxide of Azote	1·710	1·527
Nitrous gas	1·030	1·039
Muriatic acid	1·527	1·254
Oxide of Carbon	1·157	0·972
Carbonic acid	1·523	1·524
Cyanogen	2·132	1·818
Olefiant gas	2·302	0·980
Gas from stagnant water, Carburetted Hydrogen	1·504	0·559
Muriatic ether	3·720	2·234
Hydrocyanic acid	1.531	0·944
Ammonia	1·309	0·591
Phosgene gas	3·936	3·442
Sulphuretted Hydrogen	2·187	1·178
Sulphurous acid	2·260	2·247
Sulphuric ether	5·197	2·580
Sulphuret of Carbon	5·110	2·644
Proto-phosphuretted Hydrogen	2·682	1·256

The vapours of muriatic ether, sulphuric ether, and sulphuret of carbon, were taken at a degree of density, two or three times less than that corresponding to the maximum relative to each observation. The numbers contained in the preceding table are, therefore, comparable with those of permanent gases. In taking these same vapours at their maximum of density, their refractive powers were found to be as follow:

Muriatic ether	3 87
Sulphuret of Carbon	5·198
Sulphuric ether	5·290

It results, from the researches, that the capacities of bodies for heat, and their refractive powers, do not belong, as has been supposed, to the same order of causes. The capacities have an evident relation to the masses of the molecules; the refractive powers appear to be independent of them. No simple ratio exists between the refractive powers of elementary and of compound substances, even when these properties are observed in circumstances where the molecular action can be most readily compared, and where the form and arrangement of the particles cannot exert any influence.

The variations in the velocities of light passing through the different gases, considered at the same temperature and pressure, appears to depend upon the peculiar electric state of the molecules of each kind of matter. Reasoning on the theory of undulations, which seems to accord best with these new ideas, the velocity of light is more powerfully diminished, according as the molecules are more strongly positive.

BORING FOR WATER.

SIR,—In answer to J. B., in No. 144, I wish to state, that Mr. Thos. Clark, of Waggon Lane, Tottenham, Middlesex, is the person to whom I alluded in No. 130.

Mr. John Goode, of Cambridge, advertised on the wrapper of the "Labourer's Friend," for June, 1822, his prices for boring to be as follow:—

The first 10 feet, 4d. per foot
The second 10 feet, 8d. per foot
The third 10 feet, 1s. 4d. per foot

And so on proportionably for 300 feet, above which the labour was to be charged by the day. An extra price was to be paid for stoney earth; and the boring through rocks and quicksands was to be estimated by the day.

About three years ago, I spent some time in examining the excellent apparatus, by which Mr. Harry Self, of Kingston, Surrey, perforated different strata of earth on the ground of the Duchess of Buccleugh, at Richmond-hill. Some time afterward, I received a note, stating that, after boring to the depth of 252 feet, a supply of most excellent water was obtained, yielding 13 gallons per minute, and rising, as in a fountain, 24 feet above the surface of the earth.

I cannot conclude without expressing to you the high gratification I have derived from observing the communication of J. M. N., on Hydrodynamics, and trust that that gentleman will continue to favour us with further papers on the subject. By so doing, perhaps many other of your intelligent correspondents may be induced to give your readers accounts of such simple contrivances, &c. as have come under their consideration; and which cannot fail, in the end, to give to hydrostatics and hydraulics that importance which they deserve. Indeed, I feel confident that, if this subject were properly discussed in the Mechanics' Magazine, landholders, graziers, farmers, and others, would procure good water on their estates, by boring or other means; and that we should no more read in the newspapers, of mills on small rivulets being stopped for want of water; or of farmers and poor people being compelled to go great distances to procure it, at a time when they should be busily employed in the fields.

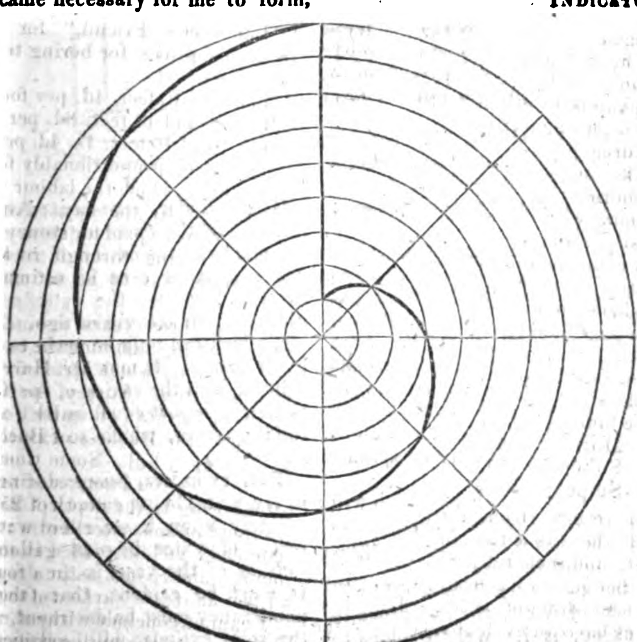
I am, &c. T. W.

To the Editor of the Mechanics' Magazine.

In pursuit of a mechanical object, it became necessary for me to form, what, I believe, watchmakers call a snail; and in the absence of books, and practical men, for information as to the best or true mode of forming it, I adopted the following:—

I drew from one centre, nine circles, the circumferences of which were at equal distances from each other. I then divided these circles by eight radii, at equal distances from each other, and proceeded to draw the snail from the circumference to the centre, as in the diagram annexed. In, however, passing from the radius at which I commenced, to the next radius in succession, I had only my eye for a guide in the formation of the grade, from one circle to another. To have gone to very minute divisions, by increasing the number of circles and radii, would have been only an approximation to truth, and not the true mode. Whether this figure is composed of an infinite number of segments of different circles, or what its character really is, perhaps some of your numerous correspondents will have the kindness to declare, as well as to state the mathematical mode of forming it. I am, &c.

INDICATOR.



ON SPECIFIC GRAVITY.

By ROBERT HARE, M. D. *Professor of Chemistry in the University of Pennsylvania.*

A clear conception of Specific Gravity, is necessary to a comprehension of the language of the most useful sciences and arts. It may be defined, the ratio of the weight of a body, to its bulk.

On the means of ascertaining Specific Gravities.

The object of all the processes for this purpose, is, either to ascertain the weight of known bulk, or the bulk of known weight. When masses are reduced to the same bulk, it is only necessary to weigh them. When they are reduced to the same weight, it is only necessary to measure them. If water were among a number of substances reduced to the same bulk, and weighed, and its weight assumed as an unit, the numbers found, would be the same as those now in use to express specific gravities. The gravity of water has been assumed as the standard, because this fluid may almost always be had, sufficiently pure; and it is generally easy to ascertain the weight of a quantity of it, equal, in bulk, to any other body.

In order to obtain the specific gravity of a body, therefore, we have only to divide its weight, by the weight of a quantity of water equal to it in bulk.

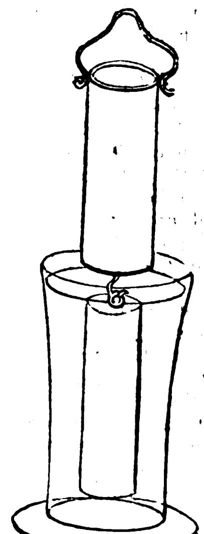
The weight of a quantity of water, equal to the body in bulk, is equal to the resistance which the body encounters in sinking in water. Hence, if we can ascertain, in weight, what is necessary to overcome the resistance which a body encounters in sinking in water, and divide, by this weight, thus ascertained, the weight of the body, we shall have its specific gravity.

In the case of a body which will sink of itself, the resistance to its sinking, is what it loses of its weight, when weighed in water.

In the case of a body which will not sink of itself, the resistance to its sinking, is its weight added to the weight which must be used to make its sink.

Experimental Demonstration, that the resistance which a body encounters, in sinking into any fluid, is just equivalent to the weight of a portion of the fluid, equalling the body in bulk.

This proposition may be experimentally demonstrated, by means of the apparatus, represented by the following figure.



V

The cylinder, represented as surrounded by the water of the vase, (V) is made to fit the cavity of the cylinder suspended over it so exactly, as that it enters the cylinder with difficulty, on account of the included air, which can only be made to pass by it slowly. It must, therefore, be evident, that the cavity of the hollow cylinder, is just equal in bulk to the solid cylinder, which so exactly fits it.

Both cylinders, (suspended as seen in the plate) being counterpoised accurately upon a scale beam; let a vessel of water be placed in the situation of the vase, in the drawing. It must be evident, that the equiponderancy must be destroyed, since the solid cylinder will be buoyed up by the water. If water be now poured into the hollow cylinder, it will be found, that, at the *same* moment *when* the cavity becomes full, the equiponderacy is restored, and the solid cylinder sunk just below the surface of the water.

It therefore appears, that the resistance which the solid cylinder encounters, in sinking in the water, is overcome by the weight of a quantity of the water equal to it in bulk. It must be evident, that the same would be true of any other body, and of any other fluid.

Rationale.

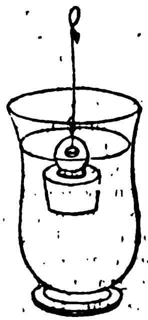
When a solid body is introduced into an inelastic solid, on withdrawing it, a hole is left, which remains vacant of the solid matter: but, no sooner is a body, which has been introduced into a liquid, withdrawn, than the liquid is found to fill up the space from which it has been removed.

It is evident, that the force which liquids exert, thus to re-enter any space within them, from which they are forcibly displaced, is precisely equal to the weight of a quantity of the liquid, commensurate with that space; since, when the space is reoccupied by the liquid, the equilibrium is restored. Consequently, every body, introduced into a liquid, experiences from it a resistance equal to the weight of a quantity of the liquid, commensurate with the cavity, which would be produced, supposing the liquid, frozen about the solid mass, split open so as to remove it, and the fragments put together again: and the cavity also thus created, must obviously be exactly equal to the bulk of the body. It follows, that the resistance which any body encounters in sinking, within a fluid, is equivalent to the weight of a quantity of the fluid, in bulk equal to the body.

To ascertain the Specific Gravity of a body heavier than Water.

Let the body be the glass stopple, represented in the succeeding figure.

First counterpoise the stopple by means of a scale beam and weights, suspending it by a fine metallic wire. Place under the stopple, a vessel of pure water, and lower the beam, so that, if the stopple were not resisted by the water, it would be immersed in that fluid. Add just as much weight, as will counteract the resistance which the water opposes to the immersion of the stopple, and renders the beam again horizontal. Divide the weight by which the stopple had been previously counterpoised, by the weight thus employed to sink it. The quotient will be the specific gravity.



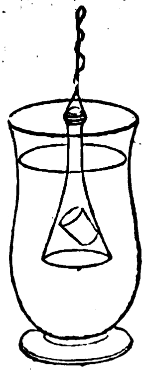
Rationale.

The weight required to sink the stopple, is equal in weight to the bulk of water which the stopple displaces. Of course, pursuant to the general rule, it is only necessary to see how often this weight is contained in the weight of the stopple, to ascertain the specific gravity.

To ascertain the Specific Gravity of a body lighter than Water.

Let a small glass funnel be suspended from a scale beam, and counterpoised so as to be just below the surface of some water in a vase, as in the following diagram.

If, while thus situated, a body lighter than water, a small cork for instance, be thrown up under the funnel, the equilibrium will be subverted. Ascertain how much weight will counteract the buoyancy of the cork, add this to its weight and divide its weight by the sum—the quotient is the answer.



Rationale.

The force with which the cork rises against the funnel, is equal to the difference between its weight and the weight of the bulk of water which it displaces. Of course, ascertaining the force with which it rises, by using just weight enough to counteract it, and adding this weight, so ascertained, to that of the cork, we have the weight of a bulk of water, equal to the bulk of the cork. By this, dividing the weight of the cork, agreeably to the general rule, the specific gravity of the cork will be found.

To ascertain the Specific Gravity of a Liquid.

Let the stopple be counterpoised, exactly as in the last experiment, only that it is unnecessary to take any account of the counterpoising weight.

Having, in like manner, ascertained how much weight will sink it in the liquid, divide this by the weight required to sink it in water, as above. The quotient will be the specific gravity sought.

Rationale.

It has been proved, that the resistance to the sinking of a body in any fluid, is precisely equal to the weight of a bulk of the fluid, equal to the bulk of the body. Ascertaining the resistance to the immersion of the same body in different fluids, is, therefore, the same as ascertaining the weights of bulks of those fluids, equal to the body, and, of course, to each other. And if one of the liquids be water, the weight of this, divided by the weight of the others, gives their specific gravities.

If the stopple be so proportioned, as to lose just 1000 grains, by immersion in water, division is unnecessary, as the weight of the liquid will be obtained in grains, which are thousandths by the premises. A metallic mass, of the same weight as the stopple exactly, may be employed as its counterpoise.

In these experiments, the liquid should be as near 60° of Fahrenheit's Thermometer as possible.

ON THE FABRICATION OF PUZZOLANA, HYDRAULIC CEMENTS, &c.

The following experiments have been made, and the conclusions drawn, by M. le Générale Freussart; they are of considerable importance in their relation to the durability, not merely of edifices constructed in the water, but to the improvement of ordinary mortar.

An alum clay is obtained at Strasburg of a dark colour, but which, heated, passes, by various shades of blue, to a white colour: portions of this earth, of the size and form of a brick, were heated in an alum-furnace in contact with air, whilst other similar portions were heated in a lime-furnace, in which the access of air was diminished by covering the top of the furnace, so that no more should pass than was required for combustion; this was repeated several times, and portions being taken from the two furnaces, which, by their colour, appeared to have undergone equal calcination, mortars were made with them, one part of good common lime, and two parts of the pulverized clays being used. On examination, it was found, that the mortar specimens containing the clay calcined in the alum-furnace, hardened in the space of two or three days, and, after a year's immersion in water, supported weights from 192 to 263 killogrammes before they broke, whilst the others required 30 days before they were hard, and broke with weights from 20 to 25 killogrammes. Some of them were soft even after a year's immersion in water.

A clay from Holzheim, near Strasburg, which contains no lime, but much iron, was formed into two bricks, two hundredths of lime having been introduced into one of them; they were calcined in a lime-kiln, with as little access of air as possible. A large Hessian crucible was pierced at the bottom, and then divided internally into two chambers, by an upright slate full of holes: into one chamber was put pure Holzheim clay in pieces; into the other, pieces of the clay mixed with two per cent of lime: the crucible was placed on the bars of a reverberatory furnace, so as to obtain a strong current of air through it and about the clay, and was then heated. In six hours, it appeared by the colour, that the crucible-clay was equally calcined with that from the lime-kiln; finally, these four specimens were powdered, and being mixed with half their weight of common lime, was made into mortar, and then put into water. The specimen containing the clay heated in the lime-kiln, required 30 days before it hardened; that containing the clay, with two per cent of lime, heated in the lime-kiln, hardened in 17 days; that containing the unmixed clay from the crucible, hardened in five days; and that mixed with two per cent of lime from the crucible, hardened in three days.

From these experiments it is concluded, that the air exerts great influence in the calcination of clay, and M. Freussart considers the effect as exclusively produced on the alumina. In consequence of this opinion, he calcined alumine in a current of air, and another portion in a lime-kiln, and then mixed them with lime made from white marble; the first hardened much quicker than the latter; and it was observed, also, that the alumine calcined in the air, dissolved more rapidly in sulphuric acid, than that from the lime-kiln. M. Freussart even concludes, that, at a high temperature, the alumine in clay absorbs oxygen, and that it is this change which renders it more competent to combine with lime in the humid way.

In consequence of these experiments and views, it is proposed that when the artificial puzzolanas are to be made, smooth clays, containing a little lime, should be taken, made into bricks, and calcined with free admission of air. Before undertaking large operations, it will be well to heat small portions, for different periods of time, in a reverberatory furnace, for the purpose of ascertaining the most advantageous degree of calcination. The method of trial, is to reduce these clays to fine powder, and to make them into mortars, with half their bulk, or rather less, of common lime; these mortars are to be put into glasses, and after having assumed a degree of consistence, by ten or twelve hours' exposure to the air, are to be immersed in water. If, at the end of three or four days, the mortars be so hard as not to receive an impression when strongly pressed by the thumb, as will be the case with puzzolanas or natural terras, it is a proof that a good artificial puzzolana has been formed.

It may be observed, that in the preparation of mortar to be exposed to air, expensive cements are frequently used, which are of no advantage. Experience has shewn, that all those cements which have not the property of making common lime harden under water, produce no other effects in mortars exposed to the air, than so much sand; whilst those which make common lime harden readily under water, produce excellent mortars in the air. Before they should be employed, therefore, in such cases, they ought to be tried as to their power of producing hydraulic cements.—*Ann. de Chim.* xxxi. 243.

To the Editor of the Mechanics' Magazine.

Sir,—In answer to a "Constant Supporter of the Mechanics' Magazine," I have, since his inquiry, made use of muriatic acid, for the purpose mentioned by him. The instant it was applied to the frame, the paint, which I think much harder, and adheres more closely to the glass than the putty, blistered, and was easily removed. The putty also was rendered so soft, that it was removed by a sharp chisel or knife, and admitted of the glass being taken out.

I am, &c.

W. C.

Winchester.

ILLUMINATING APPARATUS.

For the purpose of rendering distant stations discernible by night, during the trigonometrical survey which is now in progress, Lieutenant Drummond has constructed an instrument in which a globule of quick lime is exposed to the flame of alcohol, urged by oxygen gas in the focus of a parabolic reflector. The lime under this treatment, where the experiment is made in the most perfect manner, emits a light eighty-three times as intense as that given out by the brightest part of the flame of an Argand lamp; and this concentrated and reflected by the mirror, has enabled the officers employed in the survey, to connect very distant stations in the night-time, in the most satisfactory manner.

COILED SPRING.

SIR,—May I inquire, through the medium of the Mechanics' Magazine, where I can get made, cheap and well, a barrel containing a coiled spring, similar to that which gives motion in an eight-day clock? The barrel that I require, must be nearly a foot in diameter, and the spring much stronger than that of a clock.

I am, Sir,

F. B.

ON COMMON FIRE-PLACES.

SIR,—Little progress has yet been made in applying philosophical facts to the improvement of dwelling houses. I have heard of grates and stoves contrived to admit air, for the support of combustion, near to the fire, by a communication from without the house, in order to avoid the common currents crossing the room from the doors and windows; but I cannot learn where such are to be purchased. I should be glad to know further, what is the best mode of getting rid of the foul air of an apartment, as fast as it is formed by the respiration, &c. of the persons in it. Some vent near the top of the room seems necessary.

Your's, &c.

M. A. CORIN.

Mr. Corin is referred to No. 147, where he will find a description of a fire-place, by Dr. Arnott.

ANCIENT VASES.

(Concluded from p. 155, No. 150.)

From certain marks to be observed in the paintings and varnish of vases, it may be inferred that the black paint has not always been applied once only, but sometimes repeatedly. The first coating is not always accurately covered by the succeeding one; nor is it rare to find different shades of colour in the same vase. The parts of vases not covered by the black varnish very frequently are of a red colour, which is darker than the peculiar colour of baked clay, and has also a certain degree of lustre; properties which have probably been produced by a single application of a thin varnish.

In vases whose figures are of a black colour, the outlines have first been drawn with a pencil, and the minor parts of the figures then fill d up with paint; a mode of painting which is plainly discernible, for example, in some Locrian vases.* In vases which have red figures upon a black ground, a similar mode of painting is often observable. In them, the outlines of the figures are covered with diluted paint, and the filling up of the black ground is then perfected.† In some vases, the ground-colour does not completely touch these outlines; in some others, the ground-colour passes over the outlines here and there; sometimes connexions of the outlines are

* *Rossi*, First Letter to M. Millingen. Peint. Ant. p. lv. *Jorio*. loc. cit.

† *Jorio*, loc. cit., p. 13.

observed;* defects which clearly show the mode of painting. It may also be recognised by the circumstance, that the black colour is less intense in the places where the outlines have afterwards been covered by it than in the other parts.† According to the observation of *Meyer*, a first shading of the paintings with a red pigment, is rarely seen.‡ In some vases, it is obvious that the outlines of the figures have been cut out with some sharp instrument. Instead of cut lines, dotted ones sometimes, occur.§ *Jorio* has observed, that, in some vases, it is evident that the figures have been first painted naked, and afterwards covered with the drapery;—a mode of painting which was much in use even in the time of *Raphael*.

In vases with red figures upon a black ground, the internal delineation of some parts of the figures being of a deep colour, have undoubtedly been made last. After the laying on of the black paint has been executed, other colours have sometimes been added to the paintings, as has already been noticed above. All the paintings of the ancient Grecian vases have been done with a very fine pencil. If the black varnish has, in reality, been made in the manner above described, the greatest quickness has been requisite in applying it, according to the experiments described by me; and, therefore, the nicest address in the workman. A blunder committed, if it could not be covered over, was irreparable. Although a wonderful steadiness and sureness of hand is manifest in the paintings of vases, yet blemishes produced by haste are not unfrequently seen.

We are, in the *third* place, to treat more especially of the operations required, after the application of the paints for finishing the paintings.

We have shown above, that it is probable vases have not, after being first covered with a coating of varnish and other pigments, been again baked, like our modern glazed earthen-ware. Consequently, no further operations were necessary for finishing them. In some vases, however, engraved delineations occur, which penetrate through the black varnish, and present the clay colour of the base; in others, similar lines are seen, which pass through the pigments laid upon the black varnish, and lay the latter bare. These ornaments, which are of rare occurrence, could only have been produced, after the pigments had been applied, by means of a sharp stile.

In some vases, there occur letters either painted or cut out with a sharp instrument, which either exhibit the name of the painter, or notify the object of the painting.

The painted letters have been done in various ways.* 1. In the most ancient vases they are black, upon a red ground. 2. In more recent ones, the ground on which they are laid is sometimes white or red; or, 3, In the same manner as the figures, they are circumscribed by a black ground, and have the colour of burnt clay. The engraved letters upon some of the more ancient vases are found either in the red ground, or in the black varnish.

* *Rossi*, loc. cit., p. vi.

† *Rossi*, loc. cit., p. iv.

‡ *Boettiger's* Vasengemalden, i. p. 58.

§ Sul Met. d. Ant. nel dipingere i. Vasi, p. 10.

* *Jorio*, loc. cit., p. 16.

STEAM WHEEL.

SIR,—Will you permit me to ask G. C. (page 133, vol. 4,) who, I suppose, is an engine-maker, or a worker in the trade, what he will charge for a small working model of his steam wheel? May it be used with safety? I do not mean, may the model be used with safety, but a large wheel, when applied to machinery, and in full action? I think such apparatus would be an excellent addition to a lathe.

I am, &c.

F. B.

To the Editor of the Mechanics' Magazine.

SIR,—Some time since, I saw in your valuable magazine, a question to the following effect:—If a leaden bullet be dropped from the mast-head, when a ship is in full sail, will it fall at the bottom of the mast, or at the stern of the vessel? At first, one would be disposed to say, that, as the ship is in full sail, the ball would fall nearer to the stern than to the mast; this, however, is not the fact. It appears to me, that the ball is under the influence of two forces;

the one perpendicular by the power of gravity; the other, horizontal, from the agitation of the air by the motion of the vessel; and that it is this latter force which directs the ball to the foot of the mast.

I am, &c.
VALEDICO OPIFEX.

TELESCOPES.

Mr. Tully, of Islington, has constructed an Achromatic Telescope, the largest and most perfect yet made in England. The object-glass of the telescope is seven inches in diameter. The glass was manufactured at Neufchatel, Switzerland, and cost about 80l. the grinding and adjusting of it by Mr. Tully, are valued at 200l. viz. for the compound object glass alone. The length of the Telescope is 12 feet; it is mounted on a temporary wooden case, and is supported on a frame, moved by pulleys and a screw; it is easily adjusted, and is perfectly steady. The magnifying powers range from 200 to 780 times; but the great excellence of the telescope consists more in the superior distinctness and brilliancy with which objects are seen through it, than in its magnifying powers. With a power of 240, the light of Jupiter is almost more than the eye can bear, but his satellites appear as bright as Sirius, but with a clear and steady light; and all the belts and spots upon the face of the planet, are most distinctly defined. With a power of near 400, Saturn appears well defined, and is one of the most beautiful objects that can well be conceived. The great advantage which this telescope possesses over reflecting telescopes of an equal size, is the greater degree of light by which the delicate objects in the heavens are rendered distinct and brilliant. England had the honour of discovering the principal of the achromatic telescope; but our artists have ever had great difficulty in obtaining suitable glass for the purpose; and the excise laws have hitherto prevented proper experiments being made at our glass-houses. An establishment has been recently formed, in Surrey, for the manufacture of glass for achromatic telescopes, under the superintendence of men of science, and with permission to make experiments without the interference of the excise.

TOMPIAN THE MECHANIST.

A discovery has lately been made of the chef d'œuvre of the celebrated Tompian, which has been so long lost. It was made for "the Society for Philosophical Transactions," and is a year-going clock. Tompian was at work on this clock when the great plague broke out in London; and on the day he finished it, he himself was attacked with the pestilence, of which he died. Tompian was paid one hundred guineas ere the clock was removed to the Society's house, and there, in the confusion of the moment, it was placed in a lumber-room, where it lay, without a case, exactly a century and a half.

IRON STEAM VESSEL.

An Iron Steam Vessel, for navigating the river Savannah, between Columbia and Northumberland, is being built in New York. It is 60 feet long, nine feet wide, and three feet deep; its weight is five tons, and it is supposed, that it will draw five inches of water, and one more for every ton of freightage. The total expense will not exceed 600l. comprising the steam-engine, which weighs 4000 lbs. The wood for the construction of the cabins and the deck, is 2600 lbs. weight, and 3400 pounds weight of iron is used for the carcase of the vessel.

MERCANTILE IMPORTANCE OF SNAILS.

M. de Martens states, that the

annual export of snails, *(Helix pomatia)* from Ulm, by the Danube, for the purpose of being used as food, in the season of Lent, by the convents of Austria, amounted formerly, to ten millions of these animals. They were fattened in the gardens in the neighbourhood. This species of snail is not the only one which has been used as food; for, before the revolution in France, they exported large quantities of the *Helix Aspersa*, from the coast of Aunis and Saintonge, in barrels for the Antilles. This species of commerce is now much diminished, though they are still sometimes sent to the Antilles and Senegal. The consumption of snails is still very considerable in the departments of Charente Inferieure and Gironde. The consumption in the isle de Rhé alone, is estimated in value at 25,000 francs; and at Marseilles the commerce in these animals is considerable. The species eaten are *Helix Rhodostoma, H. Aspersa,* and *H. Vermiculata.* In Spain, in Italy, in Turkey, and the Levant, the use of snails as food is common. It is only in Britain that the Roman conquerors have failed to leave a taste for a luxury, which was so much used by the higher classes in ancient Rome.

WOODEN BUILDINGS PRESERVED FROM FIRE.

Professor Fucks has proposed to effect this desirable object, by an anti-combustible composition, thus prepared:

10 parts potass or soda
15 parts flinty sand

melted together, with one part of charcoal. This mass, being dissolved in water, applied alone, or with a further portion of earthy matter is said to render wood perfectly fire-proof. This process might, probably, be advantageously adopted in wooden buildings, or where much wood is used by the builder.

PAPER CLOCKS.

Among the curious inventions of French ingenuity, clocks made of paper claim at present no small share of public attention. The invention is said to be a great improvement on metallic machinery, the paper time-pieces being light, portable, cheap, simple in their movements, and never requiring oil. The price is about fifty francs, and they will run about thirty hours without winding up.

INQUIRY.

Can any of your Correspondents inform me, how solid articles, such as ink-stands, counters, &c. can be made of rice, like those brought from India? These are heavy and smooth, but not so hard as many common stones.

LIST OF PATENTS FOR NEW INVENTIONS.

To Daniel Dunn, of King's Row, Pentonville, in the parish of St. James, Clerkenwell, in the county of Middlesex, manufacturer of essence of coffee and spices; for an improvement or improvements upon the Screw-Press, used in pressing of Paper, Books, Tobacco, or Bale Goods; and in the expressing of Oil, Extracts, or Tinctures; and for various other purposes, in which great pressure is required. Dated May 23, 1826.—To be specified in six months.

To Thomas Hughes, of Newbury, in the county of Berks, miller; for improvements in the method of restoring foul or smutty Wheat, and rendering the same fit for use. Dated May 23, 1826.—In six months.

To Thomas Molineaux, of Stoke St. Mary, in the county of Somerset, gentleman; for an improvement in machinery for spinning and twisting Silk and Wool; and for roving, spinning, and twisting Flax, Hemp, Cotton, and other fibrous substances. Dated May 23, 1826.—In six months.

To Thomas Parrant Birt, of the Strand, in the county of Middlesex, coachmaker; for certain improvements on, or additions to, Wheel Carriages. Dated May 23, 1826.—In two months.

To John Parker, of Knightsbridge, in the county of Middlesex, iron and wire fence manufacturer; for certain improvements on, or additions to, Park or other Gates. Dated May 23, 1826.—In six months.

To Dominique Pierre Deurbroucq, of Leicester Square, in the county of Middlesex, Esq.; who, in consequence of a communication made to him, by a person residing abroad, is in possession of an apparatus adapted to cool Wort or Must, previous to its being set to undergo the process of Fermentation; and also for the purpose of condensing the Steam arising from Stills, during the process of distillation. Dated May 23, 1826.—In six months.

To William Henry Gibbs, of Castle Court, Lawrence Lane, London, warehouseman, and Abraham Dixon, of Huddersfield, in the county of York, manufacturer: for a new kind of Piece Goods, formed by a combination of threads, of two or more colours; the manner of combining and displaying such colours, in such piece goods, constituting the novelty thereof. Dated May 23, 1826.—In two months.

To Joseph Smith, of Tiverton, in the county of Devon, lace manufacturer; for an improvement on the Stocking-Frame; and an improved method of making Stockings, and other goods usually made on the Stocking-Frame. Dated May 23, 1826.—In six months.

To John Loach, of Birmingham, in the county of Warwick, brass-founder; for a self-acting Sash-Fastner, which fastening is also applicable to other purposes. Dated May 23, 1826.—In six months.

To Richard Slagg, of Kilnhurst Forge, near Doncaster, in the county of York, steel manufacturer; for an improvement in the manufacture of Springs, chiefly applicable to Carriages. Dated May 23, 1826.—In six months.

To Louis Joseph Marie, Marquis de Cambis, a native of France, but now residing in Leicester Square, in the parish of St. Martin in the Fields, and county of Middlesex; who, in consequence of a communication made to him, by a certain foreigner residing abroad, is in possession of certain improvements in the construction of Rotatory Steam-Engines, and the apparatus connected therewith. Dated May 23, 1826.—In six months.

To James Barlow Fernandez, of Norfolk Street, Strand, in the county of Middlesex, gentleman; for certain improvements in the construction of Blinds or Shades, for Windows, or other purposes. Dated May 26, 1826. —In six months.

To Robert Mickleham, of Furnival's Inn, London, civil engineer, and architect; for certain imp ovements in En gines moved by the pressure, elasticity, or expansion of Steam, Gas, or Air; by which a great saving in fuel will be effected. Dated June 6, 1826.—In two months.

To Henry Richard Fanshaw, of Addle Street, in the city of London, silk embosser; for an improved Winding Machine. Dated June 13, 1826.—In six months.

To John Ham, late of West Coker, but now of Holton Street, Bristol, in the county of Gloucester, vinegar maker; for an improved process for promoting the action of the Acetic Acid on Metallic bodies. Dated June 13, 1826.—In six months.

To Thomas John Knowlys, of Trinity College, Oxford, Esq.; who, in consequence of a communication made to him by a certain foreigner, residing abroad, is in possession of a new manufacture of Ornamental Metal or Metals. Dated June 13, 1826.—In six months.

NOTICES

TO CORRESPONDENTS.

The profundity of knowledge evinced by A. S. or rather *ASS*, is really *astonishing!!!* Perhaps he will devote some portion of his *valuable* time to an elucidation.

MANX's satire is well directed; for his good wishes he has our thanks; we hope to hear from him again.

The motto from O. G. shall appear in due course; he is requested to continue his favours.

A communication from "A YORKSHIRE FARMER" shall appear in our next; as also shall several other communications, which have been unavoidably postponed.

Communications have been received from F. E. F. ATKINSON—R. B.—W. H. J.—G. B.—O. S.—and H. W. B.—the whole of which shall meet with due attention.

Communications (post paid) to be addressed to the Editor, at the Publishers', KNIGHT and LACEY, 55, Paternoster Row, London.

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Mechanics' Magazine,

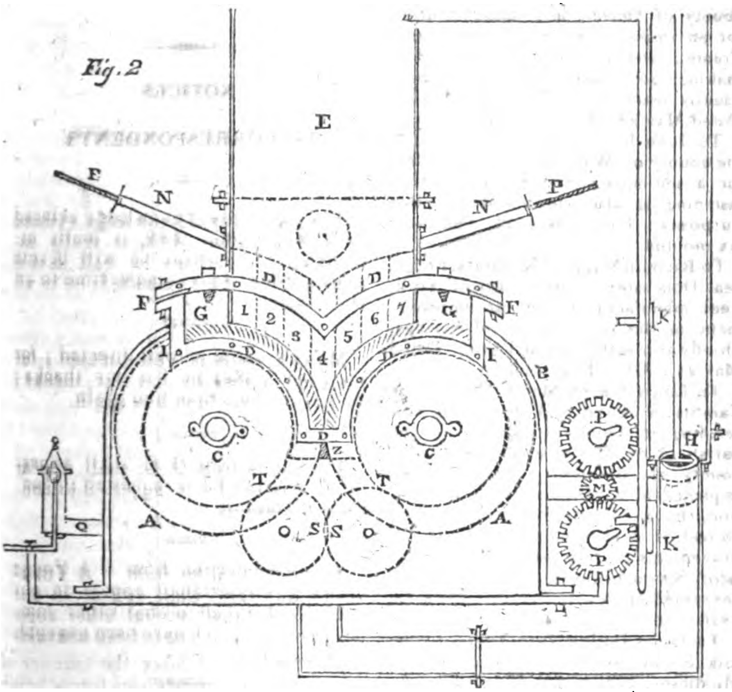
MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 152.] SATURDAY, JULY 22, 1826. [Price 3d.

"The vulgar have always regarded new, bold, and grave conceptions, which were above the ordinary capacity, as mere speculations and wild theories. Whatever is good, useful, and of general application, was at first new, and above the comprehension of the multitude, and was, no doubt, deemed impossible, before it was discovered and practised." "Men," says Bacon, "do not appear to know their own stock and abilities, but fancy their possessions greater, and their faculties less than they are."

(ART OF EMPLOYING TIME, 1822.)

ROTARY STEAM ENGINE.



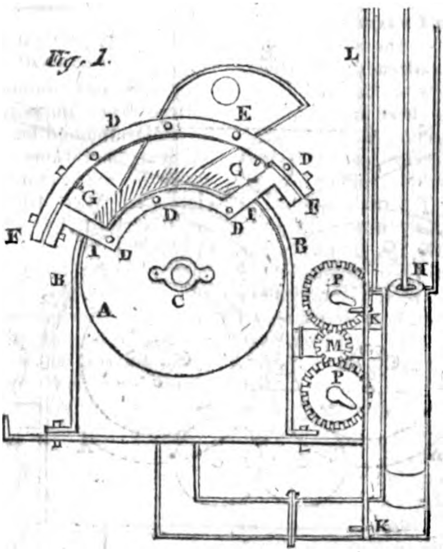
MR. EDITOR,

The opinion of any of your enlightened correspondents on the annexed figures I shall esteem a favour.

Fig. 1 is a sketch of a rotary steam-engine. The letter A represents a bucket-wheel, similar to that used when water is the motive power, but of a very fine pitch, say 2½ inches. The depth of the bucket may be made one inch, its thickness ¼ of an inch, the thickness of the shrouding one inch, and the diameter and width of the wheel according to the power required. In order to obtain great truth, the wheel should be turned on both sides the shrouding, and also on the periphery. This wheel is to be inclosed in a case of metal, B B, which is cast whole with the exception of the pieces which cover the openings, to admit of the insertion of the wheel, &c. at the top and bottom, and the stuffing-box. The bottom of the case is flanched round, and is packed and screwed down upon the bottom air-tight, and is filled with water for injection.

The wheel being bored and screw-tapped, the axis is put into it through the stuffing-box, C, and when seated is stayed in its place by a split-key wedge. The gudgeon on this end of the axis works in a seat inside the case. D D D are flanches on both sides the case, each projecting inwards about four inches. The case being so much wider than the wheel, the curve of the flanch rises about one ½ of an inch above the inner circle of the shrouding of the wheel.

E is a steam-box. The bottom or open part is nicely adjusted to the periphery of the wheel, the outside of the box forming a true facing with the outside of the shrouding of the wheel. D D, two side flanches on the steam-box, projecting outwards four inches, and forming a true facing with the outside of the wheel case. The flanches on the other two sides of the steam-box extend forward to the cap flanches on the top of the case, at F F, and are screwed down steam-tight, which supports the steam-box. The shrouding of the wheel moves through a niche in the lower part of the cap flanch, at I I.



The openings across the wheel, at G G, are packed with soft metal nicely fitted into the spaces, the length corresponding with the width of the wheel: the under side of the packing is fitted with great truth to the periphery of the wheel, and the whole is kept steady by screws through the flanch above. Against the shrouding of the wheel, steam-box, and the ends of the aforesaid metal packing, platted gaskin and loose hemp would answer the required purpose, and might be kept in its place by screws through the side caps, which must be put on after the manner of steam-tight joints. These joints being put well together, no steam can escape outside; the inside of the packing-box might be filled with oil.

The pump piston rod works through a stuffing-box at H, having on each side the box a half circle valve. At L is a rod connected with the beam of the pump piston; upon which is fixed two catches, K K, which alternately strike the two levers upon the two toothed wheels, PP, and these take into the small pinion M, which pinion moves a cock within the pipe that connects the wheel case and pump-barrel with each other. The plunger being now at the bottom, ready to ascend, the upper catch, K, takes up the lever, which closes the cock, and the foul air contained in the top of the barrel is driven through the valves before the water. When the piston begins to descend, the bottom catch strikes the lever on the lower tooth wheel, and opens the cock to admit a fresh portion of air from the case, which is again driven through the valves at every stroke the plunger makes.

Quere. Will not the same power be obtained with shallow buckets as with deep ones, and produce a great saving of steam?

Figure 2, is a *Conspiring Power Engine*, which is the same as the Rotary Engine already described, except in some few particulars. First, within this case there are two metal wheels, the gudgeons of which work in seats inside the case, save the shaft working through the stuffing box, C. At S S and T T, are two toothed wheels and pinions, uniting the power of both wheels, leaving only one stuffing box to keep in order. At E is a pentrough fitted to the periphery of both wheels, which is connected with the wheel case, and packed in the same manner as the other engine. The dotted lines and figures 1, 2, 3, &c. are partitions cast in the bottom part of the pentrough. On the top of these partitions, on each side, is a flanch or rabbet, for the two shuttles or slide valves, at N N, to work in, which are moved by screws through the ends of the boxes P P. At Q is a gas burner.

The two wheels are each six feet in diameter and five feet in width, turned to great truth, so that they touch each other at their periphery, e. The pump the same as the other engine. The pentrough, five feet square and 12 feet deep, is filled with water, oil, or quicksilver, and a vacuum is formed in the wheel-case by the burning of gas, or by steam, or by any other known method.

Quere. With this additional weight of the atmosphere, will this machine be able to move? If it should go, will the pump or pumps again supply the pentrough and also preserve the vacuum already formed?

I feel confident that the double wheel would act well with steam, with a nice adjusted packing at Z, just below where the wheels' periphery touch each other. The packing might easily be kept in order, to prevent any steam escaping betwixt the wheels, otherwise than through the buckets. I am also of opinion that the packing could be easily and effectually managed, and take up as little power as in a steam cylinder.

I am, Sir,
Your humble Servant,
A YORKSHIRE MILLER.

June, 1826.

LIEUT. DRUMMOND'S GEODESICAL INSTRUMENTS.

In our last number, we briefly noticed the improvements which lieut. Drummond has effected in geodesical operations. In the paper which he read before the Royal Society, on May 4th, two methods are described, by which geodesical operations may be facilitated to a very considerable extent,—the one applicable by day, the other by night. The first, which consists in employing the reflection of the sun from a plane mirror, as a point of observation, was first suggested by Professor Gauss; and the result of the first trials made in the survey of Hanover, proved very successful. Recourse was had to this method on some occasions that occurred in the trigonometrical survey of England, where, from peculiar local circumstances, much difficulty was experienced in discerning the usual signals.

Even as a temporary expedient, and under a rude form, viz. that of placing tin plates at the station to be observed, in such manner, that the sun's reflection should be thrown towards the observer at a particular time, the most essential service was derived from its use; and the consequence was, the invention of a more perfect instrument, of which a description is given, accompanied by a drawing.

The second method consists in the

exhibition of a very brilliant light at night. At the commencement of the survey of England, General Roy had recourse, on several occasions, and especially in carrying his triangles across the channel, to the use of Bengal and white lights; for these, parabolic reflectors illumined by argand lamps was afterwards substituted as more convenient; but from want of power they appear, in turn, to have gradually fallen into disuse. With a view to remedy this defect, a series of experiments was undertaken by Mr. Drummond, the result of which was, the production of a very intense light, varying between 60 and 90 times that of the brightest part of the flame of an argand lamp.

This brilliant light is obtained from a small ball of lime, about three-eighths of an inch diameter, placed in the focus of the reflector, and exposed to a very intense heat, by means of a simple apparatus, of which he has given drawings, with a description. A jet of oxygen gas, directed through the flame of alcohol, is employed as the source of heat. Zirconia, magnesia, and oxide of zinc, were also tried; but the light emanating from them, was much inferior to that from lime. Besides being easily procured, the lime admits of being turned in the lathe, so that any number of the small focal balls may be readily obtained, uniform in size, and perfect in figure. The chemical agency of this light is remarkable, causing the combination of chlorine and hydrogen, and blackening chloride of silver. Its application to the very important purpose of illuminating light-houses is suggested; especially in those stations where the lights are the first that are made by vessels arriving from distant voyages.

Both the methods now described, for accelerating geodesical operations, were resorted to, with much success, during the last season in Ireland; and on one occasion, where every attempt to discern a distant station had failed, the observations were effected by their means, the heliastat being seen during the day, when the outline of the hill ceased to be visible, and the light at night being seen with the naked eye, and appearing much brighter and larger, at the distance of 66 miles, than a parabolic reflector, of equal size, illuminated by an argand lamp, and placed nearly in the same direction, as an object of reference, at the distance of fifteen miles.

COLOUR OR TRINKET GOLD.

Cupidity and ignorance have often issued in commerce, under different names, a multitude of more or less noxious substances, to which extraordinary properties have been attached; and the credulous people, having no suspicion of the dangerous qualities which these substances often possess, in a very high degree, and according to which, they exert a specific agency, are frequently exposed to the most serious accidents. Secret preparations of this kind, cannot be too well made known, nor can too much publicity be given to their composition, and the analysis that may be made of them; the knowledge of the results of which, may be so eminently useful to society. The powder which the trinket manufacturers of Paris used to apply for the purpose of colouring gold, was composed of marine salt, nitrate of potash, and alum; but, for some time back, another substance has been vended, the composition of which is different. This powder is of a dirty white colour, having a tinge of red, its taste is salt, and like that of common sea-salt, but it leaves a disagreeable metalic taste in the mouth, and it sensibly detracts moisture from the air. Its analysis has furnished the following results:—Twenty grammes of it have yielded

of pure white oxide of arsenic	2·135
alum, with a base of potash	4·190
marine salt	13·560
oxide of iron and argil	0·115
grammes	20

If this powder be really used for colouring gold, as I have been assured, the oxide of arsenic, I should think, can have no effect in that way.

M. J. L. Casaseca.

Note by M. D'Arcet.—I have several times had occasion to examine the saline composition known under the name of *colour*, which is employed by the townen for giving to trinket gold, the beautiful yellow colour of fine gold. The following is the result of my analysis in round numbers:—

saltpetre	40
alum	25
sea-salt	35
	100

I was not aware that any change had been made in the composition of this mixture. If the powder examined by M. Casaseca, be now used for colouring gold, it can only have been adopted of late, and since fashion has introduced the taste, and rendered necessary the employment of variously coloured alloys of gold with silver, copper, iron, antimony, and platina. M. Casaseca's observations appear to me, to be very important, and, without doubt, induce authorities to adopt measures of administration for obliging the persons who prepare, vend, or employ the new composition in question, to employ all the necessary precautions against the danger, arising from the use of a mixture containing so much oxide of arsenic. *Annales de Chemie.*

NEW, EFFECTIVE, SIMPLE, AND CHEAP LIFE-PRESERVER, OR CORK NECK COLLAR.

The invention of this most simple means of sustaining the human body in water, was introduced to the public in the following letter, inserted in the *Liverpool Mercury*.

I have for many years past paid considerable attention to various inventions, which, under the name of Life-preservers, have been from time to time recommended to the notice and adoption of the public; and have often regretted, that none of the methods which I have yet seen, or of which I have met with any description, completely answers the purposes for which it was intended. If the apparatus has succeeded in effectually supporting the body in the water, it has often proved unweildy, or tedious in its application, liable to get out of order, or to be spoiled by accidents, which are very likely to arise where life-preservers are required. Independent of these defects, which more or less attach to all the life-preservers hitherto invented, I have found not one of them which does not impede the progress through the water, a circumstance of great consequence, when the person who resorts to them is a swimmer.

I have at length succeeded in producing a life-preserver, which combines, in an eminent degree, all the requisites which I have enumerated. It supports the body in the water in the most convenient position—leaves the arms of the wearer perfectly at liberty—is not able to get out of order—may be adjusted in a few seconds; nor does it in the least impede the progress of a swimmer who wears it. It may also be used, on an emergency, without taking off any part of the clothes; as it will sustain a man with his ordinary dress, watch, and the contents of his pocket. Lastly, it is so cheap, and so easily obtained, that it (the materials of which it is formed) may be purchased for a few shillings, unless a silk covering, or some other unnecesssary appendage be adopted; and any person can make his own preserver, although it would, certainly, be better and more expeditiously done by a corkcutter.

I am aware that many persons will be apt to think I have promised too much; but if they will have the patience to peruse the whole of this letter, I feel confident that they will alter their opinion.

It was not until Tuesday last, that I made my first experiment with the new Collar, for so I mean to call it. The trial succeeded beyond my most sanguine expectations, and the short experience I have since had of its utility, warrants me, at this short notice, in saying all that I have advanced in its favour;—nor do I hesitate to add, that if the unfortunate passengers of the Alert packet had been furnished with this simple apparatus, not one of them would have perished. This reflection has such weight with me, that I have taken this method of making the invention (if so simple a thought deserves the name) as generally known as possible; and I hope that the editors of newspapers will deem the suggestion of sufficient importance to deserve their notice.

Before I describe the Swimming Collar, I shall briefly revert to the defects of some of the life-preservers now in use. The common swimming corks used by boys, as they are generally worn, are dangerous;—they are apt to shift; and persons wearing them have been drowned by the connecting rope getting round the waist, or under the knees, which has brought the head under water, instead of keeping it above it. They are also very ill adapted for teaching the wearer to swim, or enabling those who can swim, to make their way with facility through the water. This defect arises from the manner in which they are fixed under the arm-pits, which brings the broad surface instead of the edge of the cork in opposition to the water.

Those life-preservers, the principle of which depends upon the buoyancy of air, confined in water-tight canisters of thin metal, or in water-proof canvas or linen bags, while they are liable to the defects of the common arm-corks, are, at the same time, still less to be depended upon; the puncture even of a pin will render them entirely useless.* They also materially retard the swimmer, as they greatly augment the superficial surface to be moved through the water, and, of course, in the same degree, increase the resistance. It is also very often difficult for the wearer of this kind of apparatus to preserve his proper position in the water; he is apt to roll about; nor has he the free use of his arms, which, as regards himself, and others whom he may be desirous of assisting, is a matter of the first consequence. Life-preservers of this description, generally speaking, require also too much time in adjusting; and, lastly, they are perishable, and so dear, as not to be generally accessible.

I shall now proceed to describe the very simple apparatus which it is the object of the present letter to recommend.

Fig. 1

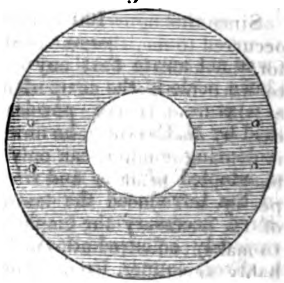


Fig. 1 is a collar of the thickest cork-wood, varying in diameter according to the quantum of buoyancy required. A cirular hole is cut out just sufficiently large to admit the head. The four white dots are four holes, made in the collar, for the bandages to pass through. These bandages, which may be of very strong tape or cord, must be passed over the shoulder behind, then under the arm-pits, and tied in a bow in front.—As the most approved mode of fastening the collar is not yet ascertained, I shall pass over that immaterial circumstance until a few more trials shall have determined the point. The collar, with which the first random experiment was made, is nineteen inches in diameter, two inches thick in the thickest part, the central hole nine inches in diameter, and the whole weighs only two pounds and three quarters. This collar supported me without any exertion on my part, and with my arms entirely out of the water. A young gentleman also hung upon me in the water, and the collar sustained us both without motion on our parts, either of the hands or feet; and I have not a doubt that a collar of similar thickness, and of two feet diameter, would keep afloat three persons.

A person may swim nearly as well

* On Saturday last, a young gentleman, had on, in the floating bath, one of the air-blown preservers, the air from which escaped while he was crossing the bath; and if he had not caught hold of a rope he would have sunk.

with the simple apparatus as without it; nor is this at all improbable, as the weight of the body being neutralized by the buoyancy of the cork, the whole exertion of the arms is applied to propelling the swimmer forwards. It is also a very great advantage of this collar, that it enables the wearer to lie on his back in the water, and thus shift his position, which, if he were subject to long immersion, would be of great consequence.

Since this figure was engraved, it occurred to me, that the central hole for the head is too large; it ought to have been oval instead of round, as the head, measured from ear to ear, is considerably narrower than it is from the point of the chin to the back of the head. Of course the apperture will vary with the dimensions of the wearer; but if it be requisite to make it nine inches one way, probably seven or seven and a half inches in diameter the other way will be sufficient.

Fig. 2

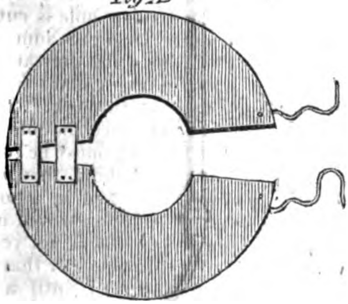


Fig. 2 describes another mode of constructing the cork collar, the only advantage of which is, that it occupies less space in carrying, as the circular piece is cut into two semicircles, the one folding over the other when not used. The collar with which I tried this mode does not weigh more than a pound and a half, and its diameter, when closed, does not exceed 7 inches. It is formed, as may be seen by the above sketch, of two parts, A and B, which are fixed together by hinges of leather, or saddle girthing, firmly attached to each semicircle by strong waxed thread. When this kind of collar is used, the open part is slipped round the neck, and the two semicircular pieces are closed by means of the two tapes, which are tied in a bow in front. When not used, the piece A is folded back upon the piece B; and in that mode of packing it, the apparatus is about 14 inches long, 7 broad, and 1½ in thickness.

The reason why so small a quantity of cork, when applied in the form of a collar, will support any man, must be obvious on a little reflection. The human body being specifically lighter than water, all men would float if they could have the requisite confidence, and would keep their hands and arms beneath the surface of the water, instead of throwing them out, as they almost uniformly do when they are apprehensive of drowning. If a man's whole body, up to the chin, be immersed in the water, it loses its entire weight, and all that is further requisite to enable a person, who cannot swim of himself, to avoid sinking, without exertion, is a float of sufficient buoyancy to support the weight of the head. Just such a float is the cork collar I am recommending. The buoyancy is applied in the proper place; the upper rim of the collar touches the chin, and the shoulders are immersed in the water, so that there is the least possible superincumbent weight. This is the circumstance that gives the superiority which, I maintain, this simple collar of cork possesses over every other more complicated or expensive life-preserver.*

* The arms and head of a man, upon an average, exceed in weight one-tenth of the whole body. The head being necessarily out of water, the swimmer has to make some exertion to support its weight; but when the hands and arms are also raised out of the water, as is often the case with persons in fear of drowning, the weight of the hands and arms, in addition to that of the head, necessarily precipitates the whole body downwards; and in the act of descending, water is swallowed, which renders the body less specifically light, until, by repeatedly taking in the water, it becomes heavier than an equal bulk

If I have protracted this letter to a much greater length that I anticipated, the importance of the subject must plead my excuse. I shall not fail to apprize your readers of the result of the further experiments I intend to make, or which others may make. The principle of the superiority of this mode of applying cork being once established, there will, no doubt, be a great variety of modes of putting the principle into practice. The more the better. If I had had no more exalted object in view than mere personal emolument, I might have secured this simple apparatus to myself, by patent; but I prefer taking this public method of preventing any person from monopolizing an invention, which cannot be rendered too cheap, or of too general application.

Before I conclude I shall further observe, that any man who can swim, and who is provided with this kind of collar, may with confidence, because without any risk, enter the water to rescue a fellow-creature who is in danger of drowning; and I will only add, that these Collars will effectually support either man or woman with their ordinary wearing apparel; nor is it a trifling recommendation, that ladies may very readily learn to swim with these collars, even with their ordinary bathing dresses on. Your's, &c.

EGERTON SMITH.

Liverpool Mercury office.

ON SPECIFIC GRAVITY.

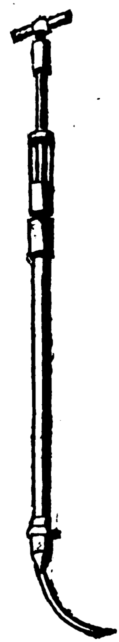
(Concluded from p. 170, No. 151.)

On the application of the sliding rod measurement, in Hydrometry.

There is, in my opinion, no mode of measuring fluids, heretofore contrived, so accurate and convenient, as that which I have employed in my Eudiometers. I allude to the contrivance of a rod, or piston, sliding through a collar of leathers into a tube, and expelling from it any contained fluid, in quantities measured by degrees marked upon the rod; and perused, with additional accuracy, by means of a vernier.

One of the most advantageous applications of the mechanism alluded to, is, in ascertaining specific gravities, in the case either of liquids or solids. To assay liquids which are not corrosive, I have employed two instruments like that represented in the following figure, severally graduated to 100 degrees, and furnished with a vernier, by which those degrees may be divided into tenths, and each scale made equivalent to 1000 parts.

Fig. 4.



In order to avoid circumlocution, I shall, to the instrument here represented, give the name of *Chyometer*, from the Greek, *chuo*, to pour, and *meter*, measure.

Supposing two such instruments to be filled, to the extent of the graduation, one with pure water, the other with any spirituous liquid, lighter than water, whose gravity is to be found; let 1000 parts of the liquid be excluded into one scale of a beam, and then exclude into the other scale as much water as will balance it. Inspecting the graduation of the Chyometer, from which

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of the fluid, and sinks to rise no more.

the water has been expelled, the numbers observed, will be the answer sought. For, supposing 1000 measures of alcohol were placed in one scale, if 800 measures of water counterbalance it, the alcohol must be to the water, in weight, as 800 to 1000; which is all that is requisite to be known: since it is self-evident, that when any two masses are made equal in weight, their gravities must be inversely as their bulks.

To ascertain the specific gravity of a solid, by the Chyometer.

For this purpose, the body, whose gravity is in question, should be suspended in the usual way, beneath one of the scales of a balance, and its weight, in parts of water, at 60° F. ascertained, by measuring from the Chyometer, into the opposite scale, as many parts as will balance the body. Being thus equipoised, and a vessel of pure water, at the same temperature as that introduced by the Chyometer, duly placed under it; the number of parts of water, competent exactly to cause it to be merged in this fluid, will be the weight of a quantity of water, equivalent in bulk to the body. Of course, dividing, by the number thus observed, the weight of the body, in parts of water as previously found, the quotient will be the specific gravity sought.

This process ought to be easily understood, since it differs from the usual process only, in using measures of water, instead of the brass weights, ordinarily employed.

The Chyometer enabled us to make new weights, out of water, for each process.

To ascertain the specific gravity of a corrosive fluid, by the Chyometer.

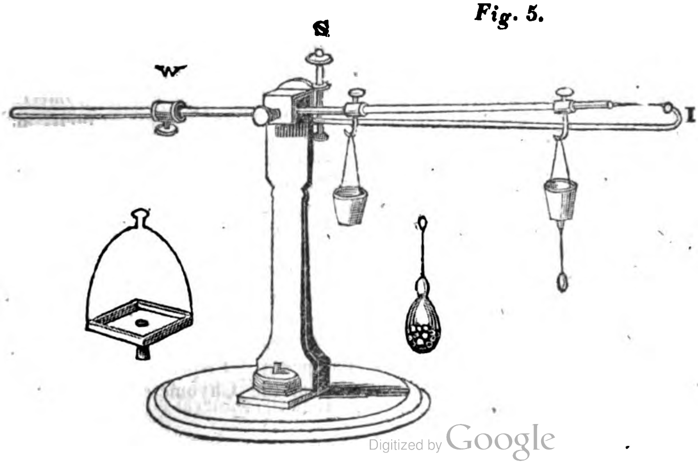
The process, described in the preceding page, is only applicable, where the fluid is not of a nature to act upon the sliding rod. By employing a body—a glass bulb for instance—appended from a balance, as in the usual process, we may use water, measured by the Chyometer, in lieu of weights.

First, having counterbalanced the body exactly, ascertain how many parts of water will cause it to sink in water; next, how many parts will cause it to sink in the liquid, whose gravity is to be ascertained. The number last found, being divided by the first, the quotient is the specific gravity sought.

Supposing that the graduation be made to correspond with the size of the bulb, so that 1000 parts of pure water will just sink the bulb in another portion of the same fluid; the process for any other liquid, will be, simply to ascertain how many parts of water will sink the globe in it. The number observed, will be the specific gravity; so that recourse to water, or to calculation, would be unnecessary.

The rationale of this last mentioned process, is given, in the case of ascertaining the gravity of liquids, by the glass stopple, weighing 1000 grains.

Fig. 5.



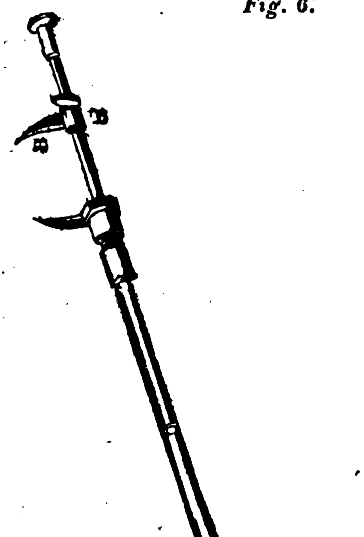
To find the specific gavity of a Mineral, without calculation, and without degrees.

The preceding figure represents a balance employed in this process. It is, in two respects, more convenient than a common balance. The moveable weight on one of the arms, renders it easier to counterpoise bodies of various weights; and, the adjustment of the index (I) by the screw (S) to the beam, saves the necessity of adjusting the beam to the index; the accurate accomplishment of which, by varying the weights, is usually a chief part of the trouble of weighing.

One of the buckets, suspended from the beam, is five times as far from the fulcrum as the other.

A chyometer is employed in this process, of which the following figure will convey a correct idea.

Fig. 6.



The rod of this instrument is not graduated, but is provided with a band, (B) which can be slipped along the rod, and fastened at any part of it by means of a screw.

Let a mineral be suspended from the outer bucket, and rendered equiponderant with the counter-weight, (W) by moving this further from, or nearer to the fulcrum, so that the index point (I) may be exactly opposite the point of the beam. Place under the mineral a vessel of water, and add as much of this fluid to the bucket, by means of the chyometer, as will cause the immersion of the mineral. The band (B) which is made to slip upon the rod, should be so fastened, by means of the screw, as to mark the distance which the rod has entered, in expelling the water, requisite to sink the mineral. Having removed the vessel of water, and the mineral, ascertain how many times the same quantity of water, which caused the immersion of the mineral, must be employed to compensate its removal.

Adding to the number, thus found, one, for the water, (previously introduced into the bucket, in order to cause the immersion of the mineral) we have its specific gravity; so far as it may be expressed without fractions. When requisite, these may be discovered by means of the second bucket, which gives fifths for each measure of water; which, if added to the outer bucket, would be equivalent to a whole number. By the eye, the distance is easily so divided, as to give half fifths, or tenths. Or, the nearest bucket, being hung one half nearer the fulcrum, the same measures will become tenths in the latter, which would be units, if added to the outer bucket.

Rationale.

The portion of the rod, marked off by the band, was evidently found competent, by its introduction into the tube of the chyometer, to exclude from the orifice a weight of water, adequate to counteract the resistance encountered by the mineral in sinking in water: consequently, agreeably to the general rule, to find the specific gravity of the mineral, we have only to find how often this weight (of water) will go into the weight of the mineral—or, what is the same in effect, how often the former must be taken, in order to balance the latter. Indeed it must, otherwise, be sufficiently evident, that the mineral and the water being made equal in weight, their specific gravities must be inversely as their bulks, which are known by the premises.

The inner bucket may be dispensed with, and greater fractional accuracy attained, by means of a sector, graduated into 100 parts. It is for this purpose that the sliding band, and the ferrule at the but-end of the tube, are severally furnished with the points. The assistance of a sector is especially applicable, where fluids are in question, since it is necessary to find their differences in thousandth parts.

To find the specific gravity of a liquid, by the Sectoral Chyometer.

Let a glass bulb, (represented in figure 5, under the buckets,) be suspended from the outer bucket, and counterpoised. Let the situation of the beam be marked, by bringing the point of the index opposite to it. Let the tube of the chyometer be full of water, and the rod retracted, until stopped by an enlargement purposely made at its inner termination. Next return it into the tube, until as much water is projected into the bucket, as is just adequate to cause the immersion of the bulb. Let the band be fastened upon the rod, close to where it enters the tube, so as to mark the extent to which it may have entered. The rod must in the next place, be drawn out from its tube, to its first position; and the sector so opened, as that the points may extend from 100 degrees on one leg to 100 upon the other. Leaving the sector thus prepared, place under the suspended ball, a vessel containing an adequate quantity of the fluid, whose gravity is required. If the fluid be lighter than water, in order to cause the immersion of the bulb in it, the rod will not have to enter so far, as at first. This distance being marked, by fixing the sliding cylinder, and the rod withdrawn from the tube as far as allowed by the stop, the number on each leg of the sector, with which the points will coincide, gives the gravity of the fluid. Forcing as much water into the bucket as had been sufficient to sink the bulb in water, will not sink it in a heavier liquid; consequently, in the case of such liquids, it will be necessary to fill the chyometer a second time, and force as much more water from it, as may be sufficient to cause the immersion of the bulb. The sliding band being then fixed, and the points separated and applied to the sector, as before, the number to which they extend must be added to the weight of water = 100, for the specific gravity of the fluid in question.

Small differences are better found by subtraction; as, for instance, suppose the specific gravity of the fluid were 101; after the small addition of water made to the bucket, beyond the 100 parts required for the immersion of the bulb *in water*, (the band being unmoved,) the points would extend from 99 on one leg, to 99 on the other. The difference between this number, and 100, is then to be added to the weight of water; so that the specific gravity is found to be 101.

The angle made by the sectoral lines in using the same bulb, and the same rod, will always be the same. Hence, a stay may be employed to give the sector the requisite opening.

Indeed, were liquids alone in question, an immoveable sectoral scale would answer. Thus prepared, it were unnecessary to have recourse to water, excepting in the first adjustment of the scale. The number of parts required to merge the bulb in any fluid, will reach (at once or twice) the number or numbers, on the sector, which give the required gravity.

In this process, if greater accuracy be desirable, it is only necessary to employ a smaller rod or a larger bulb. Instead of effecting an immersion by one stroke of the rod, it may be done by ten strokes, which will make each division of the sector indicate a thousandth of the bulk of the bulb.

The following process is, however, preferable, as the sector is made to give the answer in thousandths, without the delay of filling and emptying the chyometer more than once.

Let the distance on the rod of the chyometer be ascertained; which, when introduced five times successively, will exclude just water enough to overcome the resistance encountered by a globe, in sinking in that fluid. Let the sector be opened, to the distance so designated: let the globe be partially counterpoised, so as to float in any liquid heavier than 800. The apparatus being thus prepared, if the globe be placed in a liquid, in which it floats, add as much water, from the chyometer, to the scale, from which it hangs, as will sink it—and, by means of the points and the sector, ascertain the value of the distance to which the rod has been introduced. Adding the numbers, thus found, to 800, the sum will be the specific gravity of the liquid.

For this process, the sector should be divided into 200 parts, and, the proper opening being once duly ascertained, should be preserved by means of an arc, like that attached to common beam compasses.

Instead of a globe, a hydrometer, surmounted with a cup, may be employed, either with a graduated, or a sectoral, chyometer.

Before taking leave of the reader, it may be proper to explain the use of the square dish, which may be seen to the left, under the beam, (figure 5.) The arc of wire is for the purpose of suspending the dish to the hook, in place of the outer bucket. When so suspended, filled with water, and duly balanced, it will be found soon to become sensibly lighter, in consequence of the evaporation of the water. By means of the chyometer, it is easy to ascertain the different quantities evaporated, in similar times, at different periods, and in different places; so that, guarding against the effect of aërial currents, hydrometrical observations may be made with great accuracy.

In lieu of having points attached to the chyometer, as represented in the figure, it may be as convenient to have two small holes, for the insertion of the points of a pair of compasses, either of the common kind, of the construction used by clock makers, or that which is known under the name of beam compasses.

The compasses may be used to regulate the opening of the sector, or to ascertain, by the aid of that instrument, the comparative value of the distances which the rod of the chyometer has to be introduced into its tube.

In order to convey an idea of the nature of the sector to any reader who may be unacquainted with it, I trust it will be sufficient to point out, that its construction is similar to that of the foot-rule used by carpenters. We have only to suppose such a rule, covered with brass, and each leg graduated into 200 equal parts, in order to have an adequate conception of the instrument employed by me.

A more particular explanation of the principle of the sector, may be found in any Encyclopedia, or Dictionary of Mathematics.

VARNISH FOR ELECTRICAL RIBBON.

To the Editor of the Mechanics' Magazine.

SIR,—Your correspondent B. W. appears to labour under misapprehension in the idea he has formed of the communication of Psowtakonoski; partly, indeed, owing to the want of perspicuity of that gentleman himself. It is a fact not generally known, and which I feel a pleasure in communicating, through the medium of your truly valuable Miscellany, to the scientific world, that albumen, or the white of egg, has the singular property of rendering both isinglass and caoutchouc, soluble in alcohol The copal varnish, mentioned by your correspondent in the number for June, is that made with alcohol. Trusting that this bagatelle of mine will further the scientific amusements of some of your friends,

I remain, Sir,
Your constant reader,
VERAX.

P. S. The heat required for the thorough incorporation of the ingredients, is about 150° of Fahrenheit.

ELLIPTICAL PIANO FORTE.

Among the patents lately granted in France, is one for an "Elliptical Piano," a form the best adapted for sound. M. Bertou, member of the Institute, has made a very favourable report on it, as possessing an equality of tone throughout its whole compass, which is not to be found in others. I have seen and heard it. It is not elliptical, but rather a square piano with circular ends, invented by a common workman, whose poverty does not permit him to carry his improvements to that state of perfection, of which, perhaps, they are susceptible. He merits, however, encouragement for his endeavours, and the degree of success he has already attained. His piano has not the brilliant tone of those of Motte, but he acknowledges that his first essay is very far from what he thinks he can achieve. There are two sound boards; the keys are in the centre of the instrument, and every thing is uniform at each end. This regularity it is in which, perhaps, the principal merit consists, and the suppression of the angles, so highly detrimental to the transmission and reverberation of sound.

ALARUM CLOCK.

Sir,—I shall feel greatly obliged to any of your correspondents who will suggest to me, through the medium of your valuable magazine, a plan for arranging the dial work in an alarum clock in such a manner, that, by setting the hand which is to regulate the striking part at any required hour, the hour hand shall, when it arrives at that place, cause the alarum to strike.

I have heard of French watches being made according to this principle, in which the alarum hand remains stationary at the point at which it may have been placed; but, being a novice in mechanics, have not had an opportunity of examining their construction. I think this plan must be neater and more correct than the usual way of making alarums, that is, by having an additional dial-plate, which moves round with the hour hand, to which it is set.

I am, &c. R. B.

June 29th, 1826.

SPONTANEOUS COMBUSTION OF CHLORINE AND OLEFIANT GAS.

It has been long known that chlorine and hydrogen in mixture are liable to explode when struck by the direct rays of the sun; and an instance is related in the American Journal of Science and Art, in which these two gases exploded, even in the diffused light of a cloudy and snowy day. "I have not," says professor Silliman, "met with any account of a similar action on the part of chlorine and olefiant or heavy carburetted hydrogen." It is well-known that when mingled, in about equal volumes, they combine quietly and become condensed into the peculiar aromatic oily looking substance, since called chloric ether. This effect, the professor had so often witnessed, and had never seen any material variation in the result, that he was not prepared to look for any thing else. But, in an experiment of this kind, in the month of January, he happened to mingle the chlorine with the olefiant gas in such manner, that the latter gas was uppermost; the combination went on more slowly than when the reverse order was observed, and the oily matter was gradually precipitated, but less abundant in quantity than usual. Repeating the experiment, in the same manner, the gases had remained in contact a few minutes apparently without mingling much, except at their surfaces, the chlorine preserving its peculiar colour, and the other gas its colourless transparency, when, suddenly, a bright flash pervaded the bell glass, which was of the capacity of five or six quarts; it was raised out of the water with a slight report, a dense deposit of charcoal lined the glass and floated on the water of the cistern, and the chlorine disappeared. The appearances were much like those which are exhibited when a rag, dipped in oil of turpentine, is placed in a jar of chlorine gas.

Reflecting on the circumstances, the professor was led to believe that the peculiar effect, in this case, arose from the fact, that owing to the great difference in the specific gravity of the two gases, the action took place principally at the surfaces of contact, and thus, the chlorine acting upon a comparatively thin stratum of inflammable gas, the two became so heated, as to pass into vivid combustion. Every new occurrence in practical chemistry, which may involve danger, ought to be exactly stated, that we may beware of contingencies not otherwise anticipated.

EXPLOSION OF PYROPHORUS.

A PREPARATION of this substance, having been made by Professor Silliman, was left eight or ten days well corked, in iron tubes, (the same in which it was prepared) and being opened, for transferring to another vessel, a common ramrod was introduced, to loosen the pyrophorus, the motion of which produced considerable friction, when an explosion took place, loud as a common musket, by which the contents of the tube were blown out in a jet of fire, two or three feet long, scorching the hair and eye-brows of the person conducting the operation, and a violent jirk was given to the hand that held the ramrod. The glove with which his hand was fortunately covered, was burnt in several places to a crisp. His eyes and whole face were affected in the same manner as if gunpowder had been discharged against them: and this sensation continued several days; passing off, however, without serious inconvenience. On putting the ramrod into a second tube, containing pyrophorus, and very cautiously and gently touching the substance with the end of the rod, another explosion took place, equally violent as the first. It was not thought prudent to repeat the experiments again, as the third tube contained a much larger quantity of the preparation. This pyrophorus had been observed to be unusually good, and when breathed upon in the air, kindled in many places at the same time, with a slight explosion. The tubes, stopped with particular care, had stood within eight or ten feet of the fire, in the laboratory, and could not possibly have imbibed moisture. The explosions doubtlessly resulted from the friction and pressure of the ramrod; and they show us the necessity of care, in regard to a substance, against which the books, we believe, give us no caution.

It may be proper to mention, that the pyrophorus was, in this case, prepared from a recipe furnished by Dr. Hare; it was as follows:—Take lamp-black three, calcined alum four, and pearl-ashes eight parts; mix them thoroughly, and heat them well in an iron tube, to a bright cherry red, for one hour.

This pyrophorus rarely fails. When well prepared, and poured out upon a glass plate, and especially when breathed upon, it kindles with a series of small explosions, a little like those produced by throwing potassium upon water. There is even some danger to the eyes and face, from the number and rapid succession of these little explosions; and one is forcibly impressed with the idea, that they must be owing to potassium. Since the discovery of this brilliant substance, there has been little doubt, that it is developed in greater or smaller quantities, during the formation of pyrophorus. The above process seems peculiarly adapted to the production of an unusual quantity of potassium, since there is in the mixture a larger quantity of the alkali, and also of carbon, which, it is now known, is admirably adapted to the decomposition of potass.

If a burning coal happen to drop into a silver crucible, containing ignited caustic potass, there is a rapid succession of explosions, and the liberated potassium and potassurated hydrogen burn with a brilliant flame, and the fumes of regenerated caustic alkali are extremely conspicuous. Indeed it has long been known, that charcoal will, by intense ignition, evolve potassium from potash. Curadeau first called our attention to this fact, and more recently, Professor Brunner has shown, that this process, skilfully conducted, is even preferable to any other.

REMEDY FOR MILDEW IN WHEAT.

DR. Cartwright, during his investigation of the effect of salt upon vegetables, was led to apply it as a remedy for the mildew in wheat. The mode of applying it, is to sprinkle the corn with a solution of salt, the object being to wet the straw in which the mildew exists. The experiments, on trial, were very successful, scarcely any remains of the disease being to be found forty-eight hours after the sprinkling. Six or eight bushels will serve an acre, and the expense of the salt will be repaid by the improvement of the manure made from the salted straw. Two men, one to spread, and the other to supply him with the salt, will get over four acres in a day. The effect of the remedy depends upon the circumstance, that though the solution of salt has no injurious action on the stem and fibrous parts of vegetables, yet on getting to the roots, in sufficient quantity, they languish and die. The salt is considered as acting on the fungus which occasions mildew, in the same manner as on weeds.

RIPENING OF WALL-FRUIT.

Mr. H. Davis, of Slough, some time since, published the result of an experiment for facilitating the ripening of wall-fruit, by covering the wall with black paint. The experiment was tried on a vine, and it is stated, that the weight of fine grapes gathered from the blackened part of the wall was 20 lb. 10 oz.; while the plain part yielded only 7 lbs. 1 oz. being little more than one-third of the other. The fruit on the blackened part of the wall was also much finer, the bunches were larger, and ripened better than on the other half; the wood of the vine was likewise stronger, and more covered with leaves on the blackened part.

PROTECTION OF FRUIT FROM WASPS.

Mr. Knight has found his vinery to be perfectly protected from the attacks of the wasp, in consequence of the vicinity of some young yew trees, which, since they have come into bearing, and produced berries, have constantly attracted the insects from the vines. The wasps feed upon the berries with much avidity, and from the sweetness of their taste, and the quantity of mucilage they contain, they are, probably, very nourishing.

VITRUVIAN CEMENT.

Mr. Beavan has obtained a patent for an invention of a cement, for building and other purposes.

This invention is called Vitruvian Cement, and consists of a composition of marble, flint, chalk, lime, and water, which, when dry, is capable of being brought to a high state of polish.

The proportions are one part of pulverized marble, one part of pulverized flint, and one part of chalk, mixed together, and sifted through a very fine sieve; to this is to be added, one other part of lime, which has been slaked at least three months. To this is to be added a sufficient quantity of water, to make the whole into a thin paste, and in that state it is to be spread as thinly as possible over a coarse ground, and brought to a smooth surface by the trowel. This cement, when dry, may be polished with pulverized Venetian talc, until the surface has become perfectly smooth and shining.

In order to apply this Vitruvian cement to buildings, it is necessary that the parts to be covered, should be first prepared with a rough ground or undercoat, which may be done with the following materials. Take equal parts of the coarsest river sand, and the sand which is pulverized from mill-stones; mix them together, and add a third part of lime, which has been slaked for about three months; to these put as much water as will bring the composition into a paste; and when it is about to be used, add a fifth of very fine sifted lime, and apply it as common plaster.

If the above Vitruvian cement be required to imitate the appearance of marble, that may be done by painting the veins like marble upon its surface, after the cement has been brought to a smooth surface by the trowel; and as soon as the paint has become dry, the polishing process may be performed with the pulverized talc, as above described, when the work may be considered to be finished.

In order to increase the lustre of the polish, the patentee proposes to employ a sort of varnish, to be made by mixing two pints of water with four ounces of white soap, eight ounces of virgin wax, and eight ounces of nitre, which are to be boiled together till the substances are quite dissolved. When the cement is perfectly dry, this varnish is to be sprinkled over the surface, and when uniformly spread, is to be rubbed well with a linen cloth, until the lustre is sufficiently brought up. It is, however, to be observed, that this varnish is not claimed by the patentee; but is merely mentioned as a useful addition to improve the lustre and appearance of the cement, when a high polish is required, as in imitating marbles.

ON PILE DRIVING.

As a proof of the imperishable nature of wood when submerged in water, we may instance the circumstance of several piles having been lately dug up from the basement of Westgate, in an excellent state of preservation. These piles, which no doubt were driven in the reign of Richard II. must have lain nearly four centuries and a half. The gateway was built by Archbishop Sudbury, and by the continual action of the water upon its foundation, a great portion was sapped. We hear that water acts as a preservative to wood, where the atmosphere is entirely excluded, nor is it of much consequence of what species it is. Oak, however, has been used upon almost every occasion where piles have been found necessary; but continued observations has satisfactorily proved, that elm, beach, and even deal, have resisted the influence of time longer than oak. Upon the present occasion elm is made use of as piles, upon which the foundation of the new bridge is erected; and we have no doubt, a thousand years hence, they will be nearly as perfect and solid as at the present moment.

METEORIC STONE.

A Meteoric Stone fell on October 13, 1820, near Kastritz, in Russia, and, being analyzed by Stromeger, was found to contain

Silica	38·0574
Magnesia	29·9306
Alumina	3·4688
Protoxide of iron	4·8959
Oxide of Manganese	1·1467
Oxide of Chronium	·1298
Iron	17·4898
Nickel	1·3617
Sulphur	2·6957
Total	99·1762

TO CORRESPONDENTS.

To S. N. L.—

"*Let the galled A.S.S. wince.*"

Conformably to the wishes of our kind Correspondent, T. W. of Clerkenwell, we state, that the numbers published by Messrs. Hunt and Clark, do not belong to our Series of the Mechanics' Magazine, and, consequently, will not be noticed in the Index of the Sixth Volume.

If A, D. of Woolwich, do not intend to procure a patent for his invention, we request he will favour us with a description, accompanying the same with illustrative diagrams.

Aurnm's motto shall be inserted.

Mr. Atkinson's communication, though containing some very excellent remarks, is of too general a nature to admit of its being inserted. If he will send us a description of his Fire Engine, it shall receive our attention.

T. C. E. and Jas. Senhouse, in our next.

Communications have been received from 1 and 2 make 3—T. W. of Clerkenwell—A. M.—X. X.—and numerous other Correspondents.

By a mistake of the stationer, a small portion of the last number was printed on inferior paper: this shall not occur again.

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Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 153.] SATURDAY, JULY 29, 1826. [Price 3*d*.

"The nearer we can trace things to their origin, and press intermediate causes up to their main spring, the more accurate and circumstantial will be our knowledge."

Heap's Sermons.

ON THE DIAGONAL FRAMING OF SHIPS OF WAR,

By George Harvey, Esq. F.R.S.

Fig. 1.

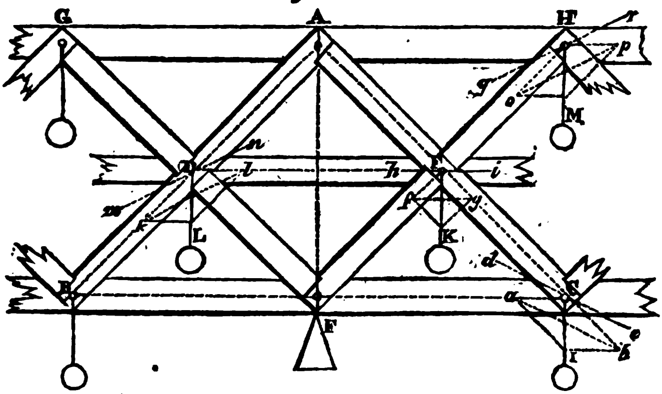
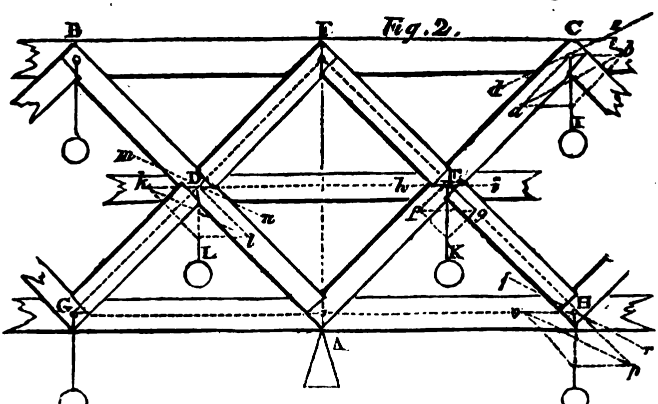


Fig. 2.



The following remarks, on the diagonal framing of Sir Robert Seppings, have been drawn up to assist the young naval engineer in the application of a well-known mechanical principle to the forces operating on the parts of that ingenious system; the proofs hitherto offered respecting the relative positions of the trusses and ties having been derived from experiment, or from considerations foreign to the legitimate purposes of mechanics.

The misconceptions that at first existed on this important subject, arose from a mistake of the proper application of trusses and ties; the opponents of the proper positions of the ties having omitted to consider the essential principle in constructive carpentry, that the force which operates *to extend the tie*, should at the same time tend *to compress the truss*. The mechanical lemma now to be added will enable the young shipwright to distinguish the parts of the diagonal framing subject to extension, and also those subject to compression; and moreover, how by the operation of the extending and compressing forces, the form originally communicated to the framing may be best preserved, and thus prevent, in the greatest possible degree, the arching of the ship.

*Mechanical Lemma.**

Through the point in which the sustaining forces meet, let a line be drawn to represent the measure and direction of the straining force; and on it let a parallelogram be constructed, as a diagonal, having its sides parallel to the sustaining forces. Draw the remaining diagonal of the parallelogram, and, parallel to it, another line through the point where the sustaining forces meet. Then all the parts of the framing on the *same side* of this line, as the straining force, will be in a state of *compression*, and all those on the *other side* of the same line in a state of *extension*.

In figure 1, let A B and A C represent two of the braces or ties of a system of diagonal framing, and G D, D F, H E, E F, corresponding trusses. Let also G H, D E, and B C, denote the longitudinal timbers of the same system, and F the fulcrum on which the whole is supported. Then if we apply the lemma in the first place to the brace A C, and the longitudinal timber B C, at the point C, where these timbers may be supposed to meet, let the vertical line C I be drawn to represent the measure and direction of the straining force operating at that point. On C I, as a diagonal, let the parallelogram C *a* I *b* be constructed, having its sides in the directions A C and B C of the longitudinal axes of the timbers selected for consideration. Draw the other diagonal *a b* of the parallelogram; and through C, where the vertical force is supposed to operate, draw *d e* parallel to *a b*. Then, since the longitudinal timber B C is on the *same* side of *d e* as the straining force C I, it will by the lemma be in a state of *compression*; and the brace A C being on the *opposite* side of the same line, will be in a state of *extension*.

To apply the lemma in the second place to the brace A C, and the truss F E, let the straining force be supposed to be applied at E, and E K denote its measure and direction. Complete the parallelogram E *f* K *g*. Join *f g*, and through E, draw *h i* parallel to *f g*. Then the truss F E being on the *same* side of *h i* as the straining force, E K, will be in a state of *compression*; and the brace A C, being on the *opposite* side of the same line, will be in a state of extension, as determined in the preceding case.

To apply the lemma in the next place to the brace A C or A B, and the longitudinal timber D E, let the straining force be allowed to act at D, and let D L be its measure and direction. Complete the parallelogram D *k* L *l*, and join *k l*; and through D draw *m n* parallel to the last-mentioned line. Then the longitudinal timber D E being on the *same* side of *m n* as the straining force, it will be in a state of *compression*, and the brace A B or A C, as before determined, in a state of *extension*.

Fourthly, let the parts now to be selected, be the longitudinal timber G H, and the truss H E. Then if the straining force be applied at H,

* For some interesting applications of this well-known mechanical principle, see Mr. Tredgold's chapter on the Equilibrium and Pressure of Beams, in his excellent work on the *Principles of Carpentry*.

let H M denote its measure and direction; and on it as a diagonal, let the parallelogram H *o* M *p* be constructed, having its sides coincident with the directions of the timbers proposed; join *o p*, and through H draw *q r*, parallel to it. Then since the truss E H is on the same side of *q r* as the straining force, it will be in a state of *compression;* and the longitudinal timber A H being on the *opposite* side of the same line, will be in a state of *extension*.

Hence it appears, that the resultant of the various forces acting on the diagonal frame proposed, will operate so as to *extend the braces* A B and A C, *and the longitudinal timber* G H; but on the remaining parts of the frame, *viz., the trusses* G D, D F, H E, E F, and the *longitudinal timbers* D E, B C, the effect will be to produce *compression;* agreeing with the experimental conclusion of Sir Robert Seppings, that the frame, with this disposition of the braces, "comes more in contact by the pressure."

Let us now endeavour to estimate the effect of a similar system of forces, on a system of framing, whose braces and trusses are disposed in *opposite* directions to those of the preceding investigation. For this purpose, let the first application of the lemma be to the longitudinal timber B C, and brace A C, fig. 2, A being the fulcrum, and let the point C be that to which the straining force is applied. Suppose C I to be its measure and direction, and complete the parallelogram C *a* I *b*. Join *a b*, and through C draw *d e* parallel to that diagonal. Then, since the brace A C is on the *same side* of *d e* as the straining force, it will be subject to *compression*, contrary to the effect produced in the former case. But the longitudinal timber B C, like G H in the former figure, will undergo *extension*.

In the next place, let the straining force be supposed to be applied at E, in order to estimate its effects on the brace A C, and the truss F E, and let E K be its measure and direction. Complete the parallelogram E *f* K *g*, join *f g*, and draw *h i* parallel to it, through the point of application E. Then the brace A E being *below* the line *h i*, will undergo *compression* as before; and the truss F E being *above* the same line, will undergo *extension*.

In the third place, let the straining force be applied at D, to produce an effect on the brace B A, and the longitudinal piece D E, and let D L be its measure and direction. Complete the parallelogram of force D *k* L *l*. Join *k l*, and through D draw *m n* parallel to *k l*. In this case, therefore, the brace D A being *below m n* must undergo *compression*, and the longitudinal timber D E, being *above* the same line, must undergo *extension*.

Fourthly, let the straining force be applied at H, to estimate its effect on the truss E H, and the longitudinal timber G H, and let its measure and direction be H M. Complete the parallelogram of forces, H *o* M *p*, having its sides in the axes of the timbers proposed. Draw the diagonal *o p*, and parallel to it, through H, the parallel line *q r*. Hence it appears, that the truss E H, being *above* the line *q r*, must undergo *extension;* and the longitudinal timber G H, being *below* the same timber, must undergo *compression*.

With this disposition of the timbers, therefore, it appears that the forces operating on the frame will produce *a compression of the braces* B A, C A, *and of the longitudinal timber*, G H; but on the remaining parts of the frame, viz., *the trusses* B D, D A, C E, E A, and the longitudinal timbers D E, B C, the effect will be to produce *compression*, agreeing also with the experimental conclusion of Sir Robert Seppings, that on the application of a straining force, the trusses and middle longitudinal piece will "be immediately disengaged and fall out."

The preceding results may be conveniently arranged in the following Table:—

	Nature of the Strain operating on the Timbers.				
	Braces.	Trusses.	Upper Longitudinal Piece.	Middle Longitudinal Piece.	Lower Longitudinal Piece.
With the Braces in the *fore body inclined aft,* and those in the *after body inclined forward,* as in figure 1.	Extension	Compression	Extension	Compression	Compression
With the Braces in the *fore body inclined forward,* and those in the *after body inclined aft,* as in fig. 2.	Compression	Extension	Extension	Extension	Compression

The primary object of the diagonal framing is to prevent arching; and if we suppose A F in both figures to represent the neutral line from which the arching proceeds towards both extremities, it is evident that it is the mechanical combination represented in fig. 1 which can alone prevent it. For since A, in that figure, by the hypothesis, is one of the *neutral* points of the system, it may be regarded as fixed; and the tendency of arching being to depress the points H, C, and G, B, the effect on the braces A C and A B will be precisely similar to the weights applied in the preceding investigation; that is, to produce *extension*, and which is effectually provided for by the fastenings. The effect, moreover, brought at the same time into action by the trusses, in consequence of the disturbing force, is to resist, by the whole longitudinal strength of their fibres, all tendency to alteration of form; so that the effort exerted to depress the point C, is at once resisted by the fastenings appertaining to the brace A C, and to the longitudinal strength of the fibres of the truss, proceeding from the unchangeable point F. The point E becoming, in this point of view, fixed, the action of the force which tends to depress the point H, in common with the point C, is resisted by the fastenings of the longitudinal timber A H, and by the longitudinal resistance of the fibres of the truss E H; so that, provided the fastenings of the braces and of the upper longitudinal timber are sufficient, and the abutments of the trusses and of the middle longitudinal timber are also proper, all tendency to arching will be resisted in proportion to the perfection of the materials, and to the excellence of the workmanship.

But by referring to the converse disposition of the braces, as represented in fig. 2, it appears, from the preceding investigation, that the braces A C and A B are subject to *compression*. And since the point A is, by the hypothesis, the neutral or fixed point, the effect of the compression of the brace A C must be to *depress* the point C, and thus to promote the tendency to arching. Nor is this tendency to lower the point C prevented by the action of the truss F E; since the point F being fixed by the supposition, the tendency to *extension* which takes place in the truss must tend to lower the point E, and thus to promote the further declension of the point C. The point E being thus depressed, must add its effect to the *extending* force called into action in the truss E H, and thus produce a declension in the point H. Hence the whole effect of the disturbing force is to *lower* every part of the frame from C to H, and thus to promote the arching of the vessel.

Hence the superiority of the present system of diagonal framing becomes apparent, and the advantages derived from it are demonstrated by the small alteration of form which ships now undergo in the act of launching.—*Journal of Science and the Arts.*

Plymouth, May 26, 1826.

METHOD OF RELEASING APARTMENTS OF FOUL AIR, SMOKE, &c.

SIR,

In answer to M. A. Corin, in No. 151 of your Magazine, I shall briefly state, that I have been for some years of opinion, that the modern practice of erecting low fire-places and cottage stoves in our houses is of more advantage to the physician than to the occupant. Sixty years ago few fire-places were made less than six or eight feet high, and though fashion has now reduced the height to about four feet, I do not perceive the value of the alteration. It appears to me, that by this mode the feet get warmed at the expense of the head: for the foul air arising from respiration, smoke, &c. being specifically lighter than the usual atmosphere of an apartment, and the nostrils of individuals being above the level of the fire-place, it has no way of escape, but continues floating in the apartment, to the production of head-aches. I shall now state what I have done to prevent this evil.

Some years ago I introduced a number of lamps in an extensive workshop. where I employed from 12 to 20 people, each of whom required a separate light during the winter season. In less than an hour after these lamps were first lighted the shop was filled with smoke, and such continued to be the case every night for about a week, at the expiration of which time my men generally complained of head-ache and of oppressive fulness at the stomach. The great advantage which oil has over tallow, with respect to artificial light, rendered me averse to abandoning the lamps, I therefore had recourse to the following expedient, which surpassed my most sanguine expectations. I made half a dozen tubes, by rolling paper round a conical piece of wood, and pasting down the edges: the wood was six inches long; one inch diameter at the bottom, and half inch diameter at the top. I then cut a round hole in as many pieces of paper, and having passed a tube through one of them, pasted these two together; and so on with the remainder. In the next place I took a gimblet, of an inch circumference, such as is used by coopers in boring holes in casks for corks, and bored a hole through the ceiling of the workshop, which was on the attic story, and having sized round the hole, with a little warm size, passed a tube through it, and pasted the paper affixed to the end of the tube to the ceiling; proceeding with the other tubes in the same way, and placing them at equal distances apart. I found this so very beneficial, that I immediately proceeded to put a tube through every ceiling of my house, consisting of six rooms, and completely ventilated the whole at something less than one shilling expense. And I am of opinion, that by adopting a similar procedure, by bringing a small tin or copper tube from the lower part of the roof through each room, and leaving a cavity in it close to each ceiling, a house might be kept perfectly wholesome.

I am, &c.

Clerkenwell, July 17, 1826. T. W.

CUTTING OF STEEL, &c. BY IRON.

The following is an extract of a letter from Mr. Isaac Doolittle, of the Bennington Iron-works, to Professor Silliman, of New York.

"Having occasion, a short time since, to cut a plate of cast iron, three-eighths of an inch thick, it was thought that the plan recommended for cutting steel by iron might succeed in this case. Accordingly, a disc of sheet-iron was placed on an axis, and adapted to a water-lathe, in a manner to revolve with great rapidity. This disc would cut hardened or soft steel, or wrought iron, with much facility, but produced not the slightest effect on the cast-iron, though the latter was very grey and soft. I confess I am quite at a loss to explain this difference in the action of the disc."

VICAT ON CEMENTS

A VERY excellent work has been published in Paris, entitled, "*Recherches Experimentales sur les*

Chaux de Construction, les Bétons et les Mortiers Ordinaires," by L. J. Vicat.

This work, containing many important facts relating to calcareous cements, and hydraulic and common mortars, is the fruit of an immense number of experiments, the results of which are arranged in 25 tables. These are preceded by a series of remarks and details, in which the general laws and effects are deduced and stated, but which lose the greater part of their value if separated from the tabular results. The following translations contain some of the results obtained by M. Vicat, and will give an idea of the importance of the work. It is only, however, by referring to the work itself, that a true estimate of its value can be obtained.

"*Trial of Lime-stones.*—It is of the utmost consequence, especially in public works, to ascertain the quality of the lime to be employed, and yet chemical analysis requires practice and knowledge which every architect does not possess. It is always more easy and certain to submit a fragment of the stone, which is to be tried, to common calcination in a lime-kiln, or, as we frequently do, with charcoal in a forge, (for coal forms clusters with the stone) than to slake it in the common way, and make a paste of it, which is to be placed at the bottom of a vessel filled with pure water. If, at the end of eight or ten days, this paste has become hard, and resists the finger, it is a proof that the stone tried will furnish hydraulic lime; if, on the contrary, it remains soft, it is the character of common lime." p. 5.

"*To convert common lime into hydraulic lime.*—The operation to be described is a true synthesis, which, by the action of fire, unites, in an intimate manner, the essential principles which analysis separates from hydraulic lime. The lime to be modified is to be left in a dry and covered place, until reduced spontaneously into powder, and afterwards mixed by the aid of a little water, with a certain quantity of grey or brown clay, or simply with brick-earth, and this made into balls, which, when dry, are to be heated to the necessary degree.

"Common lime will require 20 per cent of clay; intermediate limestone will require 15 per cent; and 10, or even 6, will be sufficient for those which already possess hydraulic properties to a certain extent. When the quantity is raised to 33 or 40, the lime obtained will not slake, but is easily pulverized, and will make a paste that hardens very readily under water. When the clay is mixed with pebbles, &c. it is to be thrown into a large quantity of water, well mixed with it, and the finer part run off into a convenient place. It may then be mixed with the lime in powder, and made into balls; the quantity required is easily ascertained by a little practice.

"It must not be supposed that the clay baked alone, and then added to common lime, in the proportions mentioned, will give the same results as when the two substances are mixed before being heated. The fire modifies the one substance by the other, and gives rise to a new compound, which enjoys new properties." p. 7.

"If fragments of common lime and a mixture of coal and charcoal be placed, stratum super stratum, in a small brick furnace, and burnt; and if, as the substances fall by the dissipation of the combustible, the lime which passes through with the cinders, be returned with fresh fuel to the furnace, and the process be continued from 15 to 20 hours, according to the size of the fragments, an over-calcined lime will be obtained, which will not slake, but which, when reduced into a fine powder, and made into a ductile paste, has the property of hardening under water." p. 15.

"*On Slaking.*—Quick-lime thrown into a proper quantity of water, splits with noise, produces a bubbling, liberates hot and slightly caustic vapours, and at last forms a thick paste. If a sufficient quantity of water has not been added in the first instance to the lime, it is necessary to wait till it is cold before more be given. If a second portion be poured on whilst the lime is hot from the efect of the first insufficient quantity, then the lime does not divide well, but remains granular. This process is called *ordinary slaking*, or the first process.

"Quick-lime plunged into water for a few seconds, and withdrawn before it begins to split, then hisses, splits, and bursts apart with noise, and falls into powder. This powder, when cold, does not heat by the addition of more water. One part of lime, thus slaked, expands into 1·5 or 1·7, parts by measure. This is called *slaking by immersion*, or the second process.

"If quick-lime be exposed to the air, it falls to powder, one part increasing in volume to 1·75, or even to 2·55. This is called *spontaneous slaking*, or the third process." p. 16.

"*Hydrates of Lime.*—Lime slaked in these three ways, was made into masses with water; these were dried in the sun, and then their resistance or tenacity, and their hardness ascertained; and the result was, that for all kinds of lime, the resistance and the hardness was in proportion to the expansion in bulk by the process of slaking, that is, the process which divided the lime most completely, gave a hydrate of the greatest strength." p. 25.

"*Effects of Slaking on the Hydraulic Mortars.*—It appears, from experiments on the hydraulic mortars made from common lime, intermediate or meagre lime, and lime slightly hydraulic, that the three modes of slaking, arranged according to the order of their superiority, are the third, the second, and the first; but that for hydraulic lime, the order becomes reversed. If common lime be considered as the commencement of the scale, and we pass from that through the various shades of difference to the hydraulic lime, which is most meagre, and which will form the last degree on the scale, the differences resulting from the methods of slaking diminish, at last disappear, and then increase in the opposite direction." p. 42.

"*Action of Water on Hydraulic Mortars.*—The dissolving action of water on hydraulic mortars appears to cease when it has removed the excess of lime that was either in weak combination, or entirely at liberty; and, it was found that the quantity which remained after the action ceased, was never far from that which had been ascertained to be the best; from whence the following: To find in all possible cases the proportion of lime which is most fit for any puzzolana, a ball of the hydraulic mortar, nearly an inch in diameter, must be made, having rather an excess of lime; this must be exposed for a year under pure water, which is to be changed frequently, and then the quantity of lime which has disappeared, is to be ascertained either by analysis or otherwise, and subtracted from the whole quantity, and the difference gives the proportion required for the quantity of puzzolana taken." p. 55.

"*Effect of Lime on Hydraulic Mortars.*—1st. Excess of lime in a hydraulic mortar retains its setting: the proportions most favourable to the setting, are also those which give the greatest strength.

"2nd. Powerful puzzolanas, combined with common lime, harden much sooner than if combined with hydraulic lime; but hydraulic lime has the advantage when combined with a less active puzzolana.

"3rd. The second and third process of slaking appears generally to accelerate the settling more than the first.

"4. Hydraulic mortars made with common lime harden more, or make more progress from the second to the third year, than from the first to the second, so that it may be said, the rapidity of their progress may be accelerated.

"5th. The resistance of hydraulic mortars, made with lime slightly hydraulic, also undergoes an acceleration, but much less than in the former case.

"6th. The progress of mortars, made with lime eminently hydraulic, begins to diminish at the end of the second year.

"Hence hydraulic mortars, made with common lime, require more time than the others to attain their maximum of resistance." p. 58.

"*On the nature of Hydraulic*

Lime.—The modification which the action of the fire has caused in the small proportion of silex and alumine, mixed with the pure calcareous matter, gives to the compound which results, the power of acting chemically by the intervention of water on the new siliceous substances, added in the state of sand. It is this circumstance which constitutes the distinctive and essential character of hydraulic lime." p. 73.

"*On the use of Siliceous Sand.*—According to our results, the different sands arrange in the following order of superiority.

"For highly hydraulic lime: 1st. Fine sand; 2nd, sand of unequal size resulting from the mixture of fine sand, either with coarse sand or small gravel; 3rd. coarse sand.

"For lime moderately hydraulic: 1st. mixed sand; 2nd. fine sand; 3rd. coarse sand.

"For common lime: 1st. coarse sand; 2nd; mixed sand; 3rd. fine sand." p. 74.

"*Rapidity of Desiccation.*—Mortars made from hydraulic lime, which have the power of solidifying all the water they contain, require to be dried slowly. They lose, according to circumstances, viz.—By common desiccation three-tenths, and by rapid desiccation eight-tenths of the force which they would acquire by slow desiccation." p. 77.

PERPETUAL MOTION.

Sir,—I beg leave to second the motion of W. M. D. D., p. 86, No. 146, of your interesting work, to the effect, "that all persons being in possession of any plausible attempts at the attainment of perpetual motion, do forthwith forward the same for insertion in the Mechanics' Magazine." Being convinced that such attempts are not only highly amusing, but very frequently contain most ingenious arrangements of mechanism. In compliance with the above, I beg leave to trouble you with my own idea on the subject, leaving to your numerous readers, to say, whether I am any nearer the attainment of perpetual motion than my numerous predecessors, in the pursuit of this "*Chaste Wanton*," as Bishop Wilkins appropriately styles it.

In the new gas engines of Messrs. Brunel, Cheverton, and others, power is produced by alternate expansion and condensation of carbonic acid gas, and a small degree of temperature gives power to the machine.

I remember reading *(in a forgotten work)* some time since, a description of Count Rumford's experiments on the production of heat by friction. I think it was stated, that he boiled water by the friction of two substances immersed in it. Then let us take a cone of metal, revolving in a concavity at the bottom of a vessel, which will form the generator for an expansive gas engine. Now the cone may be driven by the engine, and as the effect produced by the expansion of the gas by heat is *much greater* than is necessary to keep the cone in motion, we shall obtain an uniform perpetual motion. Not having a model of one of the above engines, I leave to those who have, the application of this theory, and remain,

Your's respectfully,

W. B. Jun.

10, George Yard, Lombard Street,
July 6th, 1826.

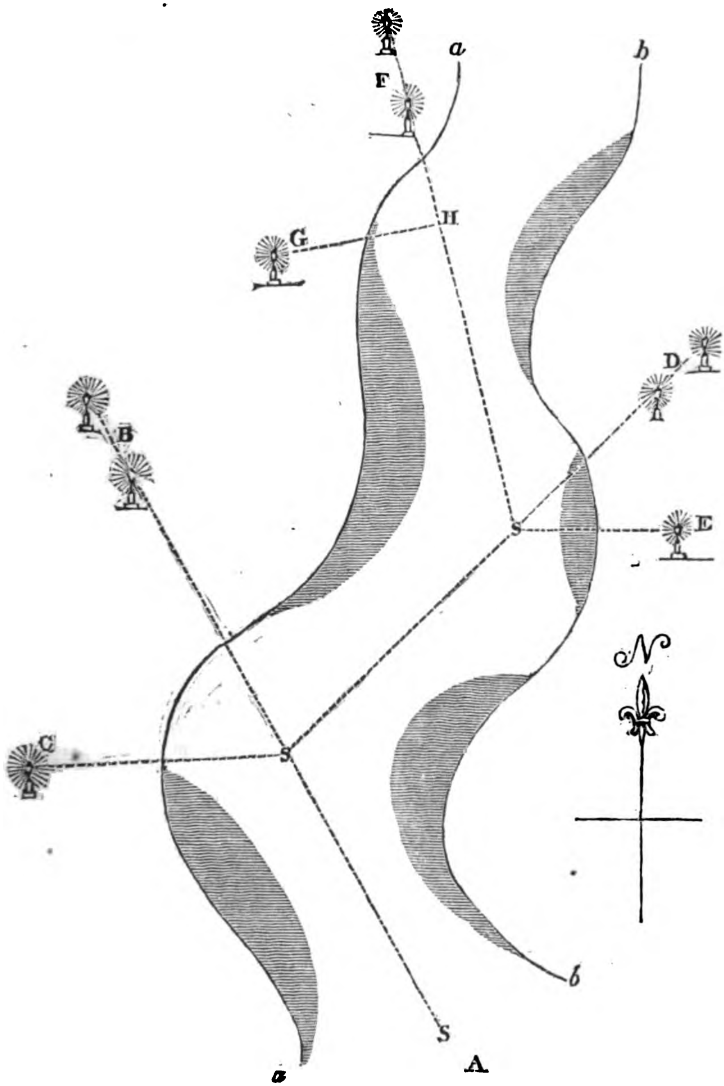
We have postponed the insertion of the preceding, in the hope that the communication of W. M. D. D. in our 146th number, would have elicited numerous other communications on this interesting subject. Should such ultimately prove to be the case, we purpose laying them before our readers in supplementary numbers. Ed.

NAVIGATION.

Hensingham House,
June 30th, 1826.

Sir,—It frequently happens that vessels are deterred from pursuing their course along navigable rivers in the night-time, from the dangers which attend the navigation: I trust, therefore, that the description of a method by which vessels may be conducted up or down a river as well by night as by day, supposing the wind to be equally favourable, will not be irrelevant to your pages.

The mode of effecting this will be better illustrated by the subjoined sketch:—



The lines *a a*, *b b*, denote the banks of the river, having dangerous sand-banks, &c. projecting into, and considerably obstructing the width of the river; to guard against which, it is necessary that the vessel, represented by the letter S, should make the angles denoted by the dotted lines. In order, therefore, that the pilot may steer clear of these dangers, I propose, that reflecting lamps, with different coloured glasses, be erected at the several places denoted by the lamps, and that the pilot be guided in altering the course of the vessel, by observing those lamps. For example, suppose a vessel, homeward bound, arrive at the mouth of the river, at A, and the pilot have to conduct her to an anchoring ground, at H; he will first have to steer her N. W. keeping the red lights at B, in a line, until the blue light, at C, become visible. At that time, the yellow lights, at D, will also be seen, and must be kept in a straight line until another blue light become visible at E. At the same time that this blue light is seen, other lights, of a pink colour, will be visible at F, which pink-coloured lights will have to be kept in a straight line, until the vessel arrive at the anchoring ground at H.

The lamps may be so contrived, as to be seen only where required; and I would recommend their being of different colours, that they may be easily distinguished from any other lights on shore. Where two lamps are erected, the farthest one should be placed on a much higher post than that which is nearest, that it may appear above the other

By this plan, I apprehend a vessel may, in calm weather, be conducted up or down a river, with the flood or ebb tide, in perfect safety, by having tow-boats ahead, to draw her either to the right or left, as may be deemed necessary. In proceeding down again, the above plan must be reversed.

I am, &c.
J. SENHOUSE.

VOYAGE OF A POUND OF COTTON.

No voyages and travels can be compared to those which an almost new-born industry entails upon the woolly blossoms of the cotton-tree. From a thousand different parts of the two hemispheres, 208,000,000lbs. of raw cotton-wool, are, every year, conveyed to England and France. This importation, in 1823, produced to England about 70,000,000*l*. and to France 40,755,000 francs, amounting to 10½ million sterling; requiring the supplies of forests containing 1,644,000,000 cotton-trees, covering a surface of 422 square leagues, 25 to a degree.

The 806,000 bales, into which this is tightly compressed, make, at least, 161,000 tons of stowage, furnishing full cargoes for a fleet of 1600 ships, which, if ranged into a single line, the bowsprit of one affixed to the rudder of another, would occupy a space of 55 leagues.

Let us then restrict our present inquiry, and, following an example which has been eloquently and pathetically propounded, *take a single pound of cotton*, (the two hundred and eight millionth part of this mass) and attempt to follow its course from the commencement of its travels to the end.

Pulled from the stem, it crosses the plains of Hindostan, a distance of 800 miles, and is received into the *stores* of the British resident at Calcutta; thence, crossing the seas, and having achieved more than thirteen times that distance, it is landed in England, and sent into the county of Lancaster, to Manchester perhaps, to be wrought by one of the 300 steam-engines that are, for this purpose, there established. The perfection of the different machinery employed in this process is such, that 16 ounces are drawn into 1380 skeins, each skein containing from 840 to 900 yards, and of which skeins or hanks one person can, with the aid of machinery, spin 100 in a day. This gives a length of nearly 340,000 yards, or upwards of 190 miles. After this metamorphosis, it is sent to Glasgow or Paisley, in Scotland, to be worked into cloth; from which latter place alone, there issues weekly 88,000 ells; this done, it is sent into Ayrshire for another operation, and is returned to Paisley to be carded, &c. by methods, complicated indeed, but particularly prompt and ingenious. It is then consigned to the manufactories of the county of Dumbarton to be embroidered or figured, where this kind of work is unrivalled. It must still take another journey, to Renfrew, for the purpose of bleaching; whence it again returns to Paisley, and finally is sent to Glasgow, where it is prepared for sale. Expedited from this port, it is again brought to London, and becomes a component item in the formation of the colossus of British commerce.

Thus, in the ordinary course of events, four years must elapse from the time when the Indian cultivator gathered the produce of his cotton pods, to the period when, by the combined agency of machinery, chemistry, and design, transformed into a texture of rare beauty, this vegetable *fleece* repasses the sea, and returns, perhaps, to its original soil, with a thirty-fold increase of value.

ON THE COMBUSTION OF ALCOHOLIC FLUIDS, OILS, &c. IN LAMPS.

By HENRY HOME BLACKADDER, ESQ. F.R.S.S. *extracted from the Edinburgh new Phil. Journal.*

A porous or filamentous substance, that has the property of raising fluids by capillary attraction, has hitherto been considered an essential part of a lamp, for burning oils or alcoholic fluids; and this part of the lamp, termed the wick, has been made of various vegetable and mineral substances, such as cotton, lint, moss, asbestus, mica, small wires, &c. All combustible fluids, however, that are commonly employed for producing light or heat, may be burned with advantage in a lamp, without making use of any wick. For this purpose, it is only requisite to have a burner in the form of a tube, and made of a substance that is incombustible, and a slow conductor of heat; and, perhaps, it would scarcely be anticipated, how well glass and other slow conductors are adapted for burners of this description, or how easily such a lamp may be constructed. In their construction, provision must be made for a constant supply of fluid to the burner, without the influence of capillary attraction; and this is effected by having the burner so placed, as to be lower than the reservoir, the supply being regulated by a stop-cock or valve, or by duly proportioning the size of the connecting tube. Lamps of this description may be made of almost any form, and of almost any solid material; it being only essential, as already stated, that the burner be a tube made of an incombustible and slow conducting substance. For alcoholic fluids, the length of the burner does not necessarily exceed an inch; and for oils, it may be reduced to the half or the fourth of that length.

Fig. 1

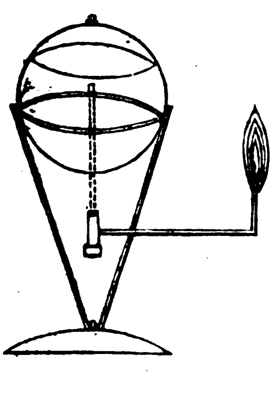


Fig. 2

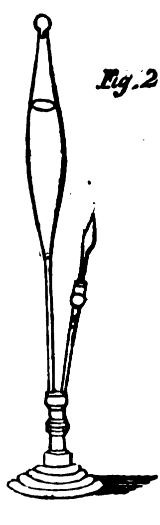


Fig. 1, represents a convenient and easily constructed lamp for the combustion of alcoholic fluids. It consists of a small glass globe, and a bent glass-tube, supported on a metallic stand or frame. The tube is of the size used for thermometers; its interior diameter being about one-fortieth of an inch. It is passed through an elastic piece of cork, which is cemented into the lower part of the glass globe, and surmounted by a collar of metal: in this way the tube may be readily slid up or down, without allowing any of the fluid to escape between it and the cork. When the extremity of the tube is above the surface of the fluid, none of the latter can escape through it; and when the lamp is to be used, the tube is drawn down, as represented in fig. 1; the degree of its depression being regulated by the size of the flame that is wished to be produced. When a low flame is required, the horizontal part of the tube is cemented to a low flat stand; and when the lamp is to be lighted, the fluid is made to flow by drawing up the reservoir, instead of, as in the former case, drawing down the tube. For occasional purposes, a tube bent, so as to form a syphon, and passed through a cork in the neck of a phial containing the fluid, constitutes a very convenient lamp. When, with a lamp of any form, it is wished to produce a large flame, it is only necessary to increase the number of the burners; and in this way the degree of heat can be regulated at pleasure, and with great accuracy. The advantages, &c. resulting from the combustion of alcoholic fluids in a lamp without a wick, will afterwards be considered.

A lamp for burning oils, for the purpose of illumination, is constructed on the same principle as that for burning alcoholic fluids. The reservoir may be made of metal, or of plain, cut, or coloured glass, so as to produce a beautiful effect And a fine green, red, or yellow colour, can easily be communicated to spermaceti oil, producing the same effect as coloured glass. The form represented by Fig. 2, which may be modified according to taste, having additional branches, &c. may, perhaps, be found as suitable as any other. One that contains one or two ounces of oil, and whose burner is not larger than an ordinary bugle bead, burns for eight or ten hours; and will enable most persons to read or write. A lamp of this description has continued burning for three days and a half, or eighty-four hours, without having been touched; and the small conical crust, which formed on the burner, did not amount to two grains, though the oil was of the inferior quality that is sold under the name of whale oil. When a greater degree of illumination is required, the number of burners, and capacity of the reservoir, must be increased in proportion. It will be found, that a lamp of this description is as readily lighted as a candle, or lamp with a wick; and the burner may be such as to produce a flame that is a mere luminous point in a dark apartment, or only a blue speck, that is invisible at a short distance; or such as to give a flame similar to that of an argand lamp with a wick. This last may be effected, either by two short and wide tubes, having an arrangement similar to the metallic wick-holder of an argand lamp, or by means of small short tubes, placed nearly in contact, and in the form of a circle.

A convenient small hand-lamp, for occasional purposes, and either for burning oil or alcoholic fluids, is made, by fixing a long tube in the mouth of a small bag, formed of caoutchouc, or other impervious substances; the burner being supplied by the pressure of the hand.

When a thin narrow collar of metal is attached to the mouth of a burner, so as to project in the form of a small cup, the resemblance of the flame then produced, to that of a gas-lamp, is so complete, as readily to deceive those who are not aware of the presence of oil. If the collar be made of impure silver, and the lamp has not recently been used, the flame, when first lighted, has a green colour; but this adventitious colour disappears in the course of a few seconds, when the metal acquires a red heat. In the practical line, this modification of the wickless lamp, is particularly deserving of attention.

Various attempts were made to take advantage of the capillary attraction of tubes, for maintaining a constant supply of oil to the burner, which, at first, proved unsuccessful; and the want of success was attributed to the well-known fact, that, however high a fluid may rise in a tube, by capillary attraction, it will in no instance rise, so as to flow from its upper orifice. This, however, was found to be incorrect; for a small perforated disk of mica, having a small tube cemented into the perforation at its centre, will constitute a burner of this description. When such a burner is placed so as to float on the surface of oil, the oil rises by capillary attraction, and fills the tube. If a lighted match be now applied, the oil in the upper part of the tube evaporates and produces a flame, fresh portions of oil rise to fill the empty space, and thus combustion is maintained. With such a burner there is no shadow; the reflected image of the flame being seen directly under the true flame. From a number of such burners, in an appropriate glass vessel, the illumination is brilliant; and the floating disks are observed to be in continual motion, as if alternately attracting and repelling each other; which proceeds from film of oil immediately under the mica, becoming expanded by heat. Though such burners, when properly constructed, will maintain combustion for many hours, if the flame is by any means extinguished, they almost instantly sink to the bottom. This results from the structure of the mica, and the expansion of the oil by heat. Mica is composed of thin plates, which admit oil into their interstices, and the oil thus admitted, with that on the under surface of the mica, is expanded by the heat of the flame. When the flame is extinguished, the oil cools, and then the mica, being specifically heavier than the oil, necessarily sinks.

A burner, similar to the one above described, but more applicable to ordinary purposes, seems to merit description, as it may be readily constructed, and will be found admirably adapted for a night lamp. In this form, a small light concave shell, or a light concave glass, resembling, in miniature, that of a watch, or a small disk of card paper, made concave by pressure, and coated with a solution of gum, is used instead of the mica. A small hole is made in the centre, and a piece of sound cork, about the size of a pea, is cemented on the convex side, and over the perforation. A small perforation is then made through the cork, and a rather wide and thin bugle bead is stuck firmly into it, from the concave side of the shell. The only use of the cork is to fix the burner, so as to admit of its being readily adjusted or replaced. When the shell floats on the oil, the upper extremity of the burner should be nearly on a level with the surface of the fluid; and if the burner be properly fixed in the cork, the shell, glass, or concave piece of paper, will not sink when the flame is extinguished. The quantity of pale rape seed oil (which, in every respect, is the best,) that is consumed by a single burner, amounts to about three-fourths of an ounce in twelve hours, and the consumption is so regular and uniform, that, when a lamp is constructed in the form of a floating syphon, it is found to measure time with great accuracy.

Tallow, and other solid combustibles, of a similar nature, may also be burned without a wick. In such cases, it is only necessary to melt a small quantity of the solid substance, with the end of a hot wire or rod of glass; or to introduce a little oil into a hollow, previous to introducing the floating burner. Afterwards, the heat of the flame is sufficient to keep up a supply of fluid.

It is well-known, that volatile oils, such as turpentine, give out so much carbon in the form of soot, during their combustion, as to prevent their being, hitherto, burned in a lamp, for the purpose of illumination. Turpentine, however, may be burned in a lamp, so as not only to give out no carbon in the form of soot, but to afford a beautiful white light, which, in splendour, far exceeds that given out by the fixed oils: this was exhibited on a small scale, by means of a small experimental glass lamp. All the fixed oils are rendered empyreumatic, previous to combustion; and the same change is necessary in the case of turpentine, but, from its volatile nature, is less readily produced. From the extreme whiteness and splendour of the flame of turpentine, there is reason to expect, that it may yet be applied to valuable purposes.

ON FIGURES.

SIR,—Having seen in your 149th number, page 135, a letter from Philo Twist'em, stating it to be his opinion, "that a series of papers, explaining, in a plain and familiar style, the science of figures," would be acceptable to a numerous class of your readers, I take leave to offer you the following, as the first of a series, which I shall continue at my leisure. I shall commence with vulgar fractions; but should any of your young readers require information on some of the earlier rules, I shall be most happy to communicate it to them.

I am, &c.

1 and 2 make 3.

Characters Explained.

+ means plus or addition, or that the figures between which it is placed are to be added together, thus $1+5$ make 6.

— Minus or subtraction; or that the figure which is placed after it is to be subtracted from that which is placed before it, thus $6-4$ leaves 2.

× Multiplication; or that the figures between which it is placed are to be multiplied, together, thus 3×3 make 9.

÷ Division; or that the figure which is placed before it is to be divided by that which is placed after it; thus $10\div2$ leaves 5.

= Equality; or that the figures which precede are of the same numerical value, or amount to the same sum as the figure placed after it; thus, in the last example, $10\div2=5$, meaning that 10 divided by 2 is equal to 5.

: :: : Proportion; or that the figures between which they are placed bear the same proportion to each other; thus, $4 : 6 :: 8 : 12$, which denotes that in the same proportion as 4 is to 6, so is 8 to 12; four being two-thirds of the amount of six, and eight being two-thirds of the amount of twelve.

$\sqrt{3}$ or $3^{\frac{1}{2}}$ denotes the square root of number 3.

$\sqrt[3]{5}$ or $5^{\frac{1}{3}}$ denotes the cubic root of number 5.

7^2 denotes that the number 7 is to be squared.

8^3 denotes that the number 8 is to be cubed.

Vulgar Fractions.

A FRACTION is a part of a whole number, or if a whole be divided into any number of parts, those parts are called fractional parts or fractions. A fraction is expressed by two numbers separated by a line, the lower of which denotes the number of parts into which the whole has been divided, and the upper, the number of those parts which a person, for example, may have. Thus, $\frac{2}{3}$ means that you are to divide one whole into three equal parts, and take two of the parts so divided. The upper figure is called the *numerator*, and the lower the *denominator*.

We shall treat of four kinds of fractions, proper, improper, compound, and mixed.

1st. A fraction is termed *proper* when the upper number or numerator is less than the lower number or denominator, thus $\frac{4}{8}$, $\frac{7}{14}$, $\frac{9}{16}$, are proper fractions, because each of them is less than a whole number; for if you were to divide any thing into 8 equal parts, and take but four of those parts, there would be four parts left.

2nd. An improper fraction is that in which the numerator is equal to, or of greater value than the denominator; thus, $\frac{3}{3}$, $\frac{4}{4}$, $\frac{3}{2}$, $\frac{6}{4}$, are improper fractions.

3rd. A compound fraction is the fractional part of a fraction, and is known by the word "of;" thus, $\frac{1}{2}$

of $\frac{2}{3}$, $\frac{3}{5}$ of $\frac{5}{6}$, are compound fractions.

4th. A mixed number is composed of a whole number and the fractional part of another whole; as $2\frac{1}{2}$, $3\frac{1}{4}$, &c.

(To be Continued.)

IMPROVED PROCESS OF PRINTING OR DYEING WOOLLEN AND OTHER FABRICS.

Messrs. Richardson and Hirst, of Leeds, have obtained a patent for this invention, which consists in covering parts of the surfaces of woollen fabrics with a certain composition that will resist the chemical action of the coloured liquor, into which the fabric is to be immersed in the process of dyeing: in order that when the cloth so covered is withdrawn from the dyeing vat, and the composition is removed from its surface, those parts which have been thus guarded, may have retained their original colour, and not have been in any degree affected by the dyeing liquor.

The composition is to be made by mixing about five stone of wheaten flour, with about four gallons of water; making a smooth paste, about the consistency of treacle. (It is not to be boiled, we presume, as the specification is silent upon that subject.) After this mixture has stood for three or four days, the yolks and whites of forty raw eggs are to be added, and the whole stirred well together. The composition is then ready for use; and is to be laid upon the fabric by means of a brush when large portions of the surface are to be protected, or by printing blocks when small parts of the surface are to be preserved from the ground colour in the form of a pattern. A small quantity of powdered glass or shells, or fine sand, is then to be sifted over the composition, for the purpose of assisting to set and bind it firmly; this, however, may be dispensed with, if the composition is thick, and can be dried soon. The fabric being thus prepared, is then ready to be immersed in the dyeing vat, and treated as usual.

When the dyeing process has been performed, the fabric is to be withdrawn from the vat, and the composition being scraped off, or otherwise removed, presents those parts which were covered perfectly free from the colour of which the other portions of the surface of the fabric have been dyed.

For the purpose of further illustration, the patentee describes the process of dyeing and figuring a lady's shawl in several colours. Suppose one side of the shawl is to be dyed of a plain blue, all over its surface, and the other side is to have a rose-coloured ground, with a white border, to be afterwards printed with a chintz or other pattern. The shawl being stretched upon a square frame, that side which is to be blue, and that part of the other side intended for the border, is to be covered with the composition as a guard, leaving only that part exposed which is designed to be dyed a rose colour; the frame with the shawl, is then immersed in the dyeing vat, and remains there until it has imbibed its tint.

The shawl being now withdrawn from the dye, that side which is intended to be blue, is to be cleared from the composition, and the other side covered completely. It is then immersed in the blue dye, and after that operation has been performed, the whole of the composition is to be removed, and the shawl will appear blue entirely on one side, and rose-coloured, with a white border, on the other; which being afterwards printed in the ordinary way, with a chintz or other suitable pattern, finishes the colouring of the shawl.

Newton's Journal.

OXALIC ACID.

This acid was discovered by Scheele, and first described by Bergman. It is obtained by heating a solution of sugar in nitric acid.

It crystallizes in small four-sided prisms, terminated by dihedral summits. These crystals are composed of 77 parts acid, and 23 water. When exposed to heat, it sublimes, but at the same time is partly decomposed.

These crystals have a very acid taste, and redden vegetable blues. They dissolve in their own weight of boiling water, and in twice their weight of cold water. They dissolve, also, readily in alcohol.

When exposed to dry air, they effloresce; but in moist air they are not altered. Neither oxygen, nor the simple combustibles or incombustibles act on this acid. It oxidizes some of the metals; but most of them are not affected by it.

It combines with the salifiable bases, and forms a class of salts, called *oxalates*. Muriatic and acetic acids dissolve it; sulphuric acid decomposes it, by the assistance of heat. Nitric acid converts it into water and carbonic acid.

When combined with a base and distilled, it is decomposed, and converted into water, carbonic acid, carbonic oxide, carburetted hydrogen, and charcoal. It is composed, according to the experiments of Dr. Thompson, of

oxygen	64
carbon	32
hydrogen	4
	100

Thenard and Gay Lussac make its constituents as follow:—

oxygen	70·689
carbon	26·566
hydrogen	2·745
	100·

COMPOUND OF VARIOUS METALS.

M. DITTMER has shown in the Hanoverian Magazine, that the following mixture, compounded by the privy counsellor, Doctor Hermstadt, may be substituted for gold, not only with respect to colour, but also to specific gravity, density, and ductility:—16 loth (less than 8 French ounces) of virgin platina, 7 loth of copper, and 1 loth of zinc, equally pure: place these metals together in a crucible, cover them with powdered charcoal, and melt them completely into a single mass.

SUBSTANCES PRESERVED FROM HUMIDITY.

When a mixture of one part of oil and two parts of resin is forced, by the application of a high temperature, to penetrate porous substances, as building stones, plaster, &c. it renders them perfectly impermeable to moisture.

CARBONATE OF MAGNESIA.

According to Bischof, 1363 parts of water dissolve one part of carbonate of magnesia, which is a larger portion than stated by Dr. Fyfe, who found that it required 2632 parts of water to dissolve one part of carbonate of magnesia.

HEIGHT OF MOUNTAINS IN OWHYEE AND MOWEE.

The gigantic height of the mountains of these islands have made them the admiration of navigators. Captain Kotzebue found their height to be as follows:

Island of Owhyee	Toises.
Merino Raa	2482·4
Merino Kaah	2180·1
Merino Worarai	1687·1
Island of Mowee.	
Highest Peak	1669·1

NOTICES TO CORRESPONDENTS.

T. C. E. in our next.

The numbers published by Messrs. Hunt and Clark, do not belong to our series of the Mechanics' Magazine, and, consequently, will not be noticed in the Index of the Sixth Volume.

Communications have been received from "A Civil Engineer,"—A. D.—G. G.—A Constant Subscriber,—A Mechanic, and J. Hall, the whole of which shall meet with due attention.

Communications (post paid) to be addressed to the Editor, at the Publishers', KNIGHT and LACEY, 55, Paternoster Row, London.

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Mechanics' Magazine,

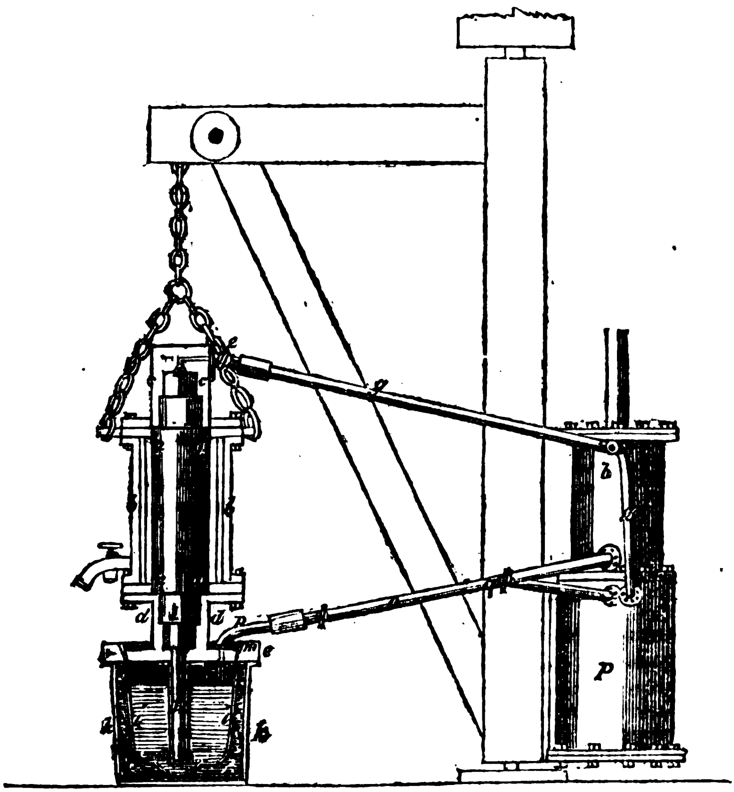
MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 154.] SATURDAY, AUGUST 5, 1826. [Price 3d.

"Though the arts which minister to luxury and refinement have attained a higher eminence in other countries, yet, in every department of intellect which is really useful, Britain has no rival among nations, and has, in fact, opened and explored more new regions of thought, in every direction, than all the rest of the world since the restoration of learning."

QUARTERLY REVIEW.

IMPROVED MODE OF CASTING CYLINDERS.



A patent has been recently granted to William Church, of Birmingham, in the county of Warwick, esq. for his invention of certain improvements in Casting Cylinder Tubes, and other articles of Iron, Copper, and other Metals.

The particular object of this invention is to effect the casting of metallic forms of the kinds above alluded to, in a more perfect manner than has heretofore been accomplished, in order to produce the articles so cast, free from air holes; that is, perfectly sound, compact, and of an uniform texture; and in which process of casting, the patentee states that he is enabled also to give a case-hardened surface to the articles if required.

For this purpose, it is proposed to employ both exhaustion and condensation of air in the process, and therefore he combines such apparatus as will enable him to effect those objects in a convenient way. But as the great variety of articles to be cast, must necessarily require differently formed apparatus, and as it is impossible to describe every form that circumstances may render eligible, he merely exhibits, in the drawing which accompanies his specification, one construction of apparatus, (by way of elucidation) which he proposes to employ for casting cylinders or rollers.

The figure represents a section of the mould in which the article is to be cast, with the other parts of the apparatus suspended by means of chains to an ordinary crane, in which is also shewn a section of the pan or chest that holds the melted metal, with an air pump and air vessel connected, both to the mould and to the metal chest, by means of tubes with union joints.

The mould in this instance consists of a hollow cylinder of iron, *a*, *a*, *a*, *a*, with flanges at the ends, the interior being bored, or otherwise truly formed to the figure of the intended cylinder or roller about to be cast; *b*, *b*, is an outer case or jacket surrounding the mould, and leaving a space between for the passage of cold water, which is intended to be conducted through this passage at the time of casting, by means of a pipe leading from a cistern, or otherwise, and a cock at bottom, in order to cool the mould; *c*, *c*, and *d*, *d*, are caps to be attached to the ends of the mould, in which is formed the hollows or recesses for casting the gudgeons and ends of the roller; these caps and the jacket are all united to the cylindrical mould by means of screws passing through the flanges. In the upper part of the cap, *c*, a small channel is made with a conical valve, and a short piece of pipe, *e*, is attached at the mouth of the orifice with a stop cock, through which channel and pipe the mould is to be exhausted. At the lower end of the cap, *d*, a pipe or tube, *f*, is attached by a gland, and rendered air tight, which pipe is made of such a material, as will resist the action of heat, or such as crucibles are usually composed of; through this pipe the melted metal is intended to flow into the mould. The lower end of this tube, *f*, is covered by a cap of iron, or other metal, which should be made to fit the tube closely, and be luted at the upper edge.

The mould thus put together is to be suspended by chains from the crane, and then the pipe, *g*, which is attached by a cock joint to the air pump, *h*, is to be connected to the short pipe, *e*, by means of the union joint. The joints of the mould being now properly luted and rendered air tight, the air pump is put to work, and the interior of the mould exhausted, in which state it is ready for casting, or it may have been previously exhausted by the ordinary application of an air pump.

The pan or metal chest may be of any convenient form; that shewn in the figure at *i*, *i*, is preferred, and it must be of such capacity as will contain a sufficient quantity of melted metal to produce the article about to be cast. This pan is to be inserted in another pan or vessel, *k*, *k*; and the space between the two to be filled with pulverized charcoal or other materials that are imperfect conductors of heat. The pan with the melted metal is to be brought from the furnace, and placed in such a situation under the mould, that the mould may be lowered down to it, and the pipe, *f*, immersed in the melted metal, the conical form of the flange at the bottom of the cap, *d*, fitting into the rim, *e*, *e*, on the top of the metal chest; and in order to make the joint more close, a springing hoop, *m*, of wrought iron, and of a wedge form, is placed round within the rim in contact, and forming an air tight joint with the upper edge of the rim, which giving way at bottom, to the pressure of the mould, secures the joint air tight. Through the lower flange of the cap, *d*, there is a small aperture, with a short piece of pipe, *n*, attached to it, through this aperture and pipe, the air may be drawn from or forced into the metal chest, *i*. The mould and metal chest being now united, as shewn in the drawing, the pipe, *o*, which is attached to the air pump, and to an exhausted air vessel, *p*, by means of a three-way cock joint, *q*, is connected to the short pipe, *n*, by a union joint, and the whole of the apparatus is now ready for effecting the casting.

In commencing the operation, the cock, *q*, is to be turned so as to open a communication between the metal chest, *i*, and the exhausted air vessel, *p*, by which the pressure of the atmosphere is removed from the surface of the metal for the purpose of preventing it from rushing up the pipe, *f*, into the exhausted mould, when the mouth of the pipe opens by the melting of the metal cap, which cap is to be made of such metal and thickness as will allow it to melt shortly after the immersion of the pipe in the fluid metal. The cock, *q*, is now to be turned so as to cut off the communication with the exhausted vessel, *p*, and open a communication with the lower end of the air pump.

It is here to be observed, that the air pump is employed both as an exhausting and a condensing pump; and its piston being now put into action, air is driven from the lower end of the pump through the pipe, *o*, into the metal chest, which forces the metal up the pipe, *f*, and thereby causes it to fill the mould.

To guard against the pressure of any air which might have gained access to the interior of this mould, the stop cock, *e*, is to be opened, which leads through the pipe, *g*, to the exhausting end of the pump, and as the pump forces air on the surface of the melted metal, a constant vacuum is kept up in the interior of the mould above the rising vessel.

In order to prevent the metal from flowing through the exhausting passage, a conical float valve is suspended in the cap, *e*, which, as the metal rises, closes the aperture. It may be necessary to remark, that the valves of the air pump are not shewn, as that apparatus is already well understood.

The patentee states, "It is obvious that moulds which are designed to cast articles, having irregular surfaces, such, for instance, as cannon that cannot be slidden out, must be constructed of parts put together, so as to render them air tight. Though I have shewn in the drawing a jacket surrounding the cylindrical part of my mould for the purpose of conducting cold water, yet I do not intend, under all circumstances, to employ that mode, but only when I desire to give the casting a case-hardened surface."

Newton's Journal.

HISTORY AND PROSPECTS OF ENGLISH INDUSTRY.

A VERY excellent article has appeared in the last Quarterly Review, under the above title, in which the author examines, in the most masterly manner, several works which have recently appeared in France, on the subject of British industry. We regret that our limits are such as will not admit of its transcription, more especially, as some of the authors whose opinions he confutes, have obtained, not only a distinguished rank in the literature of their own country, but some degree of eminence in this. This is particularly the case with M. Dupin, who, since the publication of his work on Great Britain, has acquired no small degree of credit with our countrymen. Though our limits will not admit of its being given to our readers in full, we shall, from time to time, lay before them some of the most interesting particulars, beginning with the subjoined.

The prospects which are now opening to England, almost exceed the boundaries of thought; and can be measured by no standard found in history. It is not by conquest that her empire is to be extended, neither is the power toward which she is advancing to be steeped in blood. The destiny which the present æra foretels her, is to be fulfilled by promoting happiness, and she will grow prosperous as mankind become civilized. It is by introducing comforts into uncultivated regions; by making savage man familiar with the blessings which the utmost reach of mind has discovered; by helping youthful nations into maturity, and by extending the pale of social intercourse, that the wisest, the most moral, and, consequently, the freest of nations is to fill up the career which is now before her. Instead of making distant shores resound with her great artillery, she will bless them with the produce of her still greater engines of peace; and her triumphs shall be illuminated, not by flaming cities, but by the nightly blaze that issues from her mighty fabrics of prosperity and happiness. These are the labours which suit the people that brought back peace to Europe; and it is a just recompense that the strongest in war should be the foremost in industry. When this ceases to be, civilization will have become retrogade.

Although it may not be very easy to give a just estimate of the means which England possesses, at this moment—means which are entirely of her own creation—to accomplish these ends, and to increase her own prosperity, as well as the happiness of mankind; yet the object is so vast, so much beyond what any former period of the world could have imagined, that we cannot resist the gratification of stating one or two particulars which, taken with the due restrictions, may yet give some notion of the stupendous power which is now at her disposal.

One of the first of these is furnished by M. Dupin, who, however little we incline to admire his speculations upon moral questions, may be admitted as evidence in estimating physical forces. All the world is more or less acquainted with those immense masses, the pyramids of Egypt, which were considered among the wonders of antiquity. The materials of which the largest of them is constructed, were dug out of the earth at a considerable depth; and at no small distance from their present situation. They cover more than eleven English acres; and are piled up to the height of about 700 feet. According to M. Dupin's calculation, their volume is equal to about 4,000,000 of cubic inches; their weight is 10,400,000 tons; which raised to the height of eleven metres from the bottom of the quarries to the surface of the earth, and of forty-nine more as their mean elevation above the basis; in all, sixty metres above their original level—give 624,000,000 tons raised to the height of one metre. Now the steam engines employed in England, are equal to the force of 320,000 horses, (1820) and can raise 862,800,000 tons to the height of one metre in twenty-four hours. But 624,000,000 tons being less than three-fourths of this quantity, it follows, that the steam engines of England could have raised the materials of which the great pyramid is constructed out of the quarries, could have conveyed them to their present place, and heaped them up in their present form, in less than three-fourths of one day, that is to say, in less than eighteen hours. According to Diodorus Siculus, this building employed 360,000 workmen; according to Herodotus, 100,000 workmen during twenty years. Whichever of these estimates be nearest the truth, it is certain that one of the most powerful monarchies of remote antiquity, applied its whole disposable resources in the construction. Therefore the mechanical power of British steam engines was, in 1820—and it has much increased since that time—to that of the Egyptian monarch Cheops, inversely as the times necessary to each to perform the same task; that is to say, as twenty years to eighteen hours, or about 10,000 times as great. Neither would it be unfair to deduce from this single fact, that the general power of the two monarchies, including that which is the source of power, knowledge, was, if not exactly in this ratio, at least in a proportion which could not widely differ from it, let us, with great moderation, say one-fourth as great; that is, it is more than probable that the power of England is, at this moment, 2500 times as great as was that of Egypt, at the period when this pyramid was constructed. When we consider the reach of intellect which is necessary to devise the steam engine, in its present state; together with its general influence upon civilization, and the part it acts in national prosperity, it would be impossible for a nation which it has made many times as powerful as another, by its direct effect, to be less than one-fourth as great in every branch where its action is only indirect.

By the power of steam, every machine to which it is applied, receives, not an addition, but a multiplication of force. The power thus produced, in 1820, was computed to be equal to 320,000 horses, or about 2,240,000 men. At this moment, steam, on account of its many new applications, and the improvements made in the manner of employing it, may perform the work of nearly three millions of men, in the united kingdom.

Let us now see the effect of this power in the manufacture of cotton. We have already shown the rapidity with which the consumption of this vegetable wool increased, between the years 1767 and 1787. The various machinery now used in manufacturing it, has enabled one man to perform the work of one hundred and fifty. Now the lowest computation supposes 280,000 men—some say 350,000 men—to be employed in it. Hence the work now performed in this single branch would, half a century ago, have required 42,000,000 of men, according to some, 53,000,000; that is to say, at the lowest computation, more than twice as many men, women, or children, as now people the British islands. Now, supposing the labour of each of these men cost, at this hour, the very moderate sum of one shilling per day, or 18*l*. per annum, the pay of 42,000,000 of labourers would be 756,000,000*l*. per annum, or a little more than thirteen times the annual revenue of England. Deducting from this sum the pay of the labourers now really employed, at the above annual rate, (280,000 × 18*l*. = 5,040,000*l*.) and allowing the enormous sum of 50,000,000*l*. sterling for the wear and tear of machinery, buildings, and incidental expenses; the result is, that the machinery employed in cotton manufactories, save 700,000,000*l*. sterling to the British nation; or, in other words, that, without machinery and steam, the prodigy of British industry and civilization would still have been wanting to honour mankind.

But still further—The power employed in the cotton manufactories alone, of England, exceeds the manufacturing powers of all the rest of Europe collectively. The population of this continent does not amount to 200,000,000, or to five times forty. Now one-fifth of this population certainly is not employed in manufacturing; and all Europe, supposing it to be as industrious as England, and wholly occupied by cotton, could not, unassisted by machinery, spin and weave as much of that material as England now does. But the most industrious country of Europe is not half so much engaged in manufacturing as England is, and many of them are ten times inferior; in so much, that the average hardly stands as high as one-fourth in industry; hence, then, four Europes could not, at this moment, spin and weave as much cotton as England does. But the manufacturing industry of England may be fairly computed as four times greater than that of all the other continents taken collectively; and sixteen such continents as Europe, in the average state of industry of the whole world, and exclusively occupied by cotton, could not manufacture so much of it as England now does. Again, the cotton manufacture of England may be said to be one-fourth of her total industry; and her total industry could not be performed by sixty-two such continents as Europe, in the average condition of the world. But this ratio must be multiplied by the entire population of the world, divided by that of England; and the superiority of our eighteen or twenty millions of subjects, will thus be, at least, as one thousand to one, over the average power and condition of mankind at large.

Such are the means which a rude approximation gives as those that England now possesses, to pour out the blessings of civilization on the rest of the world. But, lest this estimate should be thought too high, we are ready to reduce it to one fifth, and to say that the productive power of Britons is only 200 times as great as that of an equal number of men taken in the average population of the earth. We know not what portion of this 200 M. Dupin means to allow as the present superiority of England, and to claim as the past superiority of France; and we shall leave him to settle the account as he pleases.

From this vast career of industry, now opened to the world, the French have taken the alarm, and their thoughts begin to turn toward that rising continent, which promises so wide a market for all that man can manufacture. We must expect to find them as active rivals there, as they have been elsewhere; and employing the same means as ever to vie with us. Not that we see any real danger to be apprehended to our commerce from their exertions; unless, indeed, some miraculous progress has been made since the last public act, by which a judgment might be formed upon the state of their manufactures; we mean the last exhibition of the products of French industry. In 1823, another of those childish shows took place, so inadequate to give a just idea of the real condition of a people, or to answer any purpose but that of non-consuming idleness and non-productive vanity. This exhibition was, if possible, more meagre than any which had preceded; for in what estimation must we hold the national labours, of which periwigs and perfumes were so large a part? Yet they figured in the Palace of the Louvre, amidst cases of artificial teeth, sweetmeats, confitures and bonbons; reminding us, in the midst of what frivolity, held most solemn, of the ingenuity of a Parisian new year's day, when sugar and flour are disguised, 'a' s' y tromper,' in the shape of sucking pigs, hams, boots, and birch rods. British industry certainly is not of such stuff as this. It is not for parade and pageantry. Where is the palace that could contain a just specimen of what steam can perform on general civilization? or who would conceive the influence of an iron railway upon human happiness, from all that could be crammed into the largest gallery of Paris? The mind which projects such wonders as these, is not coercible under roofs and colonnades; neither could any show-boards utter what it is. If the French can thus be vain of useless gilding and luxuriant dyes, what would not their boasting be, if they possessed a Soho or a Birmingham? But no; where boasting is, Watt could not be.

POWER OF THE SUN'S RAYS.

Mr. Mackintosh, a respectable and intelligent gentleman, who is contractor for the government works, carrying on at Stone-house Point, near Plymouth, having descended in a diving-bell, with workmen, for the purpose of laying a foundation for a sea wall, reports, that when the machine, which is provided with convex glasses in the upper part of the bell, was twenty-five feet under water, to his astonishment, he perceived one of the workmen's caps smoking;—on examining it, he found that the rays of the sun had converged through the glass, and burnt a hole in the cap; also, that similar effects had, during hot weather, frequently occurred on their clothes, so that the workmen, now aware of the cause, place themselves out of the focal point.

SELF-ACTING PIANO-FORTE.

The Dublin Journal gives a long notice of the mechanism of an ingenious instrument of this kind, stating that it performs, with extraordinary effect, some of the most classical and difficult music, and that great difficulties have been surmounted by the inventors.

It combines the most rapid and brilliant execution with distinctness and neatness, and they venture to affirm, that there are few players of the piano-forte that can equal it in these qualities. Its harmony is necessarily more full than can be produced by eight fingers, the elements of chords having no other limit than the extent of its scale. The instrument not only plays the usual piano-forte part of a piece, but takes in also the subject of some parts of the score; its *crescendo* and *diminuendo* are graduated with more precision than can be effected by means not mechanical, the time cannot be otherwise than perfectly equable throughout; yet, where pathos is to be expressed, the time can be retarded or accelerated in any degree. In short, this admirable instrument manifests all the capabilities of a living performer, and superadds qualities derivable only from mechanical agency.

The mechanism is simple: it consists of a cylinder, which turns on its axis, and is acted on by a coiled spring, and regulated by a fly-wheel. On the surface of the cylinder a proper arrangement of brass pins is formed, each of which, in passing under a rank of levers, elevates one end of the required lever, and depresses the other. The depressed end pulls down with it a slender rod, which is connected, by a slide, with the tail of a bent lever, on the further end of which is the hammer which strikes the string. The slide can be shifted further from, or nearer to, the axis, on which the hammer lever turns, and thus the stroke of the hammer is made feeble or strong to any required degree. When wound up, the instrument will continue to play for a considerable time; and it is provided with a bench of keys like the ordinary piano-forte, so that a person may accompany the instrument, or play a duet with it, the effect of which is said to be very fine.

DESCRIPTION OF A NEW TRANSPLANTING INSTRUMENT, FOR REMOVING PLANTS WHEN IN FLOWER.

By MR. MATTHIAS SAUL, *of Lancaster.*

SIR,

I send you a description and drawing of a transplanting apparatus, which, if you think of any interest to the readers of the Gardener's Magazine, you are extremely welcome to. It differs from the one given in your Encyclopedia of Gardening, and from every other which I have seen or heard of. When the instrument is put together it forms a cylinder (*fig.* A), and when separate it consists of two parts (B), which are joined together, something on the principle of a common door-hinge. In using this instrument it is best to have two of them; one to take out the earth at the spot where you wish to insert the plant, and one to remove the flower with its ball of earth. The instrument may be made of any size; mine is about six inches long, and six inches in diameter. I find no necessity for any handles: in using it I place it so that the plant or flower is in the centre; I then press the apparatus into the soil, and find no difficulty in drawing the plant up with the soil, not more disturbed than if it had been originally planted in the instrument. On the 25th of April I took up a Van Thol tulip and a seedling polyanthus from my garden, and placed them on the flower-stage of the Lancashire flower-show, where they remained from ten o'clock in the morning till five in the afternoon. I then replaced them in the same place in the garden, and, after I had withdrawn the apparatus, there appeared no defect in the border, nor drooping in the flower. I have removed several large wallflowers in full bloom this month, without the least appearance of the flower being injured. I have always been told that a plant in full flower could not be removed, but I have proved that by this apparatus it may be done with safety.

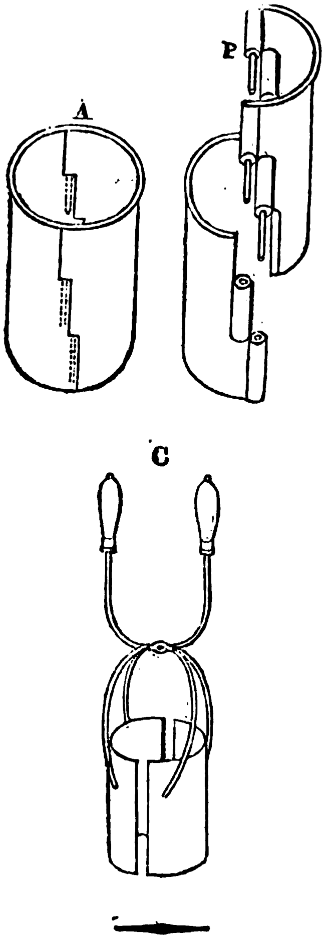
I am at present trying some other experiments, the result of which will, I hope, be of interest to the Gardener's Magazine.

I remain, Sir, &c.

MATTHIAS SAUL.

Sulyard Street, Lancaster,
April 23, 1826.

Transplanters are chiefly used by florists to fill up blanks in show-beds of flowers. The French one (*fig.* C), is one of the neatest. Excepting for the purposes mentioned, a trowel or the spade will be preferred by the practical gardener.

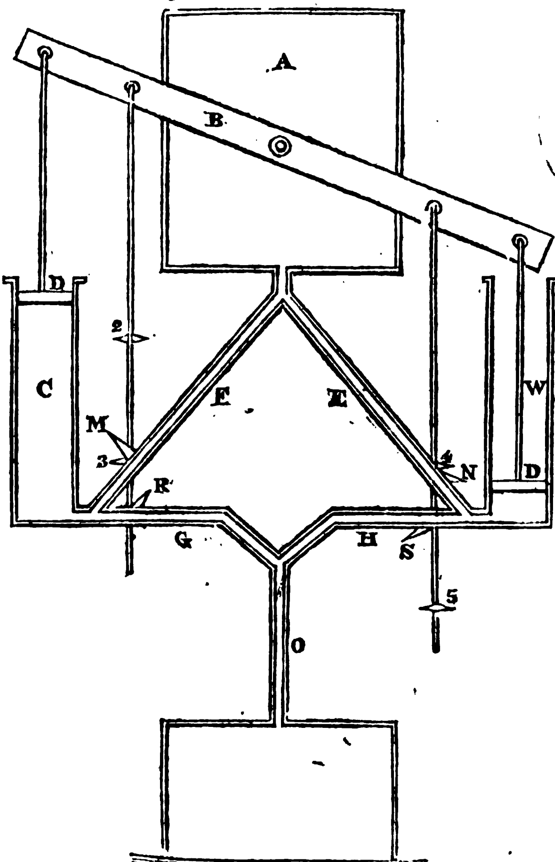


MERCURIAL VACUUM ENGINE.

SIR,—I take the liberty of sending you a design for a machine, suggested by one on a plan something similar to that of Mr. Tonkin, which appeared in the Mechanics' Magazine sometime back. A, is a cistern filled with mercury, B, the beam rod; C W, are two cylinders; D D, two pistons; E F, two pipes communicating with the cistern; G H, two pipes which lead from the cylinders, and unite into one pipe, O, which is three feet long, and dips into a reservoir below; M and N are two cocks, as also are R and S; 2, 3, 4, and 5, are stops.

The action is simple and easily explained. In the present position of the machine, the cocks M and S are represented shut, and N and R, open: the cylinder, C, has just been filled with mercury, through the pipe F, but the piston, D, having arrived at the top of the cylinder, C, the stop, 3, strikes against the cock, M, (which was before open) and shuts it; at the same instant, another stop, which could not be shown in the drawing, strikes against the cock, R, and opens it; consequently, all the mercury in the cylinder, C, runs out by the pipe G, and leaves in C, the *most perfect vacuum that art can produce*. If, therefore, the cylinder contain a little more than a cubic foot, you have a power which will raise a ton. The piston instantly descends in this vacuum, and the instant it arrives at the bottom, the stop, 1, strikes against the cock, M, and opens it, while the stop, 3, shuts R, and the mercury instantly descends through E, and raises the piston, D, to the top of the cylinder, C, and so on. The working of the other piston is exactly similar, and the action is thus continued without interruption: the cocks and stops being so arranged, that while one cylinder is emptying the other is filling. It will be perceived that the vacuum is not the only means by which the power is obtained: the descent of one piston being materially assisted by the rising of the other, impelled by the upward pressure of the mercury, which flows into the cylinder through the then opened communication with the cistern. This engine would act with water, but the pipe, O, must be 33 feet long, instead of three feet. Indeed, a column of mercury, 30 inches in height, is equal to a column of water, 33 feet in height. The power of the machine when thus used, would likewise be much diminished, as water leaves a very imperfect vacuum, on account of the vapour which is formed, while that from mercury is the most perfect which can be obtained. An objection might be raised against the expense of the mercury, but this could only apply in the first instance, as the same mercury might be used again and again, and in the working of the engine, there is no expense whatever, either of fuel or attendance.

I am, Sir,
Your's, &c.
T. C. E.



ON FIGURES.

Chap. I.

On the Reduction of Vulgar Fractions.

Before any rules can be done, it is necessary that the fractions should be reduced to their simplest forms; commonly to prepare them for the operations of addition, subtraction, &c.

Case I. *To Reduce Fractions to their Lowes Terms.*

Rule 1.—Divide both the numerator and denominator by any figure which will divide them without leaving a remainder; then divide the answer in the same manner, and so continue to do, until the answer admits of no further division.

Ex. 1. Reduce $\frac{7}{14}$ to its lowest terms.

In this we find that 7 will be the divisor; because both 7 and 14 can be divided by 7 without leaving a remainder:—thus,

7) 7 (1
— -
)14(2

Ex. 2. Reduce $\frac{144}{216}$ to its lowest terms.

$$\overset{2)}{\frac{144}{216}} = \overset{3)}{\frac{72}{108}} = \overset{4)}{\frac{24}{36}} = \overset{3)}{\frac{6}{9}} = \frac{2}{3} \text{ answer.}$$

Note 1. Any number ending with an even number, or a cypher, is divisible, or can be divided by 2.

2. Any number ending with 5 or 0, is divisible by 5.

3. If the right-hand place of any number be 0, the whole is divisible by 10; if there be two cyphers, it is divisible by 100; if three cyphers, by 1000; and so on, which is only cutting off those cyphers.

4. If the two right-hand figures of any number be divisible by 4, the whole is divisible by 4. And if the three right-hand figures be divisible by 8, the whole is divisible by 8, and so on.

5. If the sum of the figures in any number be divisible by 3, or by 9, the whole is divisible by 3 or by 9.

6. If the right-hand figure be even, and the sum of all the figures be divisible by 6, then the whole is divisible by 6.

7. A number is divisible by 11, when the sum of the 1st, 3rd, 5th, &c. or all the odd places, is equal to the sum of the 2nd, 4th, 6th, &c. or of all the even places of figures.

8. If a number cannot be divided by some quantity less than the square root of the same, that number is a prime, or cannot be divided by any number whatever.

9. All prime numbers, except 2 and 5, have either 1, 3, 7, or 9, as the right-hand figure: all other numbers are composite, or can be divided.

10. When numbers, with the sign of addition or subtraction between them, are to be divided by any other number, then each of those numbers must be divided by it.

Thus $\frac{10+8-4}{2}$, meaning that 10 added to 8 less 4 is to be divided by 2, the answer will be $5+4-2=7$.

11. But if the numbers have the sign of multiplication between them, only one of them must be divided.

Thus, $\frac{10\times8\times3}{6\times2}=\frac{10\times4\times3}{6\times1}=\frac{10\times4\times1}{2\times1}$

$=\frac{10\times2\times1}{1\times1}=\frac{20}{1}=20$ the answer.

As difficulties sometimes occur in finding the figure requisite for the divisor, according to Case 1, the reader is requested to pay particular attention to the following case.

Case 2. *To find a common measure which will reduce a fraction to its lowest terms at once.*

Rule.—Divide the greater number by the less, and by what remains, divide the last divisor; and so on, dividing always the last divisor by the last remainder, till nothing remains, and the last divisor will give the common measure required.

Ex. Reduce $\frac{147}{252}$ to its lowest terms by a common measure.

```
147)252(1
    147
    ---
    105)147(1
        105
        ---
         42)105(2
             84
            ---
             21)42(2
                42
                --
```

Thus we find 21 to be the common measure required; then

$21)\frac{147}{252}(\frac{7}{12}$ the answer.

Note.—If in finding the common measure, an unit should prove the remainder, the fraction will be at its lowest terms already.

I now subjoin examples on the foregoing rule for beginners to answer, and the correctness of the answers will be noticed in your address to correspondents.

1st. Reduce $\frac{144}{240}$ to its lowest terms by common measure.

2nd. —— $\frac{192}{576}$

3rd. —— $\frac{825}{960}$

4th. —— $\frac{1344}{1536}$

5th. —— $\frac{176}{547}$

6th. —— $\frac{5184}{6012}$

I am, &c.
1 and 2 make 3.

ECONOMICAL WINDMILLS.

Since the general introduction of steam engines, the use of wind, as a moving power for machines, has been much neglected in England. The French, who study economy to a great degree, in the construction of machinery, are beginning to bring the power of wind into more general use in agriculture, &c. The Society for the Encouragement of Agriculture at Chartres, have given a prize of 4000 francs to M. De La Molere, for the construction of a solid and economical windmill, capable of being applied to rural labours. The inventor sells these mills at the following prices: — A one-horse power, which will turn a stone of thirty inches diameter, 16*l*. and with a regulator, 24*l*.; a two-horse power, or a stone of thirty-six inches, 24*l*.; and 36*l*. with a regulator. These machines are made portable, to move to any part of the farm, to raise water for draining, irrigation, &c. Machines of three-horse and four-horse power, to turn stones of forty-two and forty-eight inches diameter, from 32*l*. to 48*l*.; with regulators the price is one-third more: to the larger of these machines is attached a smaller mill for crushing grain for cattle. Considering the small cost of these machines, that they may be made portable, and applied to a variety of purposes, and that corn may be ground by them for small families, we may expect that they will be generally introduced into farming establishments in this country: there can be no doubt that our own millwrights could make them as good, and nearly as cheap as the French. On the average, a windmill will work at least three days in the week, and it is no expense to the owner whether working or standing still.—It is not generally known that a given weight of corn will yield a larger weight of flour, when ground by a water mill, than when ground by a windmill, which is entirely owing to the greater absorption of moisture from the atmosphere of a water mill. A given weight of flour from the same corn ground at a windmill would, however, make a heavier loaf than the flour from the water mill, because the latter contains a large quantity of humidity, and will not require the same quantity of water to knead it into good bread.

VELOCITY OF THE DRAUGHT THROUGH FURNACES.

From a work in the press, called the Operative Chemist.

It might be supposed that the velocity of the draught through furnaces would long ere this have been reduced to calculation. Yet this is not the case, and the various measures of it by the several mathematicians who have investigated the subject, differ in an astonishing degree. They all, indeed, proceed upon the principle of the acceleration of velocity in falling bodies, and the usual theorems of hydrodynamics, but vary very considerably in the application of them.

The mathematical investigation of this apparently simple question may be divided into two classes. Most of them found their calculation on the compound ratio of the acceleration produced by the height of the chimney, and of difference in specific gravity between the external air of the atmosphere, and that in the flue of the chimney; and yet, even these do not agree in the results they obtain. On the other hand, Mr. Davis Gilbert, whose fame as a mathematician of the first rank is unimpeached, stands alone, as he grounds his calculation on the velocity with which atmospheric air rushes into a vacuum, or any medium of less density than itself.

They equally differ as to the place where the temperature of the heated air shall be taken to compare with that of the atmosphere: as the generality of writers take the temperature from the top of the chimney where the heated air rushes out into the atmosphere; while Mr. Davis Gilbert in this point varies from his brethren in choosing the temperature of the hottest part of the furnace for the ground-work of his calculation.

Taking then as an example, a furnace adapted for melting copper, with a chimney forty feet higher than the half, or average height of the entrance for air; the temperature of the hottest part of which is 1500 deg. Fahr., that of the air issuing from the chimney 123 deg. Fahr., and that of the external air forty deg. of the same scale. If we calculate the velocity according to the principles of M. Montgolfier, who is the first author who investigated the subject, as they are laid down by M. Payen in the Dictionnaire Technologique, namely, that the draught is equal to the velocity that would be acquired by a heavy body in falling through a space equal to the simple difference of the height of two similar columns of air standing upon the same base; the one of the air of the external atmosphere, and the other column of the air in the chimney, of the same height when hot, but reduced by cooling to the temperature of the atmosphere. Now, according to this hypothesis, the heated air will pass out of the chimney with a velocity of 10 feet ·91 in each second of time.

Another mode of calculation has been given in the article Furnaces, in Rees' Cyclopædia, grounded upon Mr. Atwood's theorem, which leads the writer of that article to divide the difference of the specific gravity of the heated air and external air by their sum, the quotient multiplied by the velocity which a falling body would acquire, by falling freely through the height of the chimney, will, it is said, give the velocity of the current of air through the flue. But this velocity will, the writer thinks, be double the real velocity, on account of the retardation which the current experiences by the friction against the sides of the flue. Now, if this mode of calculation be pursued, the velocity of the air issuing from a furnace of this kind, will be 3 feet ·88 in a second of time, so that if the half of this calculated velocity be taken for the real velocity, it will be 1 foot ·94.

Passing over, for the present, the calculations of Mr. Davis Gilbert, as being founded upon a perfectly different hypothesis, the next author who has considered the subject is Mr. Sylvester, in the Annals of Philosophy, for June, 1822. He refers to Mr. Davis Gilbert's calculations, and conceives that the hypothesis on which he proceeds must be erroneous, because it produces for its result a velocity which far exceeds that of heavy bodies falling freely in a vacuum, whereas the resistance of the medium must produce some retardation of this velocity.

According to Mr. Sylvester, the velocity of the current of heated air will be equal to the difference between the specific gravity of the cold external, and heated internal air, divided by the specific gravity of the cold external air, and the quotient multiplied into the acceleration of velocity that would be acquired by a body falling the height of the chimney. Whence, on the preceding data, the velocity would be 7 feet ·74.

In a recent work, written by Mr. Tredgold, he has given very elaborate formulæ for calculating the draught of ventilating pipes, and the chimneys of furnaces. He assumes the force whereby the current ascends, to be equal to the height of the chimney, multiplied by the expansion the air suffers from increased temperature to which it is subjected. And that the velocity is equal to the square root of sixty-four times the force; from which velocity, three-eighths, or even one half, must be deducted on account of contractions, eddies, bends, and friction.

Now, on this hypothesis, the theoretical velocity of the current of air in the flue of a furnace of this kind will be equal to 18 feet ·9; from whence, deducting one half, the actual velocity is probably nine feet and a half.

Hence, although these mathematicians all proceed upon nearly the same theory, still great discrepancies exist in their results.

According to Montgolfier's calculation, the velocity of the draught in every second of time, is . .	13 ft.	·91
The writer in Rees' Cyclopædia	1	·94
Mr. Sylvester	7	·73
Mr. Tredgold	9	·50

But these differences vanish entirely before the calculation of Mr. Davis Gilbert, in the Quarterly Journal of Sciences for April, 1822. According to this gentleman, the rarefaction or expansion of the air by the heat being ascertained, by raising the fraction $^{480}/_{481}$ to the power whose index expresses the difference of temperature, and the density or specific gravity of the burned air, as compared with that of the external atmosphere, which Mr. Gilbert states at 1·0874 to 1, the expansion divided by the specific gravity of the burned air, will shew the specific gravity of the air within the chimney.

The tendency to ascend will, he says, be equal to the difference between this specific gravity and that of the atmosphere, multiplied by the quotient obtained by dividing the height of the chimney, by the height the atmosphere would have if it were of uniform density throughout, which is assumed, by Mr. Gilbert, to be 26058 feet. The square root of this product is to be multiplied by the velocity with which the atmosphere would rush into a vacuum, namely, 1295 feet in a second of time; and the product divided by the square root of the specific gravity of the lighter air will give the velocity.

Now, according to this hypothesis, the velocity of the air passing through the above-mentioned furnace, would be no less than 225 feet ·67 in a second of time; which being equivalent to 153 miles in an hour, is about five times the velocity of the wind in a full storm.

It would appear from the immense discrepance between these calculations of the velocity by the most eminent mathematicians, that every attempt to reduce the question to mathematical calculation, has hitherto proved utterly abortive, and has left the subject in as much obscurity as ever. Thus much seems certain, that if any smoking or fuming body be held near the entrance of the air into a very powerful melting furnace, when in full heat, the velocity with which the smoke or fume is drawn into the furnace, seems by no means so rapid as might be expected on the calculation of Mr. Davis Gilbert.

Mr. Haycroft observes, that the heat in blast-furnaces does not increase merely in the ratio of the fuel consumed, but in some compound ratio: and that even in air-furnaces, those through which the greatest quantity of air passes in a given time, consume a proportionably less quantity of fuel to produce the same effect.

ON THE PRESERVATION OF THE COPPER-SHEATHING OF SHIPS.

NOTWITHSTANDING the late researches of Sir Humphrey Davy must be considered as having opened a wide and interesting field, both as regards chemical science, and the interests of navigation: yet the result of the experiments, hitherto made by this eminent chemist, do not appear to be altogether conclusive, with regard to the destruction of the sheet-copper applied for the protection of ships' bottoms. In the first series of experiments, made with the express view of ascertaining the proportion of protecting surface, of iron or zinc, which would be requisite to defend a given surface of copper from the action of the water, the President made a calculation from the result of experiments on a small scale, which (as is often the case in experimental science) did not afford equally satisfactory results on a large scale; or in cases of ships making a long voyage. Thus, it was found, that if the surface of the protecting bars of iron was sufficiently extensive entirely to neutralize the chemical agency between the copper-sheeting and sea-water (or in other words, to prevent the oxidation of the copper) that, in such cases, there was uniformly a deposit of earthy or alkaline matter from the sea water, which not only, in a certain degree, served to impede the ship's progress through the water, but also formed a rough surface to which weeds, and barnacles, &c. readily adhered. In some of the first experiments made in Portsmouth harbour, and also during one or two short voyages in warmer latitudes, it was demonstrated that the inconvenience, resulting from the adhesion of animalculæ on the ships' bottoms, was, at least, equal to a loss sustained by the wear and tear of copper in the usual way.

It would be absurd to undervalue the researches of Sir H. Davy, because he did not discover, in the first instance, that which only could be ascertained by the test of actual experience. From the repetition of his experiments, under a variety of circumstances, he found that, provided the surface of the protecting bars formed more than one foot to every hundred feet of copper, the latter was *over-protected;* and became covered with a deposition of alkaline matter. But, if the surface of the protectors formed less than 1-250th of that of the surface of the copper, the latter was found to be too greatly acted on by the sea-water. The best results appear to be obtained, when the protecting metal formed from 1-150 to 1-200 of the surface.

Now, although these experiments are valuable, so far as they demonstrate the *theory* of electro-chemical agencies, it seems to be impossible in *practice* to provide against the various contingencies, to which ships are liable, under different circumstances. For instance,—an increased temperature (which in all cases promotes chemical action) must render the destruction of copper-sheeting of vessels much greater in the tropical seas, than in temperate latitudes; and, in the same latitude, more active in summer than in winter. The quantity of alkaline and earthy matter, in suspension, in sea-water, is also very different in different situations. The harbours or coasts in the vicinity of the primitive class of rocks, being far less liable to produce this deposition of alkaline matter on a ship's copper, than the sea-water of bays or harbours adjacent to the calcareous varieties of strata. Whether a ship be at anchor in still water, or in a current, appears also to have a sensible influence, as might be expected, on the deposition of earthy matter on her copper sheeting. But the point which chiefly influences both the preservation of the copper, and the deposit of earthy matter, is the ship's motion through the water. For in addition to corrosion, or waste of copper arising from mechanical friction, the chemical agency is always much greater when a ship is under sail, owing to the connecting medium of electricity being more perfectly maintained, than when a ship is in still water. Under all these modifications, therefore, it seems to be impossible to assign anything like an exact proportion, which the surface of the protecting bars should bear to that of the copper on the ship's bottom. A *comparative degree of preservation* is all that can be expected; notwithstanding the confident manner in which the results of this "discovery" of Sir Humphrey Davy has been announced in certain scientific journals.

PATENT FLOORING MACHINE.

A machine has recently been invented and patents obtained for it, which at once performs all the various operations for converting rough sawn boards into completely finished flooring. It reduces the board to an uniform breadth, planes it, cuts the groove in the one side, and works the feather or tongue on the other; it also removes the superfluous thickness from a sufficient portion of that part of the board which is destined to become the under side of the floor, and even takes off a minute portion of the arris, that the joints may enter with more facility in laying them down; the whole being executed in a superior manner, and, as may readily be imagined, with much more accuracy than if performed by the most skilful workman. This ingenious machine is the invention of Mr. Malcolm Muir, of the Glasgow Veneer Saw-mills, who has had it in operation for some time. The idea of such a machine, however, had also occurred to Mr. William Thomson, Cabinet-maker, in Fountainbridge, Edinburgh, and both applied for a patent at the same time, without the one knowing of the other's application until officially informed of it, and upon reference to the Lord Advocate in the usual manner, the parties were called on to specify their inventions for his Lordship's consideration, when, although differing in one important particular, they were yet found to be so much alike, that they agreed to take the patent jointly, in name of both, and to share its privileges. Each of the patentees has an ample field for individual exertion in the city to which he belongs, but although a considerable portion of the work has been performed by the machine in Glasgow, it has not yet been brought into operation in Edinburgh, though, we understand, one will be started there in the course of two or three weeks. What constitutes the peculiar value of the invention is its executing to perfection the most toilsome and slavish part of the work of the house-carpenter, who will thus, in future, be relieved from the laborious task of working flooring boards, at least in the vicinity of these admirable machines.

PROCESS FOR PURIFYING HONEY.

The Jews of Moldavia, and the Ukraine, prepare, without any expense or trouble, and with common honey, a sort of sugar which is solid and as white as snow. This they send to Dantzic, where the distillers use it in making their liquor. The process consists in exposing the honey to frost, for three weeks, in some place where neither sun nor snow can reach it, and in a vessel which is not a conductor of caloric. The honey is not congealed, but becomes clear and hard, like sugar.

FLOWER POTS FOR ROOMS.

At at meeting of the Horticultural Society, on the 6th inst. the secretary recommended the use of moss for flower pots intended for the house or transportation, being well adapted for either purpose, on account of their not being likely to dirt; from frequent maturing and decomposition, it forms a fine pure vegetable mould. The plan to be adopted, is to put a cutting, or seed, into the pot, and press the mould down hard.

ACCOUNT OF THE RATTLE SNAKE.

Mr. James Pierce, in his account of the geology, scenery, &c. of the counties of Newhaven and Lichfield, has given the following interesting account of the Rattle Snake. A young man having met with a large and vigorous rattle snake, instead of killing it with his long cart-whip, as he could easily have done, amused himself by provoking it, and gently playing his whip around its body. The irritated reptile made repeated and vigorous leaps towards the young man, coming nearer to him at every effort; and, being teazed more and more with the whip, at last threw himself into the air, with such energy, that when he descended, he seemed scarcely to touch the ground; but instantly rebounding, executed a succession of leaps, so rapid and so great, that there was not the slightest intermission, and he appeared to fly. The young man betook himself to a rapid flight; but his dreadful pursuer gained rapidly upon him, till approaching a fence, he perceived that he could not pass it before the fangs of the snake would be hooked in his flesh. As his only resource, he turned, and by a fortunate throw of his lash, by which he wound it completely round the serpent's body, he arrested his progress and killed him.

Mr. Pierce had a living rattle snake two months in his possession, and every day watched his manners. He immediately killed birds, and most small animals, when put into his cage, but did not eat them. He permitted a toad, however, to remain weeks with him unmolested, and allowed it to leap upon his body and sit upon his head. When he opened his mouth, his fangs were not visible unless he was provoked; at other times they were covered with a membrane like a scabbard, only they were drawn back, so that the sheathing membrane formed only a slight protuberance on each side of the upper jaw. If irritated, he flattened his head, threw it back, opened his mouth wide, and instantly the fatal fangs were shot out of their sheaths, like a spring dagger, and he darted upon his object. After his death, Mr. Pierce examined his fangs: they were shaped like a sickle; a duct led from the reservoir of poison at the bottom of the tooth, quite through its whole length, and terminated just by the point, which was exceedingly sharp. Thus the fang is darted out at the will of the animal; it makes the puncture at the instant, and simultaneously the poison flows through the duct, and is deposited in the very bottom of the wound. As this rarely fails to touch a blood-vessel, the venom is thus instantly issued into the system, and without delay commences the march of death through every vein and artery.

YEAST AS A MANURE.

It is not generally known that yeast is one of the most powerful manures in existence. Some experiments have been tried with grass-plots and different culinary vegetables, from which it appears, that a small quantity of yeast, after it has become putrid and useless to the brewer or baker, will effect wonders when mixed with water and applied to plants as liquid manure. The only danger seems to be in making it too rich. We would recommend such of our readers as have leisure and opportunity, to try it on pines, vines, the brassica family, especially cauliflowers, the potato, as a pickle for wheat and other seeds, and for watering new-sown turnips, and similar oleaginous seeds. *Gardener's Magazine.*

ANSWER TO INQUIRY.

Thieves' Vinegar.

Rue, wormwood, sage, lavender, rosemary, mint, of each, a handful; Vinegar, one gallon. Put all into a jar covered with paste, let it stand within the warmth of a fire, to infuse, for eight days, then strain off, and to every quart, put ¼ of an ounce of camphor, dissolved.

Probatum est.

NOTICES TO CORRESPONDENTS.

The communications of Colonel Beaufoy—Indicator—A. B.—Mr. Moss—and J. S. L.—shall appear in our next.

Communications have been received from A Constant Subscriber—W. W.—B. E.—C. C.—Julian—A. H.—and W. W. H.

*** Part 38, price 1s. is published, and may be had of all Booksellers. All the back Numbers and Parts are also on sale.

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MECHANICS' MAGAZINE,

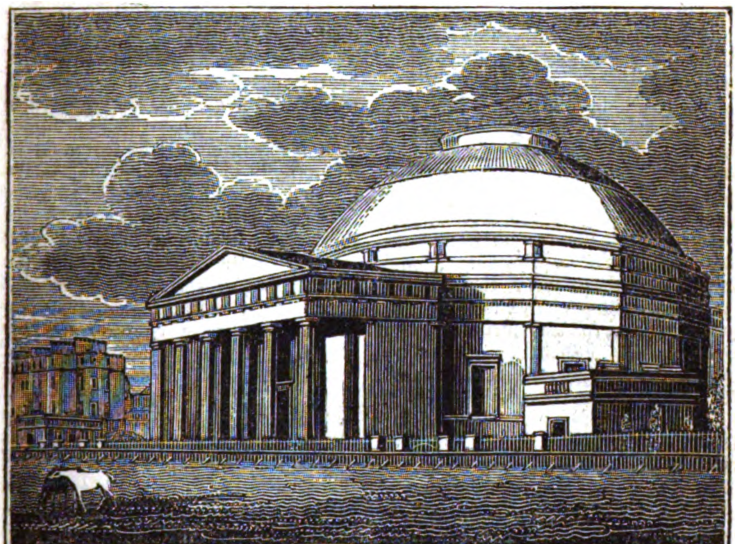
MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 155.] SATURDAY, AUGUST 12, 1826. [Price 3d.

Go, wondrous creature! mount where Science guides,
Go, measure earth, weigh air, and state the tides;
Instruct the planets in what orbs to run,
Correct old Time, and regulate the Sun.

Pope's Essay on Man.

THE COLISEUM, REGENT'S PARK.



The exterior of this building has been for some time finished, and the more important part of the work, the painting, has been proceeding with great rapidity. It is now in a very forward state. The whole of the outline is executed, and a great part of the colouring is completed. Quite enough is already apparent, to justify the belief that the view will be at once the most striking and curious that has ever yet been exhibited. At present, the only means of ascending is by a temporary apparatus, which takes the spectator to the top of the building. Suspended there, in something like the car of a balloon, only with the more comfortable reliance of several stout ropes, the view presents itself to great advantage. The effect is exactly similar to that produced by looking from the top of St. Paul's, with this difference—that in the Coliseum you may command a constantly clear atmosphere, and are spared the labour of mounting the never-ending stairs which the enterprising cockneys, who condemn themselves to ascend the heights of the metropolitan church, are obliged to tread. The drawing is executed with a degree of precision far beyond any thing that has yet been reached by panoramas, excellent as they are. By a contrivance invented by Mr.

Hornor, the most exact geometrical results have been obtained throughout the picture; and to such an extent has this accuracy been carried, that the most minute objects to which the range of the view extends may be discerned by the naked eye, and satisfactorily identified by means of glasses. The painting, regarded merely as a work of art, is also of a very high character. The effects of light and air are preserved so admirably, as to keep up the illusive idea of distance in a manner which is perfectly astonishing. Even at this moment, unfinished as the picture is, the spectator finds it difficult, after he has looked at it for a short time, to believe that his eyes are fixed on a plain surface.

As the object of the exhibition, when completed, will be to give, in the first place, an exact notion of the scene which this immense city and the surrounding country present when viewed from the highest gallery of St. Paul's, the panorama can, of course, only be well seen from a central position near the vaulted ceiling. The projector has invented a contrivance for this purpose, which will not only effectually accomplish this object, but will be new and pleasing in an extraordinary degree. The visitors enter a chamber on the floor, or *terre plein* of the building, which will be fitted up so as to resemble, in shape and character, the dome of St. Paul's. It will be furnished with various objects sufficiently amusing to excite the curiosity of the company for a few moments. In the mean time, by a strong mechanical power, and by a movement wholly imperceptible, the spectator will be raised to a proper elevation for viewing the painting. The novelty and surprise which this must produce in the minds of persons who a few moments before were sitting in a carriage, or sauntering in the park, can hardly be imagined, and cannot fail to add to the attraction and interest which the Panorama is, of itself, well calculated to excite.

The gardens by which the building is to be surrounded, will be scarcely inferior, in ingenuity and novelty, to that part of the exhibition which has just been described. The enclosure, in which the building stands, is rather a limited space, and appeared, when it was begun, little more than large enough to isolate the edifice from the roads and streets by which it is surrounded. Mr. Hornor has, however, so contrived to vary the surface, by excavating it in some parts, and heaping up banks in others, as to increase the actual extent to an astonishing degree. Trees of the height of twenty feet are growing in perfect vigour and luxuriance upon banks, which, at Christmas last, consisted of bare and loose earth. A close, and even green sward, covers the space on either side of the building, and shrubs of great variety and beauty, some of which are indigenous, and others are exotics, are planted thickly about. The disposition of the grounds is now only in progress, but their leading features will be presented in the following order:—The spectator is conducted, by means of a covered way, from the place at which he ascended to a scene in the open air, which forms a striking contrast to the multitudinous expanse he has just been contemplating. He finds himself in a valley, surrounded by rocks, and planted with alpine trees and shrubs, disposed in a wild and picturesque manner. A cascade pours from the highest crag, and then streams through the lower masses of rock. A Swiss cottage is placed here to keep up the idea which the other parts of the scene excite. The outlet from this glen is by means of a subterranean passage, which opens upon an extensive and beautiful conservatory, filled with choice plants, so disposed as to blend with the higher trees on the banks, and effectually to intercept the view of the building, large and lofty as it is. The notion of space and extent which a conservatory is calculated to create is increased by a grotto at the end, and by a peculiar distribution of light. A gentle ascent leads back again to the entrance of the building, and terminates this picturesque frame-work to the most stupendous picture of a metropolis that has ever yet been exhibited. A grove of lofty trees—the roots of which by a contrivance which almost revives the hanging gardens of Babylon, are little lower than the top of the outer wall—effectually shuts out every object that does not belong to this enchanted spot.

Such is the Coliseum as it is, and as it is intended to be when finished. What has already been done is the best earnest for the completion of the design, and it promises to unite, with a really important national object, some of the most delightful productions of art, and an exhibition of a perfectly novel character.

It has been supposed that this undertaking was the work of several artists, and that it has been supported by a sort of Joint Stock Company. We are glad to be able to state that both these notions are incorrect. The whole of the plan and execution, the drawing, the building and the gardens, have been performed by Mr. Hornor, and he will be intitled, as well to the emoluments which may be expected from this curious exhibition, as to the reputation which it must confer on him.

We have heard that Mr. Hornor has been offered ten thousand pounds for the net proceeds of the first year's exhibition, and that this offer has been rejected, as falling far short of what is confidently expected to be realized.

To the Editor of the Mechanics' Magazine.

MECHANICS' INSTITUTIONS.

We have the pleasure to lay before our readers the subjoined copy of a letter which we have received from Mr. Moss, the honorary Secretary of the Bath Mechanics' Institution; and, as the London and Devonport Mechanics' Institutions have adopted a similar line of proceeding, we feel confident, that this praiseworthy example will be followed by every other Mechanics' Institution throughout the empire.

Sir,—By request of the committee, I transmit a copy of a regulation unanimously agreed to, at the general annual meeting of the members of this Institution, on Monday, the 3rd inst. and they will feel obliged by your publication of it, in the Mechanics' Magazine, as early as convenient.

I am, Sir,
Your very obedient Servant,
PHIN. MOSS, Hon. Sec.

Bath Mechanics' Instit. July 19, 1826.

"Resolved, that members of any Mechanics' Institution, be admitted to the Bath Mechanics' Institution, as visitors, whenever the Librarian is in attendance, by producing their subscription tickets.

ROTARY STEAM ENGINE.

Mr. Lemuel Wellman Wright, the inventor of the pin machine, has recently obtained a patent for improvements in the construction of steam-engines.

This patent is stated to be supplementary to one obtained in 1817, in the name of Poole, for improvements in steam-engines, communicated by a foreigner residing abroad. The steam engine described in the specification of this patent, is of the rotary kind, and consists of a flat hollow cylinder, placed vertically, within which, another concentric cylinder is made to revolve on an axis, by square valves or flaps, which are fastened to it by close-jointed hinges, and open from it at right angles, so as to occupy the space between it and the external cylinder, during about three-fourths of its revolution, and which are gradually closed in succession by an inclined plane, that projects internally from the rim of the external cylinder, extends about a fourth of its circuit, and comes close to the revolving cylinder at one end, where it forms a stop-piece, that fills up the interval at that part between the two cylinders; beyond which stop, the pipe enters into the external cylinder, that conveys the steam to it, while the eduction pipe, that carries off the steam to the condenser, passes out near the extremity of the inclined plane. The flaps, when closed, lie in hollows, made to fit them, in the rim of the revolving cylinder, and have flat pieces of brass placed on studs near their edges, which being pressed outward by springs, that lie behind them, form what may be called a metallic stuffing, at three of their sides, while the other side is closed by the accurate fitting of the hinge, so as altogether to prevent the steam passing through between the valves and the cylinders in any part. The passage between the revolving cylinder and the stop, is made steam-tight by a thick piece of brass, that fits close to the rim of the first, and is received into a cavity of the latter, in which springs are enclosed that press it out towards this cylinder; and the two cylinders are made to fit steam-tight at their circles of contact, by two flat brass rings, one of which is fastened to each side of the revolving cylinder, by screws inserted through slots, which admit of its being moved outwards towards the fixed cylinder, and, being divided into two pieces across its diameter, flat wedges, which are pressed by springs into the lines of its junction, from the side next the axle, tend always to press it outwards against the inner rim of the external fixed cylinder, and keep the steam from passing by it, notwithstanding its gradual wear. A plate of steel or hard iron, which fits the cavity between the two cylinders, is described as being screwed against the thickest end of the inclined plane, at right angles to the sides of the cylinder, and in the line of the radius, whose use is not clearly explained, and which, it appears to us, might be omitted without any injury to the effect.

The valves or flaps are made to rise out of the cavities which contain them, after they have passed the inclined plane, by pieces that proceed from their hinges, nearly at right angles to their backs, which point towards the angle when they are closed, and which come in contact with the roller, whose axis is fastened to the side as a fixed cylinder, when the flap has completely passed the inclined plane; which roller, by pressing these angles backwards, obliges the flaps to rise upwards across the annular cavity, between the two cylinders, and constitute that opposition to the steam, which causes the internal one to revolve, and turn round the machinery that is connected with its axis.

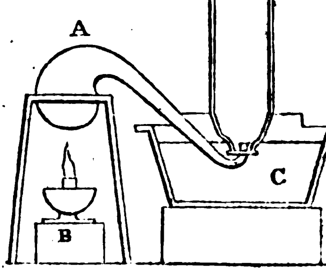
The axle of the revolving cylinder passes through brass closing boxes, which make joints impervious to steam, by being made to fit conical rollers attached near to the ends of the axle, and which are further secured by brass caps, which fit tight over them and the parts of the axle which extend beyond them.

Repertory of Patent Inventions.

OF OXYGEN.

This substance is an *air*, or, as chemists call aerial bodies, a gas. It was discovered by Dr. Priestley, on the 1st of August, 1774. It may be obtained by heating *black oxide of manganese*, in an iron bottle fitted with a long iron tube. The extremity of the tube is plunged into a trough of water, having a shelf a little below the surface, on which stands an inverted glass cylinder full of water.

The open mouth of this cylinder is brought over the extremity of the iron tube. As soon as the manganese is red hot, air issues from the extremity of the tube, and gradually fills the glass vessel, displacing the water. In this way, any quantity of oxygen gas may be procured. Red-lead, or red precipitate, may be substituted for the manganese, but they do not yield so much oxygen. The salt called hyperoxymuriate of potash, may also be used, and it yields a very great proportion of pure oxygen. Oxygen gas may also be obtained, by putting the manganese, in powder, into a glass retort, A,



and pouring on it, as much *sulphuric acid*, as will make it into a thin paste. The heat of a lamp, B, being applied to the retort, while its beak is plunged into the water trough, C, the gas is disengaged in considerable quantity, and will pass into the inverted glass cylinder, D.

This gas was called, by the discoverer, *dephlogisticated air*; Scheele, who likewise discovered it, called it *empyrial air*; Condorcet gave it the name of *vital air*; and at last, Lavoisier, from an hypothesis respecting the formation of acids, distinguished it by the appellation of oxygen gas, which it now bears.

Oxygen gas possesses the mechanical properties of common air. It is colourless, invisible, and capable of indefinite expansion and compression.

Combustibles burn in it better and brighter than in common air. Animals can breathe it longer than common air without suffocation.

It has been ascertained that one-fifth of the air of the atmosphere, is oxygen gas, and that when this portion is abstracted, the air can neither support combustion nor animal life.

When substances are burnt in oxygen gas or air, or when animals breathe them, a portion of the oxygen always disappears, and, in some cases, even the whole of it.

It specific gravity, according to Kirwan, is 1·103; according to Davy, 1·127; according to Fourcroy, Vauquelin, and Seguin, 1·087; according to Saussure, Junior, 1·114; that of air being 1000. At the temperature of 60°, and when the barometer stands at 30 inches, 1000 cubic inches of common air weigh, very nearly, 30·5 grains, troy; 100 cubic inches of oxygen, in the same temperature and pressure, weigh, according to these results, 33 grains, 34·37 grains, 33·15 grains, and 33·97 grains, troy.

It is not sensibly absorbed by water. 100 cubic inches of water, freed from air by boiling, absorbs 3·55 inches of this gas, according to the experiments of Dr. Henry.

Oxygen is capable of combining with a great number of bodies, or it has an *affinity* for them, and forms compounds with them.

WOODEN PENDULUM.

Gentlemen,—In the Mechanics' Magazine, volume fifth, page 375, there is an inaccuracy in the quotation from article 1, of the Annals of Philosophy, March 1826. Wooden Pendulum.

The remark should run thus. A rod of heavy wood, is, in point of accuracy, *inferior* to one made of light.

I remain, Gentlemen,
Your obedient Servant,
MARK BEAUFOY.

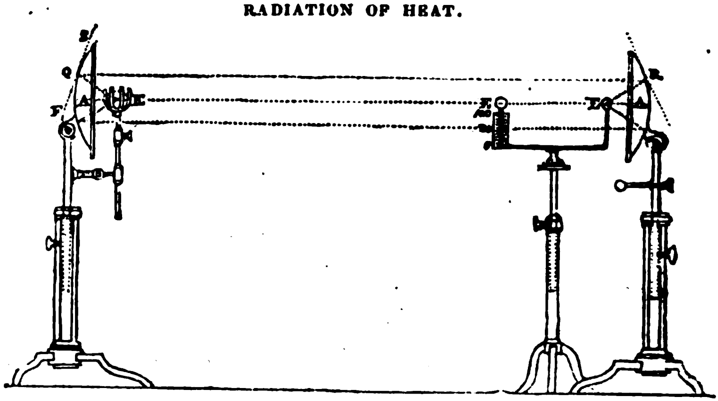
Bushey Heath, near Stanmore, July 29, 1826.

We have given insertion to the preceding in this place, as being much more likely to command the requisite degree of attention for the correction of an important error, than would result from any notification we might offer in our 'Address to Correspondents.' We feel much obliged to Colonel Beaufoy for this communication.—EDITOR.

MACHINE AND ENGINE.

The term MACHINE, is now vulgarly given to a great variety of subjects, which have very little analogy by which they can be classed, with propriety, under any one name. We say a travelling machine, a bathing machine, a copying machine, a threshing machine, an electrical machine, &c. &c. The only circumstance in which all these agree, seems to be, that their construction is more complex and artificial than the utensils, tools, or instruments, which offer themselves to the first thoughts of uncultivated people. They are more artificial than the common cart, the bathing tub, or the flail. In the language of ancient Athens and Rome, the term was applied to every tool by which hard labour of any kind was performed; but in the language of modern Europe, it seems restricted either to such tools or instruments as are employed for executing some philosophical purpose, or of which the construction employs the simple mechanical powers in a conspicuous manner, in which their operation and energy engage the attention. An electrical machine, a centrifugal machine, are of the first class; a threshing machine, a fire machine, are of the other class. It is nearly synonymous, in our language, with ENGINE; a term altogether modern, and, in some measure, honourable, being bestowed only, or chiefly, on contrivances for executing work, in which ingenuity and mechanical skill are manifest. Perhaps, indeed, the term *Engine* is limited, by careful writers, to machines of considerable magnitude, or, at least, of considerable art and contrivance. We say, with propriety, steam-engine, fire-engine, plating-engine, boring-engine; and a dividing-machine, a copying-machine, &c. Either of these terms, *machine* or *engine*, are applied with impropriety to contrivances in which some piece of work is not executed on materials which are then said to be manufactured. A travelling or bathing machine is surely a vulgarism. A machine or engine is, therefore, a TOOL; but of complicated construction, peculiarly fitted for expediting labour, or for performing it according to certain invariable principles: and we should add, that the dependence of its efficacy on mechanical principles, must be apparent and even conspicuous. The contrivance and erection of such works, constitute the profession of the engineer; a profession which ought by no means to be confounded with that of the mechanic, the artizan, or manufacturer.

RADIATION OF HEAT.



Scheele was the first chemist to notice the fact of heat radiating from all bodies, and since his time many curious experiments have been made on the subject. The above figure represents the apparatus first employed by professor Pictet, of Geneva, for the purpose of shewing that heat may be reflected and concentrated like light. Two concave mirrors, A A, are placed some yards apart. A ball, about two inches in diameter, heated, but not so as to be luminous, or any other hot body, is placed in the focus E of one mirror, and one bulb of a differential thermometer is placed in the focus E′ of the other, the other bulb of the thermometer being betwixt E and E′. The rays of heat proceeding from the ball E, in the direction Q E, to the first mirror, are reflected from it in the straight lines A A, Q R, F F, to the other mirror, and thence they are converged on the bulb of the thermometer at the second focus E′; so that this bulb is heated to a considerable degree higher than the other bulb of the thermometer, which is much nearer than it to the heated body. If a ball of snow, however, or any other cold body, be substituted for the heated ball, the thermometer is found to sink from the reflected cold as it rises from the reflected heat. This latter very curious circumstance has been explained, by supposing all bodies radiate caloric; and when the temperature of the thermometer is the same as the surrounding bodies, it receives as much heat as it emits, and thus remains stationary. But a body with a lower temperature takes more heat than it receives, and its temperature rises while the temperature of all other bodies falls. The mirrors make the interchange of rays between the cold body more intense than the interchange between any other of the neighbouring bodies, and thus the thermometer falls. We are disposed to regard this as a very incomplete and insufficient explanation; but not having a better to offer, we must leave its elucidation to the ingenuity of our readers. We may remark, however, that it is curious to see the fact, stated in this experiment, brought to prove heat a substance, because it follows the same laws as *light*, when it is not yet established that light is a substance, and when it wants one *element*, which is quite essential to the idea of a substance, viz. FORM.

TENDENCY OF BALLOONS TO BURST.

Sir,—I have abstained from replying to the answer with which "Colin," in your 150th number, has favoured me, "on the Tendency of Balloons to burst, or expand as they ascend," because I had hoped that some other Correspondent would have taken up the subject in your number of the last week, but, as that has not been the case, I beg to revive the question, by asking "Colin," whether he means to say that the gas in question, is not an elastic fluid? for he asserts what appears fully to amount to that; when he says, "that the gas counteracts the exterior pressure, merely by its *density*, which is *equal to that of the atmosphere.*"—And again, "the gas in question, has no tendency to expansion, unless a quantum of heat is introduced, greatly above that which is present in its ordinary state." I shall, Sir, merely for the present, observe, that I conceive a body to possess more or less density, in proportion as its weight is greater or less than its bulk. If then the gas in a balloon is of the same density, (that is, bulk for bulk, weighs the same as the atmospheric air,) how is it, I beg to ask, that the balloon ascends? I conceive that a balloon ascends in the air for the same reason that it would in water, viz. because two columns of water or air being given, and the balloon being of less density than the water, and occupying a part of one of them, the heavier column will exert the greater power, and the balloon must, reasonably, move in the direction in which the least resistance is offered to it, viz. upwards.

I am, Sir,
Your obedient Servant,
INDICATOR.
July 31, 1826.

PASTING OF MAPS ON CLOTH.

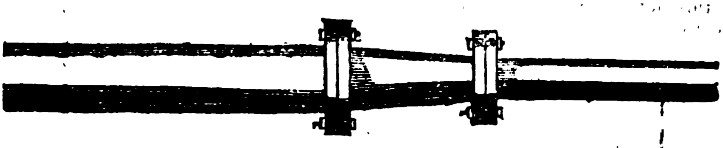
Sir,—I shall be much obliged if any of your Correspondents will inform me what is the best method of pasting maps upon cloth, so as to adhere to every part thereof, and be free from *air cockles*. I have tried several ways, but cannot succeed well with large maps.

A SUBSCRIBER.
2nd of August, 1826.

GAS PIPES.

Sir,—I wish to communicate to the public, through the medium of the Mechanics' Magazine, an idea which has suggested itself to me, of an improvement which may be made in gas-pipes.

I have observed, that whatever attention may be paid to the purifying of gas previously to its being introduced into our houses, the purification is not sufficiently effected to prevent the ceilings of the rooms from becoming blackened. This I principally attribute to the rough interior surface of the pipes collecting the impurities, however small, which pass into the pipes, and allowing the impurities, so deposited, to accumulate. To remedy this, I propose that the pipes be bored so as to form a polished surface, and that where the larger and smaller pipes are attached, I would advise the introduction of the double flanch, thus



in order to obtain a free passage for the gas.

I once mentioned the subject to an eminent engineer, who is connected with some of the principal gas works in the kingdom; but he was of opinion, that its adoption would be too expensive. That there would be a somewhat greater expense at the onset, is undeniable; but it would not amount to so much as would render it an object of importance. For the whole process of boring can be effected by steam-power; and, by being bored, I conceive that the pipes may be made of less diameter, which will save a more than sufficient quantity of gas, to compensate for the extra expense.

I am, &c.
J. S. L.

Grantham, August 2, 1826.

LAPIS CALAMINARIS.

Sir,—You will much oblige a constant reader, by your insertion in your next number, of a method (if any there be) of dissolving *Lapis Calaminaris*, or Calamine Stone. It is the stony part which is found so difficult to dissolve. The writer has been obliged, after several vain attempts, to conclude it to be indissoluble.

I am, Sir,
Your's obliged,
A. B.

Catherine Street, Sarum.

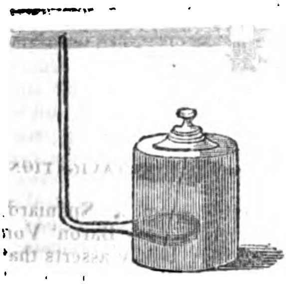
INVENTION OF STEAM-NAVIGATION.

In a letter from a Spaniard, named Navarete, to Baron Von Zach, the writer boldly asserts that the honour of the invention of steam-boats belongs neither to England, France, nor America, but to his own country. In favour of this claim he adduces the following fact: So far back as the year 1543, Blasco de Loyola, a Spaniard, made proposals to the Emperor, Charles V. and his son Philip, to build a vessel which should be impelled by steam. The documents in proof of this fact are still preserved in the Archives of Simancas. Blasco de Loyola had enemies; the emperor seems not to have been aware of the importance of his invention, and it was soon forgotten. The support and diffusion of great inventions, which form, as it were, steps in civilization of the human race, must proceed from nations themselves. It is not surprising that at a time when Charles V. was extinguishing the last spark of civil liberty in Spain, an invention which can only be appreciated by industrious, wealthy, and free citizens, should sink into oblivion.

HYGROMETER.

Mr. Daniell's hygrometer for ascertaining the *dew-point*, or the temperature at which air deposits moisture, is the first instrument which has given precision to this branch of philosophy. It is, however, extremely complex, and requires manipulation, which is a heavy objection to any instrument. It admits a double simplification:

1st. Let the bulb of the thermometer be inserted in a dark glass bottle of æther, and let the surface of this bottle be the surface of deposition.



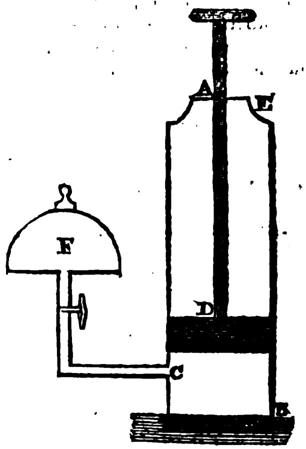
2ndly. Instead of pouring out æther upon a bulb to cool it, let the *bottle of æther itself* cool by merely taking out the stopple, so as to allow its evaporation. The instrument will take any form, nearly as here represented.

I would suggest to meteorologists the necessity of an instrument to show the *rate of evaporation* at any given time. Mr. Daniell takes for granted, when the temperature is the same, and the dew-point the same, that the bottle of æther would always cool to the dew-point, in the *same time* measured by a stop-watch. This is by no means certain. E. F. B.—*Philosophical Magazine*.

AIR-PUMP WITHOUT ARTIFICIAL VALVES.

We extract from the *Edinburgh New Philosophical Journal* the following account of an air-pump without artificial valves, by W. Ritchie, A. M., rector of the Tain Academy.

In the common construction of the air-pump the valves are very liable to be deranged, the repairing of which is attended with much trouble and expense. In the following construction no such derangement can possibly take place, which must of itself give this air-pump a decided advantage.



The machine consists of a barrel shut at the lower end, and having a small aperture at C, forming a free communication with the receiver F; the piston, D, is solid, and stuffed in the usual way. The piston rod works in a small stuffing-box at A, so as to render it completely air-tight. There is a small aperture at E, in the top of the barrel, to allow the air to make its escape when the piston is raised. This air-pump may be worked in the usual way, or by the method of continued motion. In commencing the exhaustion of the receiver, the piston is supposed to be below the small aperture at C. The piston is then raised, and the air which occupied the barrel is forced out through the aperture at E. The point of one of the fingers is applied to the perforation, in the same manner as in playing the German flute. The air easily passes by the finger, which, when the piston begins to descend, shuts the opening, and completely prevents the entrance of the external air. The piston is again forced down below the opening, C, the air in the receiver rushes into the barrel, and is again expelled by the ascending piston. Since the air in the receiver has no valve to open by its elasticity, it is obvious that there is no limit to the degree of exhaustion, as in the common construction.

CARBURETTED HYDROGEN GAS.

The following is an account of the effects produced upon Sir Humphrey Davy by the inspiration of carburetted hydrogen gas.

He introduced into a silk bag four quarts of this gas nearly pure, which had been carefully produced from the decomposition of water by charcoal, an hour before the experiment, and which had a very strong and disagreeable smell. "After a forced exhaustion of my lungs," says he, "the nose being accurately closed, I made three inspirations and expirations of the gas. The first inspiration produced a sort of numbness and loss of feeling in the chest and about the pectoral muscles. After the second inspiration I lost all power of perceiving external things, and had no distinct sensation, except a terrible oppression on the chest; during the third inspiration this feeling disappeared. I seemed sinking into annihilation, and had just power enough to drop the mouth-piece from my unclosed lips. A short interval must have elapsed, during which I respired common air before the objects about me were distinguishable. On recollecting myself, I faintly articulated 'I do not think I shall die.' Putting my finger to the wrist, I found my pulse thread-like, and beating with excessive quickness. In less than a minute I was able to walk; and the painful oppression on the chest directed me to the open air. After making a few steps, which carried me to the garden, my head became giddy, my knees trembled, and I had just sufficient voluntary power to throw myself on the grass. Here the painful feeling of the chest increased with such violence as to threaten suffocation. At this moment, I asked for some nitrous oxide, which Mr. Dyer brought me, a mixture of oxygen and nitrous oxide, which I breathed for a minute, and believed myself relieved. In five minutes, the painful feelings began gradually to diminish. In an hour they had nearly disappeared, and I felt only excessive weakness and a slight swimming of the head. My voice was very feeble and indistinct: this was about two o'clock in the afternoon. I afterwards walked slowly for about half an hour; and on my return was so much stronger and better, as to believe that the effects of the gas had disappeared, though my pulse was 120, and very feeble. I continued without pain nearly three quarters of an hour, when the giddiness returned with such violence as to oblige me to lie on the bed; it was accompanied with nausea, loss of memory, and deficient sensation. In about an hour and a half, the giddiness went off, and was succeeded by an excruciating pain in the forehead, and between the eyes, with transient pains in the chest and extremities. Towards night these affections gradually diminished; at ten no disagreeable feeling remained, except weakness. I slept sound, and woke in the morning very feeble and very hungry. I have," adds Sir H. Davy, "been minute in the account of this experiment, because it proves that carburetted hydrogen acts as a sedative; i. e. that it produces diminution of vital action, and debility without previously exciting. There is every reason to believe, that if I had taken four or five inspirations, instead of three, they would have destroyed life immediately, without producing any painful sensation."

UNITED KINGDOM STEAM PACKET.

THIS stupendous vessel measures on deck 175 feet long, by 45 feet 6 inches wide. Her paddles are above 20 feet in diameter, and she has two engines of 100 horse power each; she is frigate built, and has a spar deck above the main deck, which has a large open area in the centre, surrounded by iron balustrades. You descend to the main-deck by a flight of steps on either side, and find the bottom of this commodious area environed by a range of elegant sleeping apartments, containing ample room, and every requisite for dressing, &c. and peculiarly adapted for summer travelling.

From this is the entrance to the saloon, which is situated under the quarter-deck, and is a spacious apartment, whose dazzling splendour rivals the ideas we are wont to form of the domes of eastern luxury. It is supported on each side by Corinthian pillars of highly-polished satinwood, and in the middle by a range of brass pillars of the same order; it measures forty-six feet long, and thirty broad. Ten beautiful mirrors, ranged on all sides, shed on the surrounding objects, like the dancing light of an eternal sunbeam, their glittering and reflective rays. Three ranges of tables, extended lengthways, afford sufficient accommodation for 130 persons to dine at once. Handsome sofas, and chairs of a very fashionable pattern, while the most useful, are not the least ornamental part of the furniture of the saloon.

At one end of the middle table is the fire-place, wherein is an elegantly-mounted grate, with appurtenances, the mantel-piece of which is surmounted by a superb mirror; and, at the other end, a capacious sideboard of the finest mahogany, with fluted silk fronts. In the centre of the middle range of tables, immediately under a large circular skylight, is an oval aperture, four feet by three in diameter. It is covered by plate-glass, and admits light into the sleeping room, which is below.

The saloon is hung with crimson damask curtains; and besides the sky-light, it is lighted from the stern, and six other windows, three on each side: it has also windows which look out at the main-deck, making, in all, sixteen in number.

Immediately below this apartment is a spacious sleeping room for gentlemen; it is curtained with blue damask, and fitted up with much taste. As before observed, the light is admitted by an oval aperture at the top; around the sides of which are ranged plate-glass reflectors, which give a thousand magic localities to surrounding objects: and what at present seems to excite the particular attention of visitors, is a large glass globe containing gold-coloured fishes, resting on the plate-glass at the top, and vases of roses placed around its edge, which become represented to the spectator below, like a miniature sea of transparent brightness, bespangled by a thousand little shining inhabitants, flitting through its waters, and which seem to flow through an endless paradise of flowers. A flight of steps, guarded by brass balustrades, at one end of the room, leads to the saloon, and at the other end, an ascent of eight steps communicates with the main-deck.

From the main-deck a flight of steps, of easy descent, conducts to the ladies' apartment, which is most superbly and tastefully arranged, and affords every convenience which luxury could invent, or the most luxurious require. It is curtained with crimson damask; and the chairs, as well as the sofas which surround it, are covered with the same material. It is supported on each side by Ionic pillars, and is furnished with two large plate-glass mirrors, rich Brussels carpets, &c. so that the whole apartment, from the elegance of its ornaments, and the richness of the gilding, its convenience and seclusion, seems more to resemble some fabled bower, pictured by the fairy fingers of romance, than the cabin of a steam-boat. And one thing more must be observed respecting it, namely, its being placed so near the centre of the vessel, that the motion at sea will be scarcely perceptible.

There is also a fore sleeping cabin, comprising six apartments of different sizes, containing from two to ten beds each, for the convenience of families; also a small steerage, fitted up with fourteen beds and bedding, nearly as good as the rest. The total number of beds in the vessel are 170.

The kitchen also displays considerable ingenuity in the construction and arrangement of its various conveniences, and, we are informed, is to be placed under the direction of two French cooks. Surely, "the pride of luxury can no farther go."

To sum up the whole, without fear of contradiction, it may be asserted, that no vessel, equally well contrived for the accommodation of its expected inmates, has been ever seen since the days of Noah.

We cannot, however, quit the subject, without informing the public to whom they are indebted for thus administering so largely to their pleasure and comfort, in travelling between the capitals of Great Britain, for which purpose this packet is destined. The proprietors, we believe, are chiefly those who established the communication, by steam, between the Clyde and Liverpool, and are owners of those fine vessels, the Majestic and City of Glasgow. The builders, who have the credit of producing a vessel of the most symmetrical proportions, are Messrs. Robert Steele and Son, of Greenock; the engines are the work of David Napier, Esq. of Glasgow, whose ability and success in the construction of steam machinery are well known; and the furniture and decorative parts of the interior have been furnished by Mr. Cameron, cabinet-maker, of Greenock, from drawings by Mr. James Bannister, of Liverpool. To these gentlemen, in their respective departments, the public will award no ordinary praise, for this admirable result of their taste and ingenuity. In a few days, we understand, the United Kingdom will be ready for sea, when she will proceed round the north of Scotland, under the command of Captain James Oman, late of the Majestic, whose qualifications, as the most experienced and successful commander of a steam vessel in the country, render him every way worthy of having so important a charge confided to him.

When we consider, for a moment, the vast difference between the vessel we have now described, and the little cock-boat, comparatively, which, under the name of the Comet, first revolved its wheels adventurously on the Clyde, and was the parent of the numerous European family of steam-packets, we feel no small pride in contemplating the rapid approach to perfection, to which British capital and skill have conducted this invaluable improvement.

The Comet, if our memory serves us aright, was not more than 28 feet long, had an engine of three or four horse power, and was built in 1811. Fifteen years, therefore, each marked by new adventurers, new improvements, and a wider range of operation, have sufficed to bring steam navigation to that pitch of perfection, which we find concentrated in the United Kingdom. What further improvement it is destined to receive in the mode of propulsion, it is impossible to say; but it is not likely that, in our day, a more superb marine conveyance, for public accommodation, will be constructed; and in this respect, it may safely be added, there is no reason left for regret. Even the luxurious Sybarite, whose repose was destroyed by the doubling of a rose leaf, would be bound to acknowledge, that here his desires had obtained their full fruition. "As to the question of *costs*," as the lawyers would say, we are unable to answer it from authority, but if the general opinion is to be trusted, the first movements of the paddle wheels of the United Kingdom, will carry along with them a literally *floating* capital, of little short of 40,000*l*.

ISINGLASS DISSOLVED IN ALCOHOL.

"*Facts are stubborn things.*"

Sir,—B. W. in your 146th number, page 87, has stated in his attempt "to correct an error," of another Correspondent, in a former number, that isinglass will not dissolve in alcohol.

If B. W. were to make the experiment, he would find *himself* in error, as I have repeatedly dissolved isinglass in spirits of wine, or alcohol, by placing the ingredients in a stoppered bottle, and immersing it in boiling water.

I remain,
Your constant reader,
H. M. M.

ROBERTS' SAFETY HOOD.

We are glad to observe, that there is a prospect of Mr. Roberts obtaining from the French government a degree of encouragement commensurate with the importance of his discovery; although we cannot but regret, that the inventor should be driven to seek in a foreign state, the reward due to his talents. The following extract of a letter which has been received from him, dated Paris, July 20th, will be gratifying to our readers.

"On the 12th of this month, the Board of Health here expressed their wish that I should make the experiment; and appointed several gentlemen to be present, at the head of which was Monsieur D' Arcet, the celebrated French chemist. The place named for the purpose was an ancient common sewer running along a ditch, and on the spot where formerly stood the prison of the Bastile, which was destroyed during the Revolution. It was the receptacle of all the filth of this part of the city, and had not been opened for 12 or 15 years past, owing to the impossibility of getting any men to enter it to clear it out; one or two lives having been lost, one time, in the attempt, and several animals having died instantly on being thrown down. I descended, and was followed by two men, who, after advancing a few paces, without a hood, called out they were suffocating, immediately retreated, and left me to advance about 100 yards, up to my middle in mud and filth. After nailing up a tarpaulin, some distance from the mouth of this tunnel, and securing it by sand bags sunk in the mud and slush, so as to enable workmen to go in and clear so far, which took me altogether nearly an hour, I remounted without having suffered any inconvenience myself, excepting from the filth. They placed a funnel over the entrance, opened a communication with this sewer further on, and consumed the hydrogenous sulphuric gas generated there, by means of a furnace placed in the funnel. Monsieur D' Arcet (the commissioner appointed to make the report of the utility of my invention, and success of the experiment) assured me of his utmost satisfaction; that he would make a favourable report of the merits of the invention; and I may be assured of his protection to promote the adoption of it. Since that day (yesterday), I descended again in another part, still more infected, with the same success and satisfaction, not only to the officers appointed by Government to witness its effects, but to the surrounding workmen, who were confident, that when covered with one of my hoods, they would be in no danger of their lives. I am in a few days to undertake the experiment against suffocation from smoke, before the Commanding Officer of the Corps of Firemen (for they are organized in this country as a military corps), of which I will give you an account in my next; and I trust that I shall meet with equal success, by giving equal satisfaction to the by-standers."

ALE.

The liquor called ale, was originally made of barley, malt, and yeast alone. We are told by one of the oldest English writers, on medical subjects, (Andrew Boorde) that those who put in any other ingredient, "sophisticated the labour." "It is," he says, "the natural drink of an Englishman; but beer, on the other hand, which is made of malt, hops, and water, is the natural drink of a Dutchman, and, of late, is much used in England, to the great detriment of many Englishmen." There existed, for a long time, a strong prejudice against hops, which were considered as "pernicious weeds;" but it is now generally admitted, that they constitute the most valuable ingredient in malt liquors. Independent of the flavour and tonic virtues which they communicate, they precipitate, by means of their astringent principle, the vegetable mucilage, and thus remove from the beer the active principle of its fermentation: without hops, therefore, we must either drink our malt liquors new and ropy, or old and sour. There are several varieties of ale, distinguishable by their colour: when the malt is slenderly dried, the ale is pale; or brown when the malt is more roasted, or high dried.

PORTER.

THIS is made from high-dried malt, and differs from other malt liquors in the proportions of its ingredients, and from the peculiar manner in which it is manufactured. Much has been said on the fraudulent adulteration of this article; and, I am inclined to think, that these statements have been exaggerated. It is, at all events, certain that such adulterations are not carried on in the cauldrons of the brewers, but in the barrels of the publican. The origin of beer called *entire*, is to be thus explained:—Before the year 1730, the malt liquors generally used in London, were ale, beer, and two-penny; and it was customary to call for a pint or tankard of half-and-half; that is, half of ale and half of beer, half of ale and half of two-penny. In the course of time, it also became the practice to call for a pint or tankard of three threads, meaning, one-third ale, beer, and two-penny; and thus the publican had the trouble of going to three casks, and turning three cocks, for a pint of liquor. To avoid this inconvenience and waste, a brewer, of the name of Harwood, conceived the idea of making a liquor that should partake of the same united flavour of ale, beer, and two-penny. He did so, and succeeded, calling it entire, or entire butt, meaning, that it was drawn entirely from one cask or butt; and, as it was a very hearty and nourishing liquor, it obtained the name of porter.

Dr. Paris on Diet.

AN IMPROVED METHOD OF SEASONING TIMBER,

For which a Patent was granted, to John Stephen Langton, of Langton Juxta, Putney, Lincolnshire, Esq.

IN this method of seasoning timber, the pieces of it are put into a long, vertical, air-tight vessel or cylinder, heated externally by steam, or by a water bath, which latter may be either brought to the proper temperature in the common method, or by the use of steam. For either of these methods, the vessel or cylinder which holds the timber, must be enclosed in a second vessel, prepared so as to contain whichever of the two mediums is preferred for communicating the heat. The internal vessel is to rise a little above this enclosing vessel, and is to be enclosed with a cover, made air-tight, and fastened down in any convenient manner; and in its centre is to be another small lid, in which is to be fixed a mercurial syphon gauge; there is also to be "a screw" fixed in it, by turning which, a communication may be made with the external air: when the timber is to be removed, the top of the external vessel is to be covered with a flagged platform, on which those who are to put in and remove the timber are to stand; and from the part of the internal vessel which rises above this platform, a pipe, furnished with a stop-cock, is to go off side-ways, to a condensing vessel, below which is to be placed an air-tight vessel, for the reception of the liquor that runs from the condenser, and communicating with it by a tube; from the top of this receiving vessel, a pipe ascends to an air-pump, and from its bottom another pipe goes to a water-pump, to be used occasionally when the vessel becomes filled with water, which is known by a glass tube fixed to its upper part, which bends round at right angles, and enters into it at its two extremities. The condensing vessel is composed of a number of vertical tubes, each having at its top, outside, a tunnel, between which and the tube, a narrow interval is to be left for the passage of water, which is to be conveyed by separate pipes to the tunnels, and to be let trickle down the outsides of the tubes, to keep them cool. The tops of the tubes may be made to communicate with the main pipe, that leads from the timber vessel, either by separate pipes branching off from them, or by rows of lateral pipes, into each of which, a certain number of the vertical tubes are made to open. A similar set of intermediate pipes should be fixed at the bottom of the condenser, to form a communication from the lower ends of the tubes to the pipe that leads to the receiving vessel.

The vessel or cylinder that holds the timber, which is thirty feet or more in length, may be made of several lengths of cast iron, furnished with flanches, by which they may be fastened together air-tight with screws or nuts; and when it is to be exposed to steam alone, it should be of such strength, as to be enabled to bear the external weight of 15 lb. to the square inch; but when a water-bath is to be used, then the bottom of the vessel should be strong enough to bear a force of 30 lb. to the square inch, and the top be of the strength before-mentioned, and all the intermediate parts should be proportionably stronger as they are closer to the lower extremity. The bottom of this vessel should also be fastened down to the external vessel, so that, if the latter be filled with water while the former is empty, it may be prevented from rising from its place. Small timber should be kept in the vessel twelve hours, exposed to the action of the air-pump and the heat, before it is examined; very large timber will require a week to complete its dessication; and that of intermediate sizes, a time between the two periods, proportionate to its dimensions. The mercurial syphon gauge, at the top of the apparatus, will regulate the heat to be applied to the vessel, and also indicate when the operation is perfected. When it shows a depression of three inches of the mercury, the heat of the bath, or surrounding medium, is to be 130° Fahrenheit; when two inches, at 120°; and when the mercury is depressed one inch, a heat of 112° is to be applied; but the heat in no case is to exceed 200°. When it is desired to be known whether the timber be sufficiently exhausted of its juices, the stop-cock of the pipe that goes to the condenser, from the vessel that contains the timber, is to be closed; and if, in half an hour afterwards, no rise be observed in the mercury, the operation may be concluded to be completed.

METHOD OF PROCURING GOOD YEAST.

Put four or five handfuls of hops in a linen bag, place it in a large pot, and pour on it boiling water, or make it boil for some time. Divide the decoction into equal parts. The first half is poured while hot into a kneading trough, in which is a little sour paste or dough. Add to it a little sugar, a few whites of eggs, well beaten, and a sufficient quantity of wheat flour to form a paste of ordinary consistence. Knead it well, and cover it over. When the mass is well risen, it may be used for the purpose of fermenting the finest wheat paste or dough, without any fear that the bread, after baking, will retain the least sourness, because the acetic acid of the leaven has been completely decomposed in the course of the fermentation. It is probable that this would not have been the case without the sugar and the eggs. To obtain a leaven which will answer for future batches, reserve a portion of the dough, pour on it the second half of the decoction of hops, previously heated, and add the same quantity of sugar, white of eggs, and flour as before; knead the whole with a bit of the former leaven, and let it rise in the trough. Nothing but flour need afterwards be added.

PLANTING TREES.

The best month for planting trees is November; observing the old saying of a celebrated gardener, "Take them with their old leaves to their new graves."—Just as the sap begins to go down, and the leaves to turn, there can be no better time for planting all sorts of fruit, and other deciduous trees; but, with respect to ornamental shrubs, and more particularly evergreens, early planting is of the greatest consequence. When the weather is open, fruit trees and forest trees may be planted from the beginning of October to the end of February; but those that are planted before Christmas will do the best, especially if the following summer should be very hot and dry. But evergreens must be planted early, so that October is a better month for them than November, that the soil may get settled about the roots before the frosts come, and that the trees may have, at least, some hold of the ground before they have to encounter the heat of the sun and the cold east winds of March, the most trying month they have to stand against. It is a folly to ask a gardener whether it be a good time to plant, if he is standing in the market with trees to sell. Persons who have done so, and, at their recommendation, planted evergreens in February and March, found that they almost all died; while to the gardener, who was paid for his trees, it was no loss at all, but on the contrary, he had to supply others at Michaelmas. "In the borders of my pleasure garden," says a practical gardener, "I have no shrubs but evergreens; and the more I view them in the winter, the more I rejoice that I had planted no others; always green and cheerful in the gloomy months of winter, they give a beauty to my garden which it otherwise would not possess. The Portugal and the common laurel, the broad leaved phillarea, the red cedar and evergreen oak,—these, as they grow to such a considerable height, may, with here and there a yew, be planted in the back-ground, and form a rich variety; while these, the Grecian and Siberian arbor vitæ, the juniper, the arbutus, the cypress, the silver holly, the laurustina, &c. should be planted in the fore-ground, especially the laurustina, which is handsome in its growth, as well as beautiful in its flower. As it is rather a tender shrub, it is better to buy them in pots, and then turn them out carefully, and plant them in a sheltered and warm situation, with the soil adhering to the root. But no evergreens should be planted thickly, as they do not like knife, and few persons have resolution enough to remove a tree, before it has materially injured, and perhaps spoiled, the growth of its neighbour. Where the soil is good and the situation open, evergreens, planted in October, will make some vigorous shoots the second spring, and will fill up the ground they are intended to occupy, with astonishing rapidity. In situations where it may be desirable to plant a few firs, I would, by all means, recommend the Scotch. It looks coarser and less inviting to the eye, than other firs, while it is young, but is a tree which improves every year of its growth, losing that stiffness and formality which are the characteristics of firs in general, and becoming richly shaded in its bark."

PUTTY POWDER.

Sir,—By what means could Putty Powder, which is the oxide of tin, be reduced to a whiteness, as it inclines to yellow. Perhaps it cannot be brought to inclination of blue, rather than otherwise? If any of your intelligent Correspondents will favour me with the means, it will be of consequence, and oblige, Sir,

Your's, &c.

A CONSTANT SUBSCRIBER.

P. S. May I add, I have read in an Encyclopedia, that it is as white as snow, and is capable of being reduced to such an extreme degree of fineness, as will admit of its being used to polish metallic speculums. I want it as a pigment, in consequence of its being a permanent one, and not likely to fade.

NOTICES TO CORRESPONDENTS.

We should be happy to have the opinion of G. H. on the Improvement and Extension of Benefit Societies.

J. M. N. and 1 and 2 make 3, are particularly requested to favour us with a continuation of their respective articles, on Hydrodynamics and Figures.

Communications have been received from M. De la Fons, B. H., G. R. of Petersburgh, a Mechanic and Lover of Porter, a Lover of Sweet Meat, H., and Lieut. G. M. H.

*** Orders from the country should particularly state, the Mechanics' Magazine, by Knight and Lacey.

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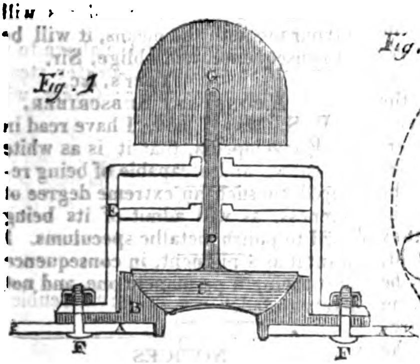
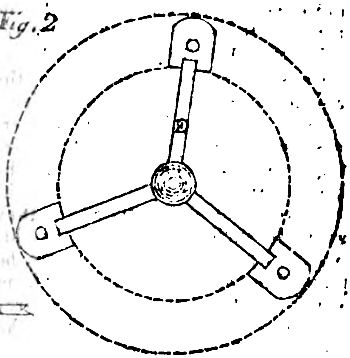
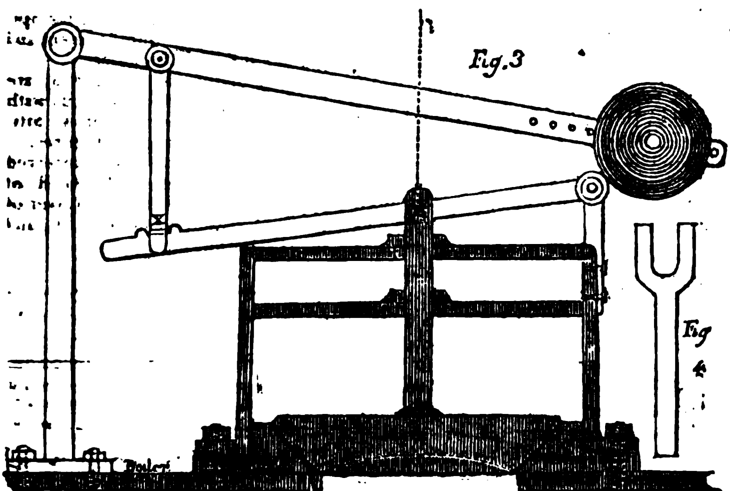
"Genius is of no country; her pure ray
Spreads all abroad, as general as the day."
CHURCHILL.

SAFETY VALVES.







SAFETY VALVES.

SIR,—Having been a working mechanic these 25 years, I feel much pleasure in the perusal of your excellent magazine; and this pleasure is considerably increased, when I consider the many beautiful mechanical contrivances which it has made known to the public, and which otherwise would probably have sunk into oblivion, or, at the best, have had but a very limited number of admirers.

I would wish, through its medium, to call the attention of engineers to what is called the *safety valve of steam boilers.*

The utility of having a good safety valve, both for steam-boats and land engines, seems to me a subject worthy of consideration. The cone valve at present in use is not on a good principle. It might be improved by substituting a spherical valve, which, in practice, I have known to answer better, not being so liable to stick. It would be advisable to have no cross-bar in the boiler, stopping up the steam-way; but to have it on the upper side of the valve, working through a bar with plenty of play, for the valve being made spherical, and falling into the seat at an angle, will be equally tight. The conical valve is the reverse of this, and, on that account, the stem is made to fit tight through its cross-bar, which is the cause of its sticking. Its being in the boiler also prevents its being oiled, cleaned, and examined, till the steam is down. I propose, therefore, a valve to be made in the following manner, beginning with one that is best adapted for small boilers:

Suppose the steam-passage through the valve-seat be three inches diameter; and that for condensing engines the valve be loaded with 5 lbs. on the cubic inch; then

3	·7854	
3	9	
9 inches	7·0686	the area of 3 in.
	5 lbs.	on cubic in.
	35·3430	

will give 35¼ lbs. on the safety valve, including is own weight; so that if the steam be a little stronger, it will raise the valve and blow off.

The above figures are drawn to a scale one-sixth of the real size.

A, the boiler; B, the seat; C, the valve; D, the stem; E, the double cross-bar, a plan of which is given in fig. 2, and may be made of brass or iron; F, bolts to secure both seat and bridge; and G, the weight of lead or cast-iron, turned to weigh with the valve's 35¼ lbs. A triangle bridge is by far the best, being more firm, and not so liable to be put out of shape.

A valve for larger boilers, fig. 3, may have double levers, and may be constructed on the steel-yard principle, thus:

We will suppose the above to represent a six-inch diameter steam-way for a large boiler: *Quere*, what weight on the valve?

6	·7854	
6	36	
36	47124	
	23562	
	28·2744	
	5 lbs. on each cubic in.	
	141·3720	

The weight with valve and levers will be 141¼ lbs. which may easily be tried, by fixing the whole on a plank, and with a strong wire from the valve stem to one end of a scale beam, with 141 lbs. in the other, the valve may be adjusted to an ounce. The joints and crutch should have a little play, to guard against sticking; and as a little clean tallow may be applied to this kind of valve once a week, I would recommend it to be locked up in an iron grating with wove wire, to prevent the engineer from over-loading it. I would recommend the turner of such valves, for I have tried several ways, to turn, and not file, a pair of iron or brass gauges, according to the size of the steam-way. If six inches, the gauge should be 10¼ inches diameter, to bring the spherical part of the valve near 45 degrees, that being the best shape in practice, as shewn by the subjoined figure, representing the sweep of a six-inch valve, at an angle of 45°, turned from a 10¼ inch gauge. The valve is turned hollow to save brass,

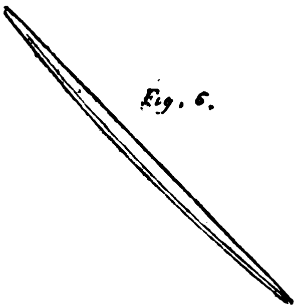


Fig. 6.

To make the gauges, take a flat piece of sheet iron, and fix it on the chuck with four wooden screws; turn out the gauge for the valve 10¼ inches, then cut it in half, as shewn in fig. 7, the gauge for the seat fig. 8.

The valve should be taken out of the lathe when the gauge is applied, otherwise it may be made of wrong shape, and in endeavouring to remedy it, it will become too small for the gauge.

I would also wish to call the attention of the proprietors of high-pressure boilers, and especially of steam-boats, to the plan adopted by Mr. Perkins, that is, of having a cast iron pipe of sufficient strength, from the boiler to the paddle case, with a flanch of copper of less than half the strength the boiler is calculated to withstand, and yet much stronger than the regular working pressure. In this case, if the engine have occasion to stop, and the steam is prevented blowing off at the valve, the flanch of copper will burst, and save a worse accident. The engine tender should have four or five of these in store, to replace such as get destroyed.

I am, &c.
GULIELMUS R.

Fig. 7.

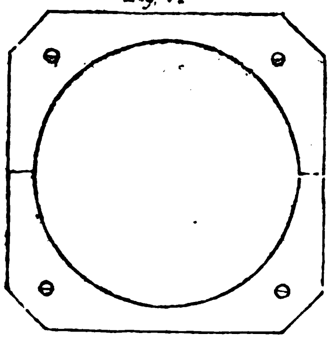
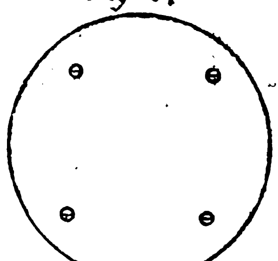


Fig. 8.



NEW METHOD OF LIGHTING LARGE APARTMENTS.

M. Locatelli, a mechanician of Venice, distinguished by many important discoveries, has invented a new process for lighting public halls. It is well known that Rumford and others endeavoured in vain to discover the means of dispensing with chandeliers, so inconvenient in theatres and other halls of audience. The new process employed at Venice has completely succeeded, and leaves nothing to be desired. Instead of parabolic mirrors, the light of several lanterns is concentrated on an opening in the middle of the hall, (probably the ceiling,) and falls upon a system of lenses, plano-concave, which fill the opening, (a foot in diameter,) and distribute through the apartment rays, which, falling parallel on the lenses, issue divergingly. From the centre, or pit, nothing is perceived but the lenses, which resemble a chaffing-dish of burning coals, illuminating the whole house, without dazzling or fatiguing the eye. Besides the advantage of being more equal and soft, the light is more intense than that of the chandelier: there is not a spot in the hall where one cannot see to read with the greatest facility.

PORTER BREWERY.

Sir,—It appears to me truly surprising, that, though so many companies have been recently established, and some to pursue the most visionary schemes, not one of them should have had for its object the lessening of the price of porter to the poor man and mechanic. The consumption of this article is immense; and its price is to the working-classes a subject of the greatest consideration. It is not, Sir, because the Golden Lane brewery failed, that a new one should not now be established, and that too upon the most extensive scale: for if persevering intelligent men can be found competent to conduct the affairs of public water-work or gas companies, why should they not also be found to conduct, with considerable emolument to the proprietors, a cheap public porter brewery?—Between Waterloo and Westminster bridges, on the Lambeth side of the river, are many very excellent situations possessing every requisite for water and land carriage.

I am, &c.
A Mechanic and Lover of Porter.

SPINNING MACHINES.

Mr. Molyneaux, of Stoke, Somersetshire, has obtained a patent for an improvement in spinning flax, cotton, wool, and silk. The contrivance is extremely simple, and consists in the adaptation of a peculiar kind of spindle and bobbin, which is applicable to spinner's frames in general; the spindle has no flyer, and the bobbin turns upon a horizontal axle, receiving the filaments of whatever material is about to be spun, in a direct line from the drawing-rollers, or from copts or creels, instead of having it conducted on a considerable angle through the arm of a flyer; the bobbin and the carriage in which its horizontal axle is suspended is made to spin round rapidly, by means of a cord from a drum, as in the old spinning-frames, by which the twist is given uniformly to the whole length of the filaments of flax, cotton, or silk under operation: and the taking up, or coiling of the thread thus spun upon the bobbin, is effected by a wheel affixed to the axle of the bobbin, which is turned by a friction of horizontal plate, attached to and revolving with the carriage.

HISTORY AND PROSPECTS OF ENGLISH INDUSTRY,

Of all the general rules relating to national concerns which can be drawn from the history of human industry—and they are many—the least subject to error is, that the nation which excels in working iron is the most advanced in true civilization. The observation and experience necessary to distinguish its ores from stones of smaller value, and the labour of extracting it, must have retarded its general use much longer than that of gold, silver, and copper. It is, however, mentioned in the Pentateuch as employed for the construction of sharp-edged instruments; but that the difficulty of working it was not yet generally overcome, appears from the value set upon it by Achillés, who proposed a ball of iron as a prize at the games instituted in honour of Patroclus. What is to be thought of the admiration bestowed by Herodotus upon a vase of the metal, most curiously inlaid, and presented by Alyattes, king of Lydia, to the Delphic oracle, cannot now be determined, unless the vase itself was forthcoming. But these are mere casual productions, and cannot be compared with the purposes to which iron is applied in modern times. The Greeks might have honoured the departed hero just as well with any other reward to the victors; the Delphic oracle, like modern oracles, might have been satisfied with a vase of gold; the Israelites, to be sure, might have been a little puzzled, without knives or swords, to cut their way into the land of milk and honey:—but were this word, iron, suddenly expunged from the catalogue of modern materials, the total fabric of European civilization would be effaced along with it. There is not a want of the present age, absolute or fictitious; not a qualification, physical or intellectual; not a link in the whole chain of social improvement, to which iron, in some shape or other, directly or indirectly, does not minister. Thus it is that Britain, the greatest iron-mistress in the known world, stands, and long has stood, at the head of civilization.

Although we have been seriously told that a very large proportion of the knives and scissars used in England were of French manufacture; although we know the commonplace story of a magnificent steel-hilted sword, sold to the late and too well-known duke of Orleans, for an English sword, and afterwards proved by a Parisian maker to be a production of his workshop; yet we do not think that M. Dupin will contest the superiority of England, in every species of hardware, even as far back as the period which he has assigned as the æra of her unskilfulness. The case is so notorious that we do not think it needs to be insisted upon. However, should he not be of our opinion, and should he bring forward facts to prove that we are mistaken, we are ready to retract.

Although all the metals are skilfully worked by English artificers, yet it is most remarkable that those in which they excel are the most refractory; those which, when dug out of the earth, have the smallest worth, but to which thought and labour give the highest importance; those on which the hand of man, directed by his genius, accumulates the greatest factitious value; that is to say, a value which is nearly null in the savage state, but which goes on increasing in the exact ratio of intellectual civilization. The French, on the contrary, have turned their attention to the metals which have the greatest value in themselves, and to which, when wrought, the workmanship adds the smallest merit. Thus a favourite manufacture with them long has been jewellery, and the fabrication of the precious metals in all their shapes. These are the most luxurious, and the least useful, of the metallurgic arts; they are the least intellectual also, as gold and silver are more easily purified and melted than iron. Necessitous nations have, indeed, fabricated jewellery, but not until more urgent wants had been satisfied, and previous exertions had brought home the wealth which entitles men to indulgence. Some nations too, whose demand for domestic consumption was small, yet fabricated them for the gratification of others. Thus anciently did Tyre and Sidon. Thus Venice and the Netherlands have at different times been celebrated for their gold and silver works; but only when the immediate necessities of those republics had been satisfied; only when other objects, more useful, had been produced both for the home and the foreign market; and the woollen cloths of Bruges were some centuries earlier than the plate and jewellery of the same city. On such conditions luxurious industry is a legitimate, a necessary consequence of the labour which is employed to overcome early difficulties, and the very obstacles which, in the first instance, seem to forbid all indulgence. But what constitutes the particularity of France is, that while she was tributary to England and Flanders for covering, she was chiselling silver, or twisting gold into filagrams; and was gratifying her vanity herself, while she was paying wiser nations for her comforts.

This is enough upon the metallurgic arts. In a wide view of the subject, we may say the English had the superiority in working iron; the French in working gold. In silver let us grant them to be equal; copper, lead, and pewter must be thrown into our scale. Now, until M. Dupin can prove that the consumption of jewellery is more profitable than that of hardware, we cannot admit the alleged superiority of his country; and when he does prove it, we can oppose him by means of the other metals.

To the Editor of the Mechanics' Magazine.

NAVAL ARCHITECTURE.

Sir,—In reply to the inquiry of H. G., February 4, 1826, "If any Vessel has been constructed agreeable to the form of the solid of least resistance, as given by W. Emerson," I cannot answer; but, to the remainder of his question, whether "that form has ever been tried," I can speak in the affirmative. The comparative resistance of the solid of the least resistance of Sir Isaac Newton, is to that of Emerson, in the proportion of 10 to 33, or less than one-third. The manner in which these experiments were made, is liable to objection; yet, nevertheless, sufficiently accurate to prove the difference is great. As the friction of the water constitutes part of the opposition of the fluid, experiment only, can determine the curve, which, most probably, will vary according to the greater or less depth of the immersion.

As the Americans are bestowing great attention on building their navy, and this is a question of such vital importance to ship-building, there is no doubt their government will, shortly, order the subject to be thoroughly investigated.

I remain, Sir,
Your obedient Servant,
B. H.

August 5, 1826

CHEAP AND DURABLE PAINT FOR COARSE WORK.

Sir,—In the transactions of the Society of Arts, vol. 23, a process is described for making cheap and durable paints with *fish* oil. This method, invented by M. Vanhermau, is quoted in the Encyclopedia Britannica, 5th edition, under the article "Painting," page 694, in which is also given another method of preparing impenetrable paints, at a very cheap rate, and Cadel de Vaux's method of house painting in *milk*. There are few subjects of more importance, in farming and domestic economy, than obtaining an *easy*, *practical*, and *cheap* means of painting the various offices and buildings attached to farms and country houses. To apply oil colours to the extensive buildings connected with farms, manufactories, and garden premises, is attended with very heavy expense, and prevents this necessary protection being resorted to, as often as is desirable. I am induced, by a consideration of the great benefit that would result from more general information on the subject, as well as desiring to adopt the same in a course of painting I am about to apply to my own premises, to inquire, through the medium of your highly useful and instructive Magazine, what is the most approved composition of a *cheap and durable paint* for coarse work, and where fish oil, *purified and prepared* for use in painting, is to be had.

I wish the proportions of the ingredients to be used to be specified.

I am, Sir,
Your obedient Servant,
A SUBSCRIBER.

August 5, 1826.

PRESERVATION OF ACCOUNT BOOKS FROM FIRE.

It is well known that the more closely paper and other combustible substances are packed, the longer they resist destruction by fire. In order that combustion may take place, the presence of air is absolutely necessary; and the more the air can be excluded, the slower, of course, will that combustion proceed. If a piece of thread be tied so tight round a poker that no air can lodge between it and the iron, the thread cannot be consumed by holding it over a candle. For the same reason, if a handkerchief be stretched as tight as possible over a watch-glass, a burning coal, laid upon the glass, will not injure the handkerchief. Few substances become more easily a prey to the flames than paper in loose sheets, but when packed up tight in reams, it will resist destruction for a long time, and only burn slowly about the edges.

It follows from these facts, that the best mode of preserving account books from fire is to have them closely packed in the iron chest. This suggestion was communicated to us by Mr. Jones, librarian of the Athenæum, and is well worth the attention of the public, as we can hardly imagine a greater calamity to a merchant, banker, or tradesman, than the loss or mutilation of his books of accounts. If the books kept in the bookcase so completely fill the space from side to side, as to pack pretty closely, they would not be materially injured by exposure to a heat which would utterly destroy them if they lay loose or straggling about. In order to keep the books in the requisite close order, when there are not enough of them to fill the bookcase, Mr. Jones recommends something like a hat screw, of iron, by which the books might be screwed up tight to the sides of the bookcase. The end might be accomplished in this way, or by wedges, or a variety of other easy methods; and we trust that so useful a hint will not be lost upon the public.

Liverpool Mercury.

CHLORURET OF LIME.

M. Virey communicated to the Academy of Sciences at Paris, on the 14th of May, a statement of the diseases which afflicted the army of Spain in 1812, by Dr. Estienne, by which it appears that chloruret of lime, spread among the beds of those affected with typhus, produced in the most infected hospitals very advantageous effects. M. Lisfranc stated that he had used the same substance successfully for a considerable time, i the treatment of atonic ulcers: and M. Girard added, that he had employed it with advantage in the carbuncled affections which had accompanied the disease recently prevalent among horses. M. Labarraque said that this substance was employed in Spain, merely for the disengagement of the chlorine in a manner less objectionable than that of Guyton de Morveau, while he employed the chloruret of lime or of soda, in substance, so as to apply it to the infected matters, and thus to destroy at once the putrefaction.

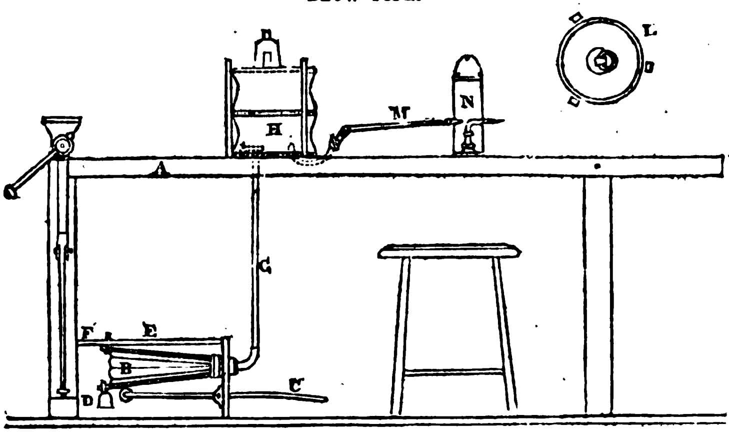
DOUBLE-BOTTOMED SHIP.

Sir,—Underneath I hand you a quotation from the Life of Sir William Petty, and shall feel obliged, if any of the numerous readers of your Magazine, can favour the public with a description of the vessel there referred to.

I am, Sir,
Your obedient Servant,
H.

About that time he was much talked for his new invention of a Double-bottomed Ship, to sail against wind and tide; which, in July 1664, made one very successful voyage to Holyhead and back again, contrary to the expectations of most persons, who thought it an impracticable experiment. But, in a second voyage, it had the misfortune to be lost in a violent storm. This invention appeared so remarkable to the author of the History of the Royal Society, that he has given it the following encomium, "It was," says he, "the most considerable experiment that has been made in this age of experiments; if either we regard the great charge of the work, or the wonderful change it was likely to make in navigation, or the great success to which this first attempt was arrived. Though it was at first confronted with the doubts and objections of most seamen of our nation, yet it soon confuted them by experience. It appeared very much to excel all other forms of ships, in sailing, in carriage, in security, and many other such benefits. Its first voyage it performed with admirable swiftness. And, though it miscarried after its return, yet it was destroyed by a common fate, and by such a dreadful tempest, as overwhelmed a great fleet the same night; so that the ancient fabricks of ships, have no reason to triumph over that new model, when, of threescore and ten sail, that were in the same storm, there was not one escaped to bring the news." Sir William presented a model of this ship to the Royal Society.

BLOW-PIPE.



Sir,—Inquiries being made for a cheap and simple blowpipe, I take leave to forward you a drawing and description of one which I have contrived since the appearance of those inquiries in the Mechanics' Magazine. I have made two of them: one for an old brazier and the other for a jeweller, both of whom are well pleased with its mode of operation.

A, represents a work bench; *B*, a pair of common house bellows; *C*, a treadle fixed in the middle by an iron pin or two gudgeons, and having, at that extremity which is beneath the bellows, a small wooden wheel or roller of three inches diameter; *D*, a weight to bring down the bellows; *E*, a light frame, to which the upper board of the bellows is affixed by the pin *F*; *G*, a pipe of tin, lead, or leather, having at the top a clap or hinge valve, to prevent the wind from returning or pressing on the interior; *H*, an air-box or vessel to regulate the blast by means of a weight, *I*, at the top; *K*, three pieces of wood driven into the bench a little distance from the air-vessel, that it may have play to work up and down; *L*, a plan of the air-vessel, shewing the position of the three pieces of wood which keep it upright, two of which only can be seen in the elevation; *M*, a branch pipe leading from the air-vessel, having a small cock to regulate the blast, according to the degree of heat required; and *N*, a lamp.

The air-vessel may be made with two circular pieces of flat board, ten inches or a foot diameter, placed at the top and bottom, and with a third piece, like a hoop or ring, in the intermediate space between them, as represented, having pliable leather nailed round them. The branch pipe, *M*, may have a variety of tips with different sized apertures adapted to it, to suit the gas, candle, or lamp, employed.

I am, &c.

Gulielmus R.

MEMOIR OF MATTHEW BOULTON, ESQ.

Matthew Boulton, a manufacturer and practical engineer of great celebrity, son of Matthew Boulton, by his wife Christian, daughter of Mr. Peers, of Chester, was born at Birmingham, the 14th of September, 1728, and died in August, 1809.

He was educated at a neighbouring grammar school, kept by Mr. Ansted, of Deritend, and was called into active life upon the death of his father, in 1745. The various processes by which the powers of the human mind give facility to the artist in rendering the different forms of matter obedient to his command, afforded ample scope for the exercise of his inventive faculties, in improving the manufactures of his native place. His first attempt was a new mode of inlaying steel; and he succeeded in obtaining a considerable demand for the products of his manufactory, which were principally exported to the Continent, and not uncommonly reimported for domestic use, as of foreign manufacture.

In 1762, his fortune being already considerable, he purchased a tract of barren heath, in the neighbourhood of Birmingham, with a single house on it, and there founded, at the expense of 9000l. the manufactory which has been so flourishing, and so well known under the name of Soho. His workmen were at first principally employed in the imitation of or-moulu, and in copying oil paintings with great accuracy, by means of a mechanical process which was invented by a Mr. Egginton, who afterwards distinguished himself by various works in stained glass. Mr. Boulton, finding the force of horses inadequate to the various purposes of his machinery, erected, in 1767, a steam engine, upon the original construction of Savery, which, notwithstanding the inconvenience of a great loss of steam from condensation, by its immediate contract with the water raised, has still some advantages from the simplicity of the apparatus which it requires, and has even lately been found to succeed well upon a small scale. But Mr. Boulton's objects required a still more powerful machine, and he had the discernment to perceive that they might be very completely attained by the addition of the various improvements lately made in the steam-engine by Mr. Watt, of Glasgow, who had obtained a patent for them in 1769, the privileges of which were extended, in 1775, by an act of parliament, to a term of 25 years. Mr. Boulton induced this ingenious and scientific inventor to remove to Birmingham.

They commenced a partnership in business, and established a manufactory of steam-engines, in which, accurate execution kept pace so well with judicious design, that its productions continued to be equally in request with the public, after the expiration of the term of that legal privilege, which, at first, gave the proprietors the exclusive right of supplying them; and which had been confirmed, in 1792, by a decision of the court of King's Bench, against some encroachments on the right of the patentee. It was principally for the purpose of carrying on this manufactory with greater convenience, that the proprietors established an iron foundry of their own, at Smethwick, in the neighbourhood of Soho.

In 1785, Mr. Boulton was made a fellow of the Royal Society, about the same time with Dr. Withering, and several others of his scientific neighbours. In 1788 he turned his attention to the subject of coining, and erected machinery for the purpose, so extensive and so complete, that the operation was performed with equal economy and precision; and the coins could not be imitated by any single artist for their nominal value; each of the stamps coining, with the attendance of a little boy only, about eighty pieces in a minute. The preparatory operation of laminating and cutting out the metal, is performed in an adjoining room; and all personal communication between the workmen employed is rendered unnecessary, by the mechanical conveyance of the work from one part of the machinery to another. A coinage of silver was executed at this mint, for the Sierra Leone Company, and another of copper for the East Indies, besides the pence and halfpence at present in circulation throughout England, and a large quantity of money of all kinds for Russia. In acknowledgement of Mr. Boulton's services, and in return for some specimens of his different manufactures, the emperor Paul, made him a present of a valuable collection of medals and of minerals.

Mr. Boulton obtained, in 1797, a patent for a mode of raising water by impulse, the specification of which, is published in the ninth volume of the Repertory of Arts, p. 145. It had been demonstrated by Daniel Bernoulli, in the beginning of the last century, that water flowing through a pipe, and arriving at a part in which the pipe is suddenly contracted, would have its velocity, at first, very greatly increased; but no practical application of the principle appears to have been attempted, until an apparatus was set up, in 1792, by Mr. Whitehurst, for Mr. Egerton, of Oulton, in Cheshire; consisting of an air-vessel, communicating with a water-pipe by a valve, which was forced open by the pressure or rather impulse of the water, when its passage through the pipe was suddenly stopped by turning the cock, in the ordinary course of domestic economy; and although the pipe, through which the water was forced up, was of moderate height, the air-vessel, which was at first made of lead, was soon burst by the "momentous force," as Mr. Whitehouse very properly terms it. The apparatus had excited much attention in France, under the name of Montgolfier's Hydraulic Ram, and Mr. Boulton added to it a number of ingenious modifications; some of which, however, are more calculated to display the vivid imagination of a projector, than the sound judgment of a practical engineer, which had, in general, so strongly characterized all his productions.

He died, after a long illness, in possession of considerable affluence, and universal esteem, leaving a son and daughter to profit by the wealth and respectability which he had acquired. He was buried on the 24th of August, at Handsworth, near Soho, attended by a procession of 600 workmen, and by a numerous train of his friends and acquaintance. —*Monthly Magazine*, Oct. 1809, p. 358.

PAPER.

The brothers Cappueino, paper-makers at Turin, have found the means of supplying the want of rags, by the fabrication of a new kind of paper from the thin bark of the poplar, willow, and other kinds of wood. The academy of sciences having examined the specimens thus produced of writing, printing, and wrapping paper, acknowledge the goodness of them, and praise the invention, so that his majesty has granted to the brothers, an exclusive privilege for ten years, for the manufacture of paper from ligneous materials.

HYGROMETRY.

Professor De La Rive of Geneva, finds that if the naked ball of a thermometer be dipped in sulphuric acid, and then suspended in the air, the moisture attracted by the acid, in combining with it, causes an elevation of temperature in the mercury, which, by its extent in a given time, affords a good indication of the relative quantity of moisture in the air. For this purpose it is necessary to use the same thermometer, (or one of several in which the effect is found to be uniformly the same,) and an acid of uniform strength.

POCKET ELECTRICAL APPARATUS.

Sir,—Through some unknown cause, the monthly parts of your instructive Magazine have, of late, very tardily come to hand, so that I have remained totally ignorant of the Queries of your Correspondents respecting my former communication on this subject, until within the last day or two; but not thinking the answers you have received, quite satisfactory, I will, as briefly as possible, explain how I coat the jars and varnish the ribbons.

To coat a small mouthed bottle is certainly no easy matter; but, after a little practice, the difficulty may be overcome. I cut out a piece of tin foil of sufficient size, and fold it up so as just easily to slip into the bottle, I then apply a little glue to the inside of the bottle or jar with a feather, the tin foil is next inserted, the folds of which are to be gradually opened with a feather or quill, the glue causing it to adhere to the inside of the glass as the work proceeds; after this is done I apply a little glue to the bottom, and covering it with tinfoil, the inside is finished. There are other ways of coating jars, as, with an amalgam of mercury and tin, &c. but I think them equally as troublesome. To coat the outside of the jar I apprehend requires no comment.

I now come to the ribbon, the proportions of mine are three feet long by three inches broad, and varnished on each side by the copal varnish. What may be the secret composition, used by mathematical instrument makers for this purpose, I do not pretend to determine, having found, from repeated trials, the copal to answer; for when the ribbon is very dry, and the experiments made in the dark, it is surprising to perceive how completely it is enveloped in fire. The reason, therefore, of G. M. H——n failing, could not be for the want of the recipe of my unknown friend Psowtakonoski; his addition of the India rubber, I consider an improvement; but as this substance is not easily dissolved, I fear it would prove, to the major part of your readers, a more difficult task than the pronunciation of his name, having in vain tried turpentine, ether, and spirits of wine, as solvents.

The explosion of gunpowder, I am aware, generally requires a larger jar than the one I have described. G. M. H——n will, however, find the ribbon charge a jar of sufficient power for this experiment, or the inflammation of spirits of wine.

I remain, Sir,
Your obedient Servant,
GALVANUS.
Great Missenden, August 10, 1826.

GUN CARRIAGES.

Sir,—"Paul Pry's" criticism, in your No. 145, page 72, on my suggested "Improvement on gun carriages," appears to savour more of satire, than any real desire of information; nor am I aware of any nautical phrase used, not common to the *most common capacity* in these learned days. I perceive, in my description, fig. 1, an error in two places, instead of "the truck D" it should be "the truck E," and doubtless, Paul Pry, if he really has any further desire for information on my proposed plan, will find no difficulty in meeting with some nautical man, "*learned* and *intelligible*" enough, to solve his difficulties; if not, I shall not retort, as he so prematurely anticipates, but clear his researches, by an explanation of any nautical phraseology which may puzzle him.

Were it, however, found necessary for every writer to whom your pages are open, to make clear to *every capacity*, the technical terms so inseparable from descriptive machinery, it would tend to swell your scientific publication to an enormous size, without in the least aiding its intended purposes, further than satisfying simple curiosity; more especially, since the existence of an Encyclopedia, and so many scientific books are open, to amply gratify the assumed, or real propensities of my critic.

I remain, Gentlemen,
Your obedient Servant,
G. M. H. Lieut. R. N.
August 8, 1826.

CAPTAIN MANBY'S LIFE BOAT AND APPARATUS FOR CONVEYING ASSISTANCE TO SHIPS IN DISTRESS, ON A LEE SHORE.

The Committee of the Port of Plymouth Branch Society, for preserving the lives of seamen from shipwreck, lately embarked from the Admiral's Stairs, on board the life boat, for the purpose of proceeding in her, to Port Wrinkle, to ascertain her qualities, and to witness a trial of captain Manby's apparatus for conveying assistance to ships in distress on a lee shore; the result was, in both cases, highly satisfactory. A shot thrown by the mortar, charged with six ounces of gunpowder, carried the rope 91 fathoms in a straight line; and when the charge was increased to eight ounces, the elevation was very considerably greater, and the distance in a straight line, 21 fathoms. The life boat made much greater way through the water when rowed, than might have been expected from her appearance; and on her return, a swift breeze came on, accompanied by a heavy swell, through which she sailed swiftly and steadily. On nearing the shore at Cawsand, the plugs were drawn out and the water admitted, in order to ascertain how low she would sink; and although there were eighteen persons on board at the time, she did not drop above six inches; the water then ceased to flow into her, fully convincing the gentlemen on board, of her perfect safety.

SULPHATE OF QUININE.

The high price of this valuable medicine, has tempted the cupidity of counterfeiters, and what is more remarkable, one of them had the audacity to request M. Pelletier, of whom he purchased this article, to prepare for him some sulphate of lime, (which, as is well known, crystallizes in silky fibres,) in order to mix it with sulphate of quinine. This then is one method of adulteration. Others have substituted carbonate of magnesia. These frauds are easily discovered, for it is sufficient to treat the sulphate of quinine with alcohol, which dissolves it entirely, whilst the two other salts remain insoluble, and washed with cold water are insipid.

CLOCK AND WATCH-MAKING

We have now lying before us a very excellent treatise on watch and clock making, by Mr. Thomas Reid, of Edinburgh.

This gentleman having retired from the active pursuit of his profession, to which his whole life has been devoted, has now, at the advanced age of fourscore, completed a work, which we have little hesitation in saying, is the best treatise on the subject extant. In it, he has endeavoured to combine his own observations with those of the best practical writers, and to give to the operative watch and clock-maker a condensed view of the art in Great Britain, and on the continent of Europe. The work consists of thirty-three chapters, with an appendix, and is embellished with twenty plates of engravings. On the subject of oil for watches and clocks he gives the following:

"*A receipt to deprive oil of its acid.*—To four ounces of the best spermaceti oil, add four grains of *kali æratum* in five ounces of distilled water, shake them well for a day or two, then pour the whole into a tumbler, covered by another, and when exposed to the light for three or four weeks, the pure oil will float on the top, to be skimmed off by a tea-spoon. This oil, it is said, neither dries nor turns green.

"*Oil may be prepared in the following manner.*—Put a quantity of the best olive oil in a phial, with two or three times as much water, so as the phial may be about half full. Shake the phial briskly for a little time, turn the cork downwards, and let most of the water flow out between the side of the cork and the neck of the phial. Thus the oil must be washed five or six times. After the last quantity of water has been drawn off, what remains is a mixture of water, oil, and mucilage. To separate these from each other, put the phial into hot water for three or four minutes, and most part of the water will fall to the bottom, which must be drawn off as before. The oil must then be poured into a smaller phial, which being nearly full, must be well corked, set in a cool place, and suffered to stand for three or four months, or until the water shall have subsided, with the mucilage above it, and the oil perfectly transparent, swimming on the top of the mucilage. When time has thus completed the operation, the pure oil must be poured off into smaller phials, and kept in a cool place, well corked, to preserve it from the air. This, by Mr. E. Walker, of Lynn, dated 13th Nov. 1810." (See Nicholson's Philos. Journal.)

The fat or oil which is left in the pan after making calves-feet jelly, if taken and put into a jug or bowl, and allowed to remain for some months, what swims on the surface may be skimmed off, put into a small phial, and kept there for some time; this will be found to be a very fine kind of oil, at least it has the appearance of being so. A French chemist, of the name of Jodin, prepares an oil, adapted for the use of watch-makers; it resists the cold to a considerable degree, but in time will become green at pivot holes, like most other oils. Olive oil freezes at 38° or 36° of Fahrenheit's thermometer; but if put into an open glass phial, and exposed to the sun-shine for a little while, it will not be apt to freeze till the thermometer is down to 21°. "As the amount of friction, even in the best clocks, in a great measure depends upon the oil, with which the various parts are lubricated, the following information may be considered of some importance. Colonel Beaufoy states, that olive oil may be freed from its mucilage, merely by exposure to the rays of the sun for one or two years."

"Chevereul, an eminent French chemist, recommends another process for the same purpose. To effect this, he mixes seven parts of alcohol with one of oil, which must be heated in a flask almost to boiling; the lighter fluid is then decanted, and on being suffered to cool, a little portion of fatty matter separates, which is to be removed. The alcoholic solution must be evaporated to one-fifth of its bulk, and the fluid part of the oil will be deposited colourless, tasteless, and free from smell." This oil seems much like what was called Arabian oil, lately (April, 1825) exhibited in Edinburgh. The printed description given with it, gave neither name of an inventor nor any place of abode, a circumstance somewhat extraordinary, and unless a great quantity of it was to be taken, none could be purchased.

Of old, watch-makers were taught not to allow the small phial, which contained the olive oil, to stand even in the light, far less to be exposed to the rays of the sun, because this deprived it of its yellow colour, which was considered to be a quality of the goodness of the oil. And now, the moderns, by depriving it of that colour, say they improve it.

Oil extracted from poppy seeds, and properly prepared, will remain uncongealed at a very low temperature. Almond, walnut, and hazelnut oil, if freed from the mucilage with which these oils are frequently intermixed, may be tried for watches. It was formerly an object of inquiry, to know when a jar of Florence oil was in a frozen state, which sometimes took place in severe winters,—a portion of it remaining unfrozen, was taken out for the use of watch-makers.

We are informed that M. Frederic Schmidt, of Stutgard, has discovered an oil for chronometers, &c. which will not freeze at minus 17 of Fahrenheit's thermometer; does not dry at ×212, and boils at 512; it is not affected by cold at upwards of 50 degrees below the freezing point. M. S. is of opinion, in which he is confirmed by experiments, that this oil will not be affected under the poles.

The process of pouring the water off between the cork and the neck of the phial, was found to have something in it awkward and clumsy; we therefore got a large phial of about 17 or 18 inches deep, two inches wide, made with a glass stopper at top, and another at the side and close on the bottom, to let the water out, which answered the purpose extremely well. Also a few long sort of phials, with ground glass stoppers to each. The tall phial and its stop-cock was found very convenient in the process of washing with water, and letting the water out occasionally, to give room for more fresh and clean water. Oil thus prepared, and afterwards carefully managed, will perhaps be found to be as good as can in any other way be obtained; some of it we prepared in this way, and applied to the pivots and holes of the clock in the Royal Observatory, Edinburgh. This clock was taken down to be cleaned about the beginning of the year 1825, after having gone nearly twelve years; the pivot holes had a little greenish and thick oil in them, but in the reservoirs it was in some degree tolerably fresh and yellow. It is singular that the washing did not deprive it of its yellow colour.

How to preserve the oil, by making such reservoirs as to allow the greatest quantity to be put to the pivots and holes.

To have the pivot holes, so as to preserve the oil for the greatest length of time, with the greatest quantity possible, the following is what should be done, if a little more expense can be allowed:—For those holes, where the pivot ends do not go beyond the surface of the plates, fit into a drill stock, a drill made so as to form something like a drop of fat, when dropped on a table, or such like surface, making the diameter of the artificial drop, to be made by the drill near to four-tenths of an inch or so; in a thick piece of plate brass, make a round hole to receive the drill; the piece of brass must be fixed outside on the frame plates, so as the pivot hole shall be in the centre of the round hole, in order to guide the drill, which must be allowed to cut no further down in the plate, than barely to come to the surface, which should be left to remain, particularly at the pivot hole. A kind of collet might be put on the drill to prevent it from sinking too deep. The drill has the cutting part concave; the inside of the pivot holes may be chamfered a little way by a tool, whose point should be a little on the obtuse side; pieces of hard steel must be screwed on, outside of the plates, so as to cover fully the sinks made by the concave drill, and against the pieces of steel, the pivot ends should occasionally bear; the shoulders of the pivot should be turned nearly away, leaving a sort of cone in their place, and near to the shoulder, or top end of the cone, with the point of a very nice graver, make a slight notch.

The shape of a drop of fat (goutte de suix) at the top of a pivot hole, was a thought or contrivance of that celebrated artist, the late Julian Le Roy, and a most beautiful idea it was. (It is to be regretted that it was not adopted in a clock, otherwise very nicely got up, and for public purposes.) Between the hard steel pieces and the top of the tome, formed by the concave drill, there should be a small degree of space; if they are to close, the oil will spread too much over them, and if at a proper distance, the oil will be attracted to a point connected with the pivot ends, gradually draining the reservoirs to supply the waste at the pivot holes.

VALUABLE DISCOVERY.

One of the most simple and useful discoveries in agriculture, is to mix layers of green or new cut clover, with layers of straw, in ricks or stacks; thus the strength of the clover is absorbed by the straw, which, thus impregnated, both horses and cattle eat greedily, and the clover is dried and prevented from heating. This practice is particularly calculated for second crops of clover and rye grass.

METHOD OF MAKING SOUP OF BONES, AS PRACTISED IN THE HOSPITAL OF MONTPELIER.

The various means of extracting gelatine, hitherto published, require no inconsiderable attention and expense. The managers of the hospital of Montpelier, have succeeded in a more economical method; namely—

The bones are broken with a hatchet into pieces, from an inch to an inch and a half long, with which an earthen pot is made two-thirds full. Water is then added, an earthen cover is adjusted, and the pot is placed in an oven immediately after the batch is withdrawn. After remaining four hours, the pot is found to contain very fat and gelatinous soup. This being poured off, the pot is again filled with water, placed again in a hot oven, and affords, after an exposure of six hours, broth less rich than before, but still of good quality. It is filled a third time with water, and being heated seven or eight hours, yields a fresh supply. These three portions are then mixed together, and being properly seasoned with vegetables, the whole affords a very nutricious and valuable article of diet. Six killogrammes of bones extracted from coarse meat, produce twenty-one killogrammes of broth, which is a sufficient quantity for dealing out to four hundred and forty of the hospital poor.

There is no process which requires less skill and is more economical, for it saves even the expense of fuel.

DOUBLE STARS.

Professor Stuve, of Dorfat, to whose hands Frauenhofer's large refracting telescope has been intrusted, has determined on a review of all the double stars already observed, as well as on a minute examination of the heavens, from the north pole to fifteen degrees of south declination, with respect to these objects. He has now accomplished one-third of the labour, and has found 1000 double stars of the first four classes; among which, 800 are new, and of these, nearly 300 are of the first class. He extends the examination to all stars of the 8th and 8·9 magnitudes.

SUICIDES.

According to a statement made by authority, there were 371 suicides in the city of Paris during the year 1824; namely, 239 men and 132 women. This is 19 less than in the preceding year. Gambling-houses, lotteries, brothels, openly authorized, are so many perfidious snares laid for cupidity, misery, weakness, and all the corrupt passions: and these schools of immorality pay a tribute to enjoy a shameful privilege, and obtain a legal existence in the bosom of a social order which they dishonour.

METHOD OF OBTAINING FLOWERS OF DIFFERENT COLOURS ON THE SAME STEM.

Split a small twig of elder bush lengthways, and having scraped out the pith, fill each of the apartments with seeds of flowers of different sorts, but which blossom about the same time; surround them with mould, and then tying together the two bits of wood, plant the whole in a pot filled with earth, properly prepared. The stems of the different flowers will thus be so incorporated as to exhibit to the eye only one stem, throwing out branches covered with flowers analogous to the seed which produced them.

LIST OF NEW PATENTS.

THOMAS HALAHAN, of York-street, Dublin, Lieutenant in the Royal Navy, for machinery or apparatus for working ordnance.—Dated June 22, 1826.—(*Six months to enrol specification.*)

LEWIS AUBREY, of Two-Waters, in the county of Herts, engineer, for an improvement or improvements in the web or wire for making paper.—Dated July 4, 1826.—(*Four months.*)

JOHN POOLE, of Sheffield, shopkeeper, for improvements in steam-engine boilers or steam generators; applicable also to the evaporation of other fluids.—Dated July 4, 1826.—*Six months.*)

DANIEL FREEMAN, of Wakefield, saddler, for improvements in measuring for and making collars for horses and other cattle.—Dated July 4, 1826.—(*Six months.*)

PETER GROVES, of Liverpool-street, London, Esq. for improvements in manufacturing or making white lead.—Dated July 4, 1826.—(*Six months.*)

ROBERT WORNAM, of Wigmore-street, Cavendish-square, piano-forte maker, for improvements on piano-fortes.—Dated July 4, 1826.—(*Two months.*)

PETER GROVES, of Liverpool-street, London, Esq. for improvements in making paint or pigment for preparing and combining a substance or material with oil, turpentine, or other ingredients.—Dated July 10, 1826.—(*Six months.*)

BENJAMIN LOWE, of Birmingham, gilt toy manufacturer, for improvements in useful and ornamental dressing pins.—Dated July 14, 1826.—(*Two months.*)

JOHN GUY and JACOB HARRISON, of Workington, Cumberland, straw-hat manufacturer, for an improved method of preparing straw and grass to be used in the manufacture of hats and bonnets.—Dated July 14, 1826.—(*Six months.*)

JOHN PALMER DE LA FONS, of George-street, Hanover-square, dentist, and WILLIAM LITTLEWART, of Saint Mary Axe, mathematical instrument maker, for an improvement in securing or mooring ships and other floating bodies, and apparatus for performing the same.—Dated July 14, 1826.—(*Six months.*)

EDWARD BAYLIFFE, of Kendall, Westmoreland, worsted spinner, for improvements in the machinery used for the operations of drawing, roving, and spinning of sheep and lambs' wool.—Dated July 14, 1826—(*Six months.*)

JOHN LANE HIGGINS, of No. 370, Oxford-street, Esq. for improvements in the construction of cat blocks and fish hooks, and in the application thereof.—Dated July 14, 1826.—(*Six months.*)

NOTICES TO CORRESPONDENTS.

Agreeably to the request of Gulielmus R. and other correspondents, we shall in our next number give a description of Messrs. Applegath and Cowper's printing press, with several illustrative engravings.

Communications have been received from Sir Joseph Senhouse—Nemo—Non Geometricus—Bath-as—Gulielmus R.—Europus R.—J. M. N.—1 and 2 make 3 — Senex — Josiah Churchill—and the Secretary of the Hull Mechanics' Institution.

PART 39, price one shilling, will be ready with No. 157, on Saturday next, August 26th.

X is informed that his hint has been anticipated; preparations are already making to analize "The Man of Letters."

Communications (post paid) to be addressed to the Editor, at the Publisher's, KNIGHT and LACEY, 55, Paternoster Row, London.

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Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 157.] SATURDAY, AUGUST 26, 1826. [Price 3d.

MESSRS. APPLEGATH AND COWPER'S PRINTING PRESS.

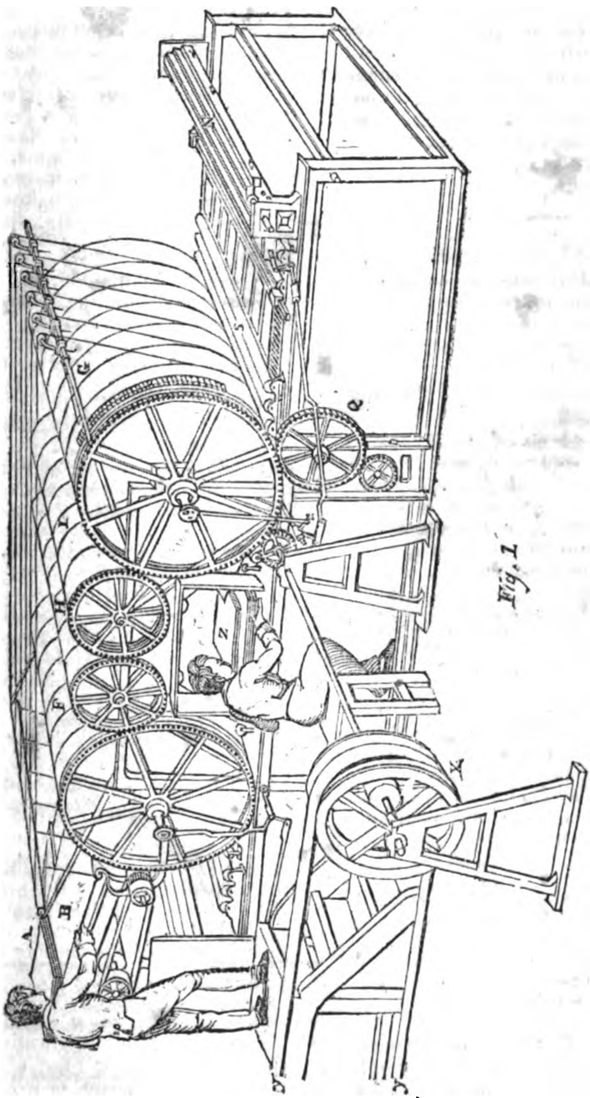


Fig. 1

MESSRS. APPLEGATH AND COWPER'S PRINTING PRESS.

In consequence of the solicitations of G. R. and other Correspondents, we have now the pleasure of laying before our readers, a description of the Printing Press, invented and patenteed by Messrs. Applegath and Cowper.

From the first invention of printing, till within a very few years, the printing press remained unchanged; and it is truly surprising, that so long a period as four centuries should have rolled away, without a single improvement in so important a machine.

The printing press of Lord Stanhope, ingenious and beautiful as it is, should rather be considered as an improvement than as an invention. This press, being made of cast iron, having the surfaces of the table and platen turned true, and a compound lever added to the screw, is more solid and compact, and produces a better impression, with less manual exertion, than the common wooden press, with a stone table and wooden platen; but still the parts are the same, and the only difference consists in producing better workmanship with better materials.

No improvement of importance was therefore made till after the year 1790, when Mr. William Nicholson, the editor of the Philosophical Magazine, obtained a patent for a machine, for printing on *paper, linen, cotton, woollen,* and other articles, in a more neat, cheap, and accurate method, than by the printing presses then in use.

This metho consisted, first, in making his moulds, punches, and matrices, for casting letters, in the same manner and with the same materials, as other letter-founders, with the exception that, instead of leaving a space in the mould for the stem of one letter only, he left spaces for two, three, or more letters, to be cast at one pouring of the metal; and at the lower extremity of each of those spaces (which communicate by a common groove or top) he placed a matrix, or piece of copper, with the letter punched upon its face in the usual way. He then brought the stems of his letters to a due form and finish, not only by rubbing it upon a stone, and scraping it when arranged in the finishing-stick, but likewise by scraping it, on one or more sides, in a finishing-stick whose hollowed part was less deep at the inner than the outer side. That side of the groove which was nearest the face of the disposed letter, he called the outer side; and the purpose accomplished by this method of scraping was, that of rendering the tail of the letter gradually smaller the more remote it was, or farther from the face. Such letters as these could be firmly imposed upon a cylindrical surface, in the same manner as common letters are imposed upon a flat stone.

Secondly, he applied the ink, or colouring matter, to the types, forms, or plates, by causing the surface of a cylinder, smeared or wetted with the colouring matter, to roll over the surfaces of the said forms or plates; or by causing the forms or plates to apply themselves successively to the surface of the cylinder. The surface of this colouring cylinder was covered with leather, or with linen, woollen, or cotton cloth. When the colour to be used was thin, as in calico-printing, he proposed that the covering should be supported by a firm elastic stuffing, consisting of hair, or wool, or woollen-cloth, wrapped one or more folds round the cylinder. When the covering was of woollen-cloth, it was to be defended by leather, or oil skin, to prevent its imbibing too much colour, and by that means losing its elasticity. It was absolutely necessary that the colouring matter should be evenly distributed over the surface of the cylinder; and for this purpose, when the colour was thick and stiff, as in letter-press printing, he applied two, three, or more small cylinders, called distributing rollers, longitudinally against the colouring cylinders, so that they might be turned by the motion of the latter. The effect of this application was, that every lump or mass of colour which was redundant, or irregularly placed upon the face of the colouring cylinder, was pressed, spread, and partly taken up and carried by the small rollers to the other parts of the colouring cylinder; thereby preserving an even face of colour. When the colouring matter was thinner, he did not apply more than one or two of these distributing-rollers; and when very thin, he applied an even blunt edge of metal, or wood, or a straight brush, or both of these last against the colouring cylinder, for the purpose of rendering its colour uniform. When he applied colour to an engraved plate, or cylinder, or through the interstices of a perforated pattern, as in the manufacturing of some kinds of paper-hangings, he used a cylinder entirely covered with hair or bristles in the manner of a brush.

And thirdly, he performed all his impressions, even in letter-press printing, by the action of a cylinder or cylindrical surface.

Though Mr. Nicholson did not carry his ideas into successful practice, he may deservedly be considered the father of modern improvements in this important art. With him originated the idea of inking types by means of rollers, and of producing impressions by means of cylinders, which constitute the essential parts of all modern printing machines.

The honour of being the first to carry these ideas into successful practice is due to Mr. Koënig, by birth a Saxon, who, after various attempts to improve the common press, and which resulted, to use his own words, "in discovering that they were only employing a horse to do what had been before done by a man," succeeded in producing a machine in which the impression is given by a cylinder. This machine was erected at the office of the Times newspaper, and two on a similar principle were erected at Mr. Bensley's printing office, and although some publications have stated that the latter were destroyed by fire, in 1819, they continue to be worked at the present day. These errors may have arisen from the great difference in the appearance of the machine now, and when first erected. This is owing to a reduction of the complexity of the inking apparatus, by Messrs. Applegath and Cowper, who have produced a machine far superior to that by Mr. Koënig, and which possesses nothing in common with it, but the pressing-cylinders, the inkiug-rollers, and the tapes to hold the sheet of paper on the cylinders. The pressing-cylinders and inking-rollers were first suggested by Mr. Nicholson; and tapes are similarly used in machines for the ruling of paper for account-books. These gentlemen, therefore, though producing their machine subsequently to Mr. Koënig, cannot, with justice, be accused of having, in the slightest degree, infringed upon his invention. Mr. Koënig's machine possessed originally *sixty* wheels; Messrs. Applegath and Cowper's but *sixteen;* and the machines of the former are now almost entirely superseded, even in the office of Mr. Bensley, the principal proprietor of Koënig's patent, by the improved machines of Applegath and Cowper.

A perspective view of Messrs. Applegath and Cowper's machine is given in our first page, and a longitudinal section, to explain the manner in which the paper passes through to receive the impression upon both sides, and the mode of applying the ink to the surface of the types, will be given in our next number.

VAPOUR BATH.

Sir,—A much simpler, more economical, and as effective a mode of preparing a steam bath, as that described in No. 148 of your magazine, as Capt. Jekyll's, will not probably be unwelcome to some of your readers. Referring to that article, take away the fire-place, boiler, and pipes, and substitute a small iron stand, placed under the chair. When the bath is wanted for use, the bather being seated as in the sketch, let an assistant place upon the stand a heated brick; a few drops of cold water thrown occasionally upon this, or suffered to fall from a small tin vessel, regulated by a cock, under the control of the bather, will produce a complete vapour bath, and may be continued by exchanging the brick when cold, &c.

Another—a great advantage of this plan, besides its simplicity, is its portability; it may be commanded any where at a very few minutes' notice.

BATH-OS.

ON LIGHT.

Sir,—Can any of your readers inform me what becomes of that portion of light which occupies any open vessel, and immediately disappears on its being closed?

Were it air or water, closing the vessel, would only shut off fresh supplies—that already in the vessel would not be annihilated.—Wherein arises this distinctive property in light, from other material bodies?

NEMO.

Cannot Mr. Editor, or some of his correspondents give us some information on the subject of engraving on steel—a process as applied to landscape engraving, quite new to the writer.

GEOMETRICAL PROBLEM.

Sir,—There is, I think, a fallacy in the proof of the assertion, that "two points or lines may continue to approach each other for ever, and yet never meet," page 158. The diagram only proves that the line E 5, forms a smaller angle with C D, than the line E 4 did; it does not, as conditioned by the proposition, approach C D; on the contrary, it continues, the moment it is produced, to diverge from A, unless taken in the opposite direction, when it not only approaches, but cuts C D. The fallacy consists in the assertion that *two* points or lines may continue to approach each other for ever, and yet never meet; the fact being, that the diagram describes many lines, each forming a less angle with C D than its preceding neighbour; and it therefore only proves, that one line may approach another nearer than a former one did—an assertion not needing proof.

NON-GEOMETRICUS.

IMPORTANT MAGNETIC DISCOVERY.

Sir,—The subject of magnetism is at once of importance to the arts, and of interest to the experimentalist. We have, of late, been abundantly supplied with essays on the effects of various rays of light, &c. in communicating the magnetic property to ferruginous bodies; but a more curious and useful discovery than the following, I flatter myself, has seldom been made.

Some late experiments in chemistry, have enabled me to ascertain, that the sulphate of ammonia, or, (to use the language of my youthful days) Glauber's secret sal ammoniac, possesses the singular property of rendering the needle magnetic. I was busying myself with a solution of this salt, which I was stirring with a rod of steel wire, and after removing my rod from the fluid, I happened to bring it in contact with my spectacles, which long experience has taught me to procure mounted with steel. Judge of my surprise when a union took place. The rod has continued magnetic ever since.

I remain, &c.

Your old Friend and Well-wisher,

SENEX.

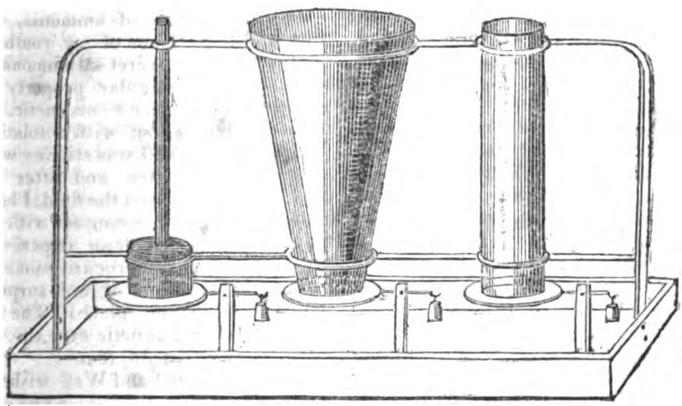
Perhaps some of your more scientific correspondents will do an old man the favour to examine into this subject at large, and to communicate to him, through the medium of your miscellany, the result of their observations.

HYDROSTATICS AND HYDRAULICS.

(*Continued from page* 140, *vol.* vi.)

Sir,—In a mass of fluid contained in any vessel, any particle whatever is equally pressed in every direction, with a force equal to the weight of a column of particles whose height is equal to the depth of the particle pressed below the surface of the fluid. In like manner, also, the pressure upon a given portion of the bottom of any vessel, is equal to the weight of a column of fluid, whose base is equal to the area of the given portion, and whose altitude is the mean altitude of the fluid. From this last law may be deduced, what is generally called the *hydrostatic paradox*, viz. that the pressure upon the bottoms of vessels, filled with fluid, does not depend upon the *quantity* of fluid which they contain, but upon its *altitude*; or, inother words, that any quantity of fluid, however small, (within certain limits) may be made to balance any quantity or any weight, however great. Having made these preliminary observations, I shall endeavour to describe some of the instruments and experiments employed, to illustrate and prove the pressure of fluids, most of which are uncommonly simple, and may be performed by any one at a very trifling expense.

One of the instruments which is employed to exhibit the effects of what is commonly called the *hydrostatic paradox*, consists of three glass vessels placed in a frame, and open at both ends, having the opening at the bottom equal in all. The first is in the form of an inverted cone, the second, a cylinder, and the third, is much smaller at the top than at the bottom. See the annexed figure.



To each of the lowermost openings, a brass plate is fixed with equal force, opening by a hinge on one side. They are retained in their places by equal weights attached to the ends of the levers, and when the vessels are filled with water to the same altitude in each, the pressure of the fluid will overcome the resistance of the weights, and force open the plates at the same instant. The water is caught in the trough below.

If a long narrow tube, full of water, be fixed in the top of a cask, likewise full of water, then, though the tube be so small as not to contain a pound of the fluid, the pressure of the water in the tube on the bottom of the cask, will be so great, as to be in danger of bursting it; for the pressure is the same as if the cask were continued up, in its full size, to the height of the tube, and filled with water. Upon this principle it has been affirmed, that a certain quantity of water, however small, may be rendered capable of exerting a force equal to any assignable quantity, by increasing the height of the column and diminishing the base on which it presses. But this, also, has a limit, as well as most other things.

To prove that the downward pressure of fluids, depends upon their altitudes, take a tin cylinder, furnished with a cock at the bottom; when it is full, a given quantity of water will run out in less time than when it is only partly filled; that is, more will run out in a given time when the altitude is greatest, than when it is less. The *sideward* pressure is also equal to the downward when the altitudes are equal, as is illustrated by the following experiment, in which we may employ the same vessel, making a hole at the bottom, and likewise at the side, as close as possible to the bottom; when, if both are of the same size, equal quantities of water will issue from them in equal times. The *sideward* pressure depends, also, upon the altitude; it is as the squares of the depths below the surface. This is shown by a simple experiment, in which we use the same cylinder, having made two apertures of equal dimensions, (which may be done by using the same tool for both, a bradawl for instance,) but at different distances from the surface of the fluid in the vessel, when it will be found, that the greatest quantity of water, in a given time, will issue from that which is most remote.

I may here notice an experiment for showing, that the superior strata press upon the inferior strata of fluids. Immerse two tubes of different bores, but not of the capillary kind, in a vessel of mercury; the mercury will rise in the tubes on a level with its surface in the vessel; let water be then poured upon the mercury, so as not to enter the upper orifices of the tubes, when the pressure of the water, upon the inferior fluid, will cause the mercury to ascend in the tubes, above the level of that in the vessel, but to the same height in both tubes. The columns of quicksilver, in the two tubes, are evidently supported by the pressure of the water on the inferior fluid. The same experiment may be performed with oil and tinged water, the latter being made the inferior fluid. The *upward* pressure of fluids may be shown by a variety of experiments. Take a glass tube open at both ends, cover one end with the hand so as to confine all the air, and plunge it into a vessel of water. In this position, very little water will rise in the tube, because it is prevented by the air within, but, on removing the hand, it immediately rises to the same height as that in the vessel, owing to the upward pressure of the fluid. If we were to do the same with sand or any other finely-powdered substance, it is obvious that it would not rise in the tube. Again: take a tube and tie a piece of bladder round the lower end; pour in a small quantity of coloured water, and gently press it down into a vessel of that fluid. As long as the level of the water in the tube, is above that of the water in the vessel, the bladder continues convex; when they are both on a level, the bladder is flat and flimsy, the upward pressure being equal to the downward pressure; and when it is pressed still lower, when the level of the water in the tube is below that of the water in the vessel, the bladder will be forced upwards and become concave, the upward pressure being now the strongest. If a fine tube be plunged into a vessel of mercury, and the thumb be placed close over the upper end, on withdrawing the tube, a small column of mercury will be found within it: if the tube be then forced down into a vessel of water, so as to be fourteen or fifteen times the length of the column of mercury below the surface of the water, the upward pressure of that fluid will cause the mercury to rise on removing the thumb. Similar to this experiment, is the following. Take a piece of lead, ground smooth, and after having greased it, place it at one end of an open tube; from the centre of the lead proceeds a string to keep it close to the tube; immerse it in a vessel of water, and if it be eleven times its thickness below the surface, the string may be let go with perfect safety, the upward pressure of the water supporting the lead. If it be raised ever so little, the lead will fall off. Thus lead, or any other metal, may be made to swim in water. The reason in this and the preceding experiment, of immersing the tubes to the depth of fourteen and eleven times the thickness of the metals, is because, in the former case, mercury is fourteen times heavier than water, and, in the latter, because lead is eleven times heavier.

It is on the same principle as the foregoing, that a bucket of water in a well, appears to have little or no weight till it is drawn out of the water; for since fluids press equally in all directions, it requires very little force to move it. The hydrostatic bellows is an instrument well calculated to exhibit the effects of the upward pressure of fluids. It is of different forms, but the simplest consists of a long tube of glass or metal, (a piece of glass pipe for example) bent at right angles near the lower end, to which a large bladder is firmly tied, this is placed in a box with a loose board at top, which rises as the bladder fills with water. The most common kind consists of two circular boards connected together by strong leather, as in the common bellows. On the upper board is placed a weight which is raised as the water is poured in at the tube, and by this means a few ounces of water may be made to raise and support two or three cwt. The principle on which this acts is similar to that before mentioned, in the case of the cask which is burst: only that here, instead of bursting the vessel, the upward pressure of the fluid is made to raise a considerable weight.

The upward pressure is again strikingly illustrated by means of jets. Take a vessel with a lateral projection at the bottom, in which make two or three small holes. When the vessel is full and the stoppers removed from the holes, the water will rise to a considerable height; and this would always be equal to the height of the water in the vessel, were it not for friction and the resistance of the air.

I have now, I think, illustrated the *downward*, *sideward*, and *upward* pressure of fluids, and the experiments which I have mentioned prove the general law, that fluids press equally in all possible directions, provided their perpendicular depths be the same. In my next communication, I shall endeavour to explain the principle of the *syphon*, and notice its connexion with intermitting springs.

I am, Sir,
Your's, &c.
J. M. N.

(To be Continued.)

HINTS FOR PREVENTING THE EXPLOSION OF FOUL AIR IN COAL AND OTHER MINES.

(See Magazine, vol. 4, p. 244.)

SIR,—Soon after the plan of my Igniter was sent to you, I shewed the original to a gentleman well informed of the pernicious effects of fire damps, &c. found in coal pits, and made it to act of itself, before him. He expressed much satisfaction, and thought it might be of great utility to miners, in dispersing the noxious vapours found in mines, although it might be attended with much injury to the brattins and such things as stood in the way of an explosion. He stated that if I could by any means prevent *that*, he had no doubt my machine would be of great value. In reply to this, I informed him, that although I considered it impossible entirely to prevent the wreck that might ensue, yet I hoped it would be very much mitigated by attention to the following.

As foul air, or gas, when exploded, is much of the nature of gunpowder, and its power immense, more particularly so when confined in narrow compass, I would recommend that the brattins of stone, or wood, should be taken away, and canvas, either painted or sised, substituted to divert the current of air to the part where the colliers are at work. This canvas to be fixed to the roof and floor, in such manner that it may be expeditiously let down, or taken away, when a blast is intended to be made. This will afford much more space for the gas to act in, and, therefore, I conceive will in a great degree lessen its power.

The first explosion will probably be the most tremendous, and the succeeding ones milder; so that should the explosion be repeated, at proper intervals, I trust those regions of darkness will, with the Almighty's blessing, become hereafter much less detrimental to human life, than they have hitherto been.

With regard to the choke damp, which, I am informed, generally succeeds an explosion, it may possibly be expelled by irritation.

I am, Sir,
JOSEPH SENHOUSE.

MR. OTTLEY'S IMPROVED OXY-HYDROGEN BLOW-PIPE.

Sir,—The following description of an improved Oxy-hydrogen Blow-pipe, by Mr. Ottley, is extracted from that gentleman's Dictionary of Chemistry, which being very lately published, may not, as yet, have met your eye; as it is an instrument of general utility and interest, I beg leave to transmit it you for the gratification of your scientific readers,

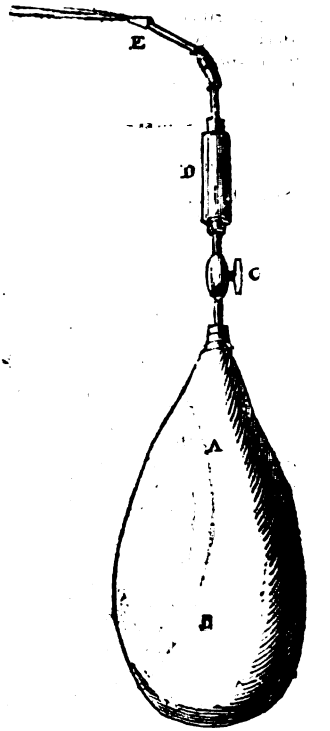
And remain, Sir,

Your's, &c.

1 and 2 make 3.

"The oxy-hydrogen Blow-pipe is an apparatus which acts by the combustion of a mixture of one part of oxygen and two of hydrogen gases; it produces a more intense heat than any of our furnaces, and would have been generally used long ago, could this have been done in safety; but when the gaseous mixture is set fire to, under common circumstances, the flame recedes into the vessel containing the gas, and the whole explodes with tremendous force. To prevent such accidents, several plans have been adopted, but none has been found to combine safety with sufficiently powerful effects.

"Being, however, lately engaged in some experiments, in which iron filings were used, and observing that air could easily be made to pass through them, it suggested itself to me, that if the mixed gases were made to pass through a brass cylinder containing metallic filings, all possibility of an explosion would be done away with; I consequently made the experiment, and found, that from the great conducting power of the filings for caloric *(matter of heat)*, and the density with which they lie together, it was impossible to make the flame recede into the gas vessel, even when the whole of the pressure was removed, for it is immediately extinguished upon coming to the cylinder containing the filings. A Blow-pipe, made upon this plan, is very simple, and produces a most astonishing heat, as we are enabled, by its safety, to have a jet and flame, much larger than those formerly used.



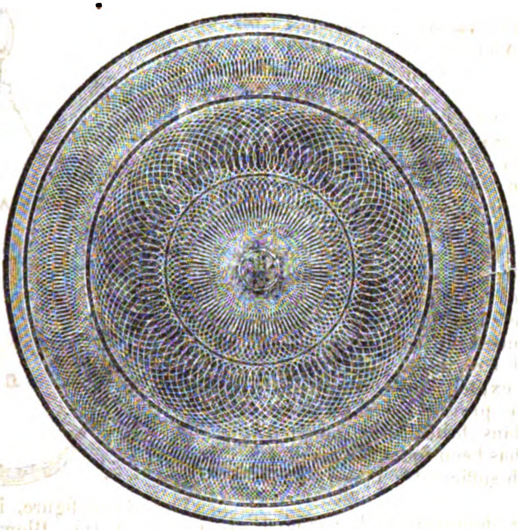
"The above figure, is the representation of this Blow-pipe, with which I have made numerous experiments. It consists of a bladder, A B, containing the mixed gases, a stop-cock, C, which can be opened and shut at pleasure; and the brass cylinder, D, with the jet, E, from which the flame proceeds; the brass cylinder is about an inch in diameter; it has two little necks with a small piece of new gauze in each, to prevent the filings from falling out, and one of these necks screws on to the stop-cock of the bladder, while the other is attached to the jet. In using this Blow-pipe, pressure may be applied to the bladder by the hand, and as the flame consists of two cones, one inside the other, it is necessary to recollect, that the point of the inner cone gives the strongest heat; it fuses all sorts of earthenware, as well as platinum, marble, and many other substances which cannot be fused by any other means.

"I have been enabled to work the

above described blow-pipe, with such perfect safety, that I have used jets like the spout of a watering pot, with five, or even seven apertures.

CYCLOIDAL CHUCK.

Sir,—I beg to inform your Hereford Correspondent, "Amicus," in No. 147, that I have constructed a Cycloidal Chuck, from the plan and description given in the 72nd number of your Magazine, and which answers equally well for an *Eccentric Chuck*, as the accompanying specimen will show, if you think proper to insert it with the letter press.



Probably Amicus may get one made at Holtzapffel and Co.'s, Charing Cross, but I can form no correct opinion of the cost, only I know that, together with a slide rest, without which, of course, the Chuck cannot be made use of, it cost me an immense deal of labour, and had I been aware of the great accuracy required in its construction, I believe I never should have undertaken the job.

The headstock wheel and the wheel K (see plate in No. 72) of my chuck, have 48 teeth or cogs, in each, the large face wheel, H, 96, and I have pinions of 12, 16, and 24 teeth, which form circles of eight, six, or four cycloids. By *taking off the headstock wheel*, and with the help of a spring catch, or dog, which fits into the teeth of the wheel, K, it serves for an eccentric chuck of 384, 288, or 192 divisions, according to the size of the pinion used. The *eccentric* border of *circles* in the specimen, contains 288.

I shall be glad to give Amicus, or any other brother amateur, any information on the subject in my power, or to see him here if he thinks the inspection of the chuck worth the trouble and expense of the journey. He may learn my address at the publishers, or at Messrs. Proctor and Jones, Booksellers, Ludlow.

I am, Sir,
Your's, &c.
R. M.

Ludlow, August 19, 1826.

PURE CAOUTCHOUC.

This useful substance, commonly known by the name of Indian rubber, has been examined by Mr. Faraday. It was a sap in the fluid state, nearly as it came from the tree, of a pale yellow colour, thick, creamy, and uniform, smelling like putrescent milk. When exposed to the air in thin films it soon dried, and became tough and elastic as usual: 100 grains, when perfectly dried at 100°, were reduced to 45. Heat immediately coagulated the sap, the caoutchouc separating in the solid form, and leaving an aqueous solution of its other ingredients. Alcohol poured into the sap precipitated from it pure caoutchouc, leaving a solution of impurities. Alkali had no other effect than to evolve a fetid odour. The sap left to itself for several days separated into an opaque portion, which contracted upwards, leaving beneath a deep brown transparent solution. Water seemed to produce no effect on the sap further than uniform dilution; a creamy portion soon rose to the top, which was the original caoutchouc somewhat purified; by repeated treatment of this kind it was washed free of every impurity without further change; and, diluted with water, was kept very little altered for a year. When the sap was put on absorbent surfaces, as bibulous paper, chalk, or plaster of Paris, the water was rapidly abstracted, the caoutchouc immediately formed a mass retaining the form of the thing on which it was cast, and thus beautiful medallions were made.

When aggregated in any of these ways, the caoutchouc appears at first as a soft white solid, almost like curd, which, by pressure, exudes much water, contracts, becomes more compact, acquires elasticity, but is still soft, white, and opaque. The opacity is not an essential property of the body, but is due to water within its mass: this is dissipated by free exposure, and then the caoutchouc becomes a transparent, nearly colourless elastic body. No reduplication and pressure in a Bramah's press was found permanently to alter it. It is a non-conductor of electricity. It has a very adhesive surface, which it retains after many months' exposure; its fresh-cut surfaces, when pressed together, adhere, and the juncture is as strong as any other part. Solution of potash boiled on it produced no effect. It burns readily. At a high temperature it is decomposed, and resolves itself into its two ultimate elements, carbon 6·812 and hydrogen 1, in a total of 7·812 parts. Dr. Ure makes the carbon bear a greater proportion than this; he says 90 carbon to 9·11 hydrogen.

If newly precipitated camphor be mixed with the sap diluted with water, and a coagulation effected by heat or absorption, the caoutchouc obtained is highly odorous. Colour may be imparted to it by similar means; body colours answer best, as indigo, vermilion, chrome-yellow, carmine, lake, &c. they being well levigated with water previously.

By analysis, which space will not allow us to detail, Mr. Faraday ascertained, that the liquor remaining after the coagulation contains several ingredients. One thousand grains of the original sap consists of, caoutchouc 317 grains, albuminous precipitate 19, peculiar bitter colouring matter, highly azotated, and wax, 71·3, substance soluble in water and not in alcohol 29, water, acid, &c. 563·7.

Olive oil being added to well-washed milky caoutchouc, and both well beaten together, a stringy adhesive substance was produced, of a pearly aspect, stiff, and almost solid: it contained water, and when this was expelled, it became oily, fluid, and clear, being then an oily solution of caoutchouc. Oil of turpentine agitated with dilute sap, and allowed to stand 24 hours, separated into three portions; the bottom was the usual aqueous solution, the top was the oil of turpentine, holding a little caoutchouc dissolved, and in the middle was a substance like birdlime, consisting of caoutchouc with some oil of turpentine.

Quarterly Journal, XXI. 19.

CARRIAGE TO CARRY AND LAY DOWN ITS OWN RAIL-ROAD.

Mr. James Bryan having been strongly impressed with the many practical advantages that would be derived from a carriage constructed so as to carry and lay down its own rail-road, with a comparatively small increase of friction or weight, he turned his attention to the subject, and after forming many plans, he conceives he has hit upon one which will answer this desirable purpose. We, from the nature of our work, can only give a general outline of the machine, and illustrate the principle of its motion.

The side of the waggon overhangs the wheels at the top considerably, but the rest of the side is vertical, and about midway between its top and bottom, and at the opposite ends of the sides are fixed two grooved pulleys, moving in the same plane as the side, the axles perforating the side at right angles to its plane. An endless chain traverses these pulleys, the length of which is divided into three equal parts, and at the points of division it is attached to brass blocks, having lateral friction rollers; these move along in a lateral groove, which retains them in the plane of the side. Each block carries a spindle, which projects, and receives a vertical iron bar, having its lower end fixed to the outer side of one of the rails.

When the carriage is set in motion by horse or steam power, the weight of the carriage acts on two rails on each side, and these are attached to the part of each chain which is below the pulleys, the spindles of these rails acting as fixed points to retain the chain, while the carriage moves forward till the second spindles are raised, and with them the rails which the carriage wheels have left, and then the third spindles are depressed with the rails on which the carriage is next to run. A lateral motion is given to the rails by proper guides, so that they may not interfere with one another, nor with the wheels of the carriage.

The four carriage wheels are supported alternatively by four and by two rails, and there are either two or four rails constantly moving forward to be placed to receive the carriage wheels.

The union of the ends of the rails on the ground is effected by a simple mechanical contrivance, so that the pressure in this case is said to be diffused over a surface equal to the length of two rails multiplied into their breadth; but this contrivance is not described.

Carriages of this nature would be well adapted to convey articles of great weight, in such situations, or on such occasions, as did not admit of a continued fixed rail-road being laid down. In the passage of flat sands, where, by the diffusion of pressure, the carriage would be prevented sinking, or in the cultivation and improvement of bogs, it might, perhaps, be used with advantage.

Many objections may be started as to the instability in the application of the rails to the surface, their adhesion to moist, soft surfaces, &c.; but Mr. Bryan conceives these disadvantages might be obviated by mechanical and local adaptations; and if carriages carrying their own rail-roads could be brought into operation, he further thinks "that the tracks might *descend* on a *level* stone causeway, or continuous bearing on each side; any occasional impediments could be removed by adjustments in front of the carriage, which would precede the laying down of the rails.

The fact is, however, that a smooth stone causeway would be far superior to these movable rails, as a railway. The contrivance may do very well on an Irish bog; and it is not a bad idea for a carriage to travel on snow, were it not that the sledge of the Laplander is vastly superior for the purpose, to this invention.

MECHANICS' INSTITUTION.

Sir,—In perusing your number for June 3rd, p. 70, you mention your wish to have regular accounts of the Mechanics' Institutions already formed. There seems another important use to which your valuable register may be applied; you will, therefore, pardon a constant reader for stating it. There are many places in which a desire exists for forming Mechanics' Institutions, but from local circumstances, none have yet been constituted. Hints or directions to aid such, would be of great importance to the diffusion of those methods by which the mechanic might be directed to secure the exertions of others similarly disposed with himself, and the philanthropist induced to countenance plans, that experience has proved fitted to enlighten the understanding, to correct vicious habits, and to advance domestic comfort and social improvement. When I visit any new place, my custom is to inquire what plans are there pursued for educating the young, and meliorating the condition of other classes. If there is a Bell, a Lancasterian, or an infant school, I am anxious to see their method of proceeding, with a view to find if any local practice can be turned to a general profitable account.

Since Mechanics' Institutions have been introduced, I have endeavoured to ascertain their progress and effects, and have uniformly been pleased with the result. On that account, I regret that they are not more general. In a late tour to the Isle of Wight, at Portsmouth, I was delighted to find the good effects already produced, and in the same degree vexed, when at Southampton, to hear of no such institution being established there. I inquired the cause, and one reason assigned for nothing being done surprised me; "Southampton is a party town." This, Mr. Editor, is the very reason that the mind should be turned to subjects in which no party can prevail—the very reason for causing discordant passions, to be lulled into the peace of inquiry, and the attainment of useful knowledge.

I was informed, that there are several gentlemen of much prudence and liberality, resident in the town, who have ever seemed anxious to promote the benefit of the lower classes. Such being the case, sir, either you or some of your correspondents may be able to throw out some suggestions which may be turned to a good account, and if so, I am sure I shall be forgiven for having occupied any part of your publication.

L. E.

London, July 8th, 1826.

ON FIGURES.

Chap. I. Continued.

Case 3. *To Reduce a mixed Number to an Improper Fraction.*

Rule.—Multiply the whole number of the mixed number or fraction by the denominator of the fraction, adding the numerator to the answer, and the sum will be the numerator of the improper fraction required, the denominator of the fraction of the mixed number being still the denominator of the new fraction.

Ex. 1. Reduce $7\frac{2}{10}$ to an improper fraction.

$$\begin{array}{r} 7 \\ 10 \\ \hline 70 \\ 2 \\ \hline 72 \\ \hline \end{array} \quad \text{thus } \frac{72}{10} = 7\frac{2}{10}\text{*}$$

Ex. 2. Reduce $59\frac{6}{12}$ to an improper fraction.

$$\begin{array}{r} 59 \\ 12 \\ \hline 708 \\ 6 \\ \hline 714 \\ \hline \end{array} \quad \text{thus } \frac{714}{12} = 59\frac{6}{12}$$

Examples for Students to practice.

1st. Reduce $132\frac{60}{120}$ to an improper fraction.

2nd. —— $25\frac{17}{40}$

3rd. —— $763\frac{78}{92}$

4th. —— $65\frac{36}{38}$

5th. —— $12\frac{27}{76}$

6th. —— $45\frac{178}{212}$

Case 4. *To Reduce an Improper Fraction to a whole or mixed Number.*

Rule.—Divide the numerator by

* = means that the two sums between which it is placed are equal.

the denominator, and the quotient shall be the answer.

Ex. 1. Reduce $\frac{120}{15}$ to a whole or mixed number.

$$15)120(8 = \frac{120}{15}$$

120
——
0
——

Ex. 2. Reduce $\frac{175}{20}$ to a whole or mixed number.

$$20)175(8\,\frac{15}{20} = \frac{175}{20}$$

160
——
15
——

Examples for Students to practice.

1st. Reduce $\frac{1276}{150}$ to a whole or mixed number.

2nd. —— $\frac{767}{16}$

3rd. —— $\frac{21}{18}$

4th. —— $\frac{75}{60}$

5th. —— $\frac{65}{13}$

6th. —— $\frac{8267}{1529}$

CASE 5. *To Reduce a whole Number to an Improper Fraction, its Denominator being given.*

Rule.—Multiply the number by the denominator given, and place that same denominator under the product.

Ex. 1.—Reduce 71 to an improper fraction, having three for the denominator.

71
3
——
213 $\qquad \frac{213}{3} = 71$
——

Ex. 2. Reduce 11 to an improper fraction, having 17 for the denominator.

11
17
——
187 $\qquad \frac{187}{17} = 11$
——

Examples for Students to practice.

1st. Reduce 23 to an improper fraction. Denominator 12

2nd. —— 165 46

3rd. —— 8764 7

4th. —— 18 85

CASE 6. *To Reduce a Compound Fraction to a Simple one.*

Rule.—Multiply the numerators of all fractions into one another, and the product shall be the new numerator. The denominators are to be multiplied in the same way for a new denominator.

Ex. 1. Reduce $\frac{2}{5}$ of $\frac{6}{10}$ of $\frac{110}{256}$ to a simple fraction.

2	5
6	10
——	——
12	50
110	256
——	——
1320 new numer.	12800 new denom.
——	——

Thus $\frac{1320}{12800} = \frac{2}{5}$ of $\frac{6}{10}$ of $\frac{110}{256}$

Ex. 2. Reduce $\frac{6}{8}$ of $\frac{9}{12}$ of $\frac{72}{94}$ to a single fraction.

6	8
9	12
——	——
54	96
72	94
——	——
3888 new numer.	9024 new den.
——	——

Thus $\frac{3888}{9024} = \frac{6}{8}$ of $\frac{9}{12}$ of $\frac{72}{94}$

Examples for Students to practice.

1st. Reduce $\frac{7}{13}$ of $\frac{16}{30}$ of $\frac{2}{7}$ to a simple fraction.

2nd. —— $\frac{18}{23}$ of $\frac{32}{46}$ of $\frac{7}{16}$ of $\frac{3}{8}$

3rd. —— $\frac{178}{343}$ of $\frac{25}{60}$ of $\frac{2}{11}$ of $\frac{17}{20}$

4th. —— $\frac{29}{33}$ of $\frac{37}{50}$ of $\frac{20}{72}$

5th. —— $\frac{7}{20}$ of $\frac{12}{16}$ of $\frac{17}{20}$

I am, &c.

1 and 2 make 3.

August 12th, 1826.

NEW DIVISION OF THE THERMOMETER.

Lieutenant Skene, who accompanied Captain Parry in his expedition of 1820, has renewed the idea of dividing the thermometric scale, according to the fusion of two solid bodies, and not according to the fusion and vaporization of one, as has hitherto been done. In truth, the circumstances proper to give a fixed degree of temperature by the vaporization of a liquid cannot be united at will, while the fusion of a solid body to a liquid state is determined only by the affinity of the particles of the body for each other and for caloric, and depends upon no other cause. Mr. Skene proposes to establish as the thermometric unity, the difference of temperature between the degree at which mercury fuses, and that at which ice melts, care being taken that these two substances are perfectly pure. This unity is to be called a degree, and to be divided into 100 minutes. The point at which ice melts would, as at present, separate the cold from the heat, and be marked 0. The ascending minutes would have the sign +, the descending ones the sign —. An advantage would result by the highest temperatures, even at those which the least fusible metals are melted, being devoted by even numbers. Between the melting of ice and the boiling of water there would not be more than about 2° 50′ zinc. would melt at 9°, &c.: numbers more easily to be remembered than those at present employed. The graduation of thermometers would certainly be more difficult, and could only be entrusted to skilful artists: this, however, would be of the greatest benefit, fully appreciable, indeed, only by those who have felt to what a degree the scientific world is infested with thermometers on which not the slightest reliance can be placed.

ON THE COMPASS.

SIR,—Having seen, in the Quarterly Journal of Science, &c. for 1820, vol. 9, an article, stating as Colonel Beaufoy's opinion, from his own magnetical observations, that the compass had then (1818) attained its greatest variation, and was slowly retrograding, and returning towards the North Pole; and, being quite a novice in these things, would you, or any of your correspondents, through the means of your much approved and excellent Magazine, be kind enough to inform me if the Colonel be correct; and what *now* is the variation of the needle from the true north; also the method how it is ascertained.—Trusting you will not consider my request impertinent,

I am, most respectfully, Sir,
Your very obedient Servant,
A SUBSCRIBER.

Wakefield, 16th Aug. 1826.

GROUND SWELL IN THE POLAR REGIONS.

The ice in the Polar regions accommodates itself to the surface by bending, but when several yards in thickness, it refuses to yield beyond a certain extent, and is broken in pieces with dreadful explosions. The best account that we know of the appearances presented on such occasions is given by a party of Moravian missionaries, who were engaged in a coasting expedition on the ice along the northern shore of Labradore, with sledges drawn by dogs. They narrowly escaped destruction from one of those occurrences, and were near enough to witness all its grandeur. We extract it from the recent interesting compilation of the Rev. Dr. Brown, on the History of the Propagation of Christianity. The missionaries met a sledge with Esquimaux turning in from the sea, who threw out some hints that it might be as well for them to return; after some time, their own Esquimaux hinted that there was a ground swell under the ice; it was then scarcely perceptible, except on lying down and applying the ear close to the ice, when a hollow disagreeable grating noise was heard ascending from the abyss. As the motion of the sea under the ice had grown more perceptible, they became alarmed, and began to think it prudent to keep close to the shore; the ice also had fissures in many places, some of which formed chasms of one or two feet, but as these are not uncommon even in its best state, and the dogs easily leap over them, they are frightful only to strangers; as the wind rose to a storm, the swell had now increased so much that its effects on the ice were extraordinary and really alarming. The sledges, instead of gliding smoothly along on an even surface, sometimes ran with violence after the dogs, and sometimes seemed with difficulty to ascend a rising hill; noises, too, were now distinctly heard in many directions, like the reports of cannon, from the bursting of the ice at a distance: alarmed at these frightful phenomena, our travellers drove with all haste towards the shore, and as they approached it the prospect before them was tremendous; the ice, having burst loose from the rocks, was tossed to and fro, and broken in a thousand pieces against the precipices, with a dreadful noise; which, added to the raging of the sea, the roaring of the wind, and the driving of the snow, so completely overpowered them as almost to deprive them of the use of both their eyes and ears. To make the land now was the only resource that remained; but it was with the utmost difficulty that the frightened dogs could be driven forward, and as the whole body of the ice frequently sunk below the summits of the rocks and then rose above them; the only time for landing was at the moment it gained the level of the coast, a circumstance which rendered the attempt extremely nice and hazardous; both sledges, however, succeeded in gaining the shore, and were drawn up on the beach, though not without great difficulty; scarcely had they reached it when that part of the ice from which they had just escaped bust asunder, and the water rushing from beneath instantly precipitated it into the ocean; in a moment, as if by a signal, the whole mass of ice for several miles along the coast, and extending as far as the eye could reach, began to break and to be overwhelmed with the waves; the spectacle was awfully grand; the immense fields of ice rising out of the ocean, clashing against one another, and then plunging into the deep with a violence which no language can describe, and a noise like the discharge of a thousand cannons, was a sight which must have struck the most unreflecting mind with solemn awe. The brethren were overwhelmed with amazement at their miraculous escape, and even the pagan Esquimaux expressed gratitude to God for their deliverance.

TIMES OF THE DAY WHERE THE MEAN TEMPERATURE OCCURS.

In a paper on this subject, in the Edinburgh Journal of Science, Dr. Brewster remarks, I am not aware of any observations made in our climate, by which the hours, when the mean temperature of the day occurs, could be determined. It has generally been believed that it occurs at eight o'clock in the morning; and Professor Playfair not only considers this as nearly the hour of mean temperature for Edinburgh, but he regards the maximum as occurring from one to half-past two, or even three o'clock; and upon these principles he has selected his three periods, viz. eight A. M., the time of maximum, and ten o'clock, P. M. Referring to tables, shewing the mean temperature of each hour for each month of the years 1824 and 1825, Dr. Brewster finds that the mean temperature of these two years occurred at 13 minutes past nine, A. M.

MEDALLION WAFERS.

SIR,—I should feel greatly obliged to you, if you could inform me, through the medium of your valuable miscellany, the best method of making the medallion wafers, stating of what the composition consists, and how it can be prepared; and also whether the wafers on which the composition is fixed, are the common wafer; and if not, how it may be prepared also.

I am, Sir,
Your obedient Servant,
A Constant Reader, and a
COLLECTOR OF SEALS.

Hull, 15*th August*, 1826.

TO BUILDERS AND OTHERS WHOM IT MAY CONCERN.

Gentlemen,—It would ill become me, at a season like the present one, were I not to remind you of the impropriety of the present mode of building, and the great danger that ultimately awaits such a system. It has repeatedly occurred to me, on passing through the principal streets of this town, where building is carried on to an almost unlimited extent, that the proper authorities have not exercised their power over the workmen. Bricks ought never, in such a season as the present one, to be put together without being previously dipped in water, or having water thrown upon them; and they ought never to be used immediately after they are taken from the kiln, as is too often practised in this and other towns. Bricks, dipped in water, are absolutely necessary; because, if there is any limestone in the heart of the brick, the moisture absorbed by the clay will cause the brick to burst; and this is the only and best way of trying the materials a brick is made of. There is another advantage attending it; it will cause the mortar to adhere to the bricks, which is the principal point now under consideration in the present time. Bricks are taken out of the hot sun, piled upon each other with a bed of mortar (nearly all sand) three quarters, and even an inch thick. Now, it is impossible for a building to stand after being put together in such a way. Mortar will never adhere to any thing of a dry or hot nature. Mortar ought to be in proportion of one part of lime to two of sand, and well trodden; no more mortar should be used in their beds than is absolutely necessary. Walls of large dimensions ought to be grouted every fourth or fifth course, with fresh burnt lime and good sharp sand; and no part of a building ought to be carried up above another, but the whole gradually carried up together. Buildings intended to bear large burdens, ought never to have their walls carried up more than two or three feet each day; and it is the greatest folly imaginable to employ more workmen than is necessary to carry the building up in a gradual manner. I have known repeated injuries to be done by employing too many men at one building. I recommend a few days to be allowed between each story, after the timbers are laid, for the proper settlement of the brickwork; and I have no hesitation in saying that, if the plan I have recommended be strictly attended to, our posterity will find as great difficulties to encounter in pulling down our works, as many of you have experienced in pulling down the old buildings of this town.

J. B., Architect.

Walton Breck, August 10, 1826.

KALEIDOSCOPE.

NOTICES TO CORRESPONDENTS.

We have to apologise to W. W. of Exeter, for the non-insertion of his last communication. His former letter we have never seen; and the present one has, unfortunately, been mislaid till now. The Inquiry shall appear in our next.

Communications have been received from Mr. Truman—A Subscriber—A. B. W.—B. Y.—Jasper—R. S.—A Friend—and X. X. Y.

*** Orders from the country should particularly state, Knight and Lacey's Mechanics' Magazine.

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Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 158.] SATURDAY, SEPTEMBER 2, 1826. [Price 3d.

Were the word iron suddenly expunged from the catalogue of modern materials, the total fabric of European civilization would be effaced along with it; for there is not a want of the present age, absolute or fictitious, nor a gratification, physical or intellectual—not a link in the whole chain of social improvement, to which iron, in some shape or other, directly or indirectly, does not administer.

NEW EFFECTUAL AND CHEAP MARINE LIFE-PRESERVER

Fig 1

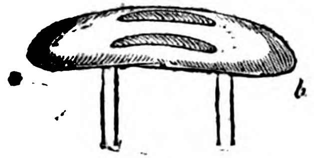

Fig 3

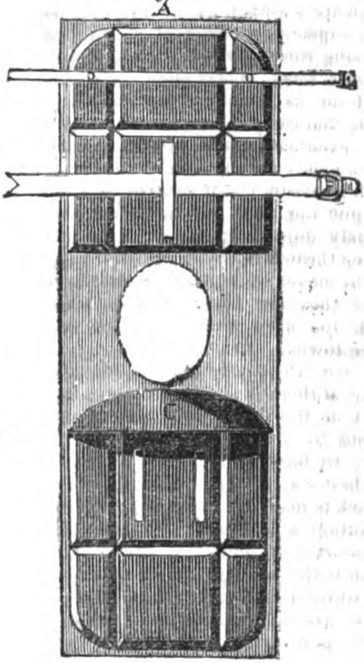

Fig 2

SIR,—In number 152 of your valuable work, you have copied from the Liverpool Mercury, an account of a new marine life preserver, invented by Mr. Egerton Smith, the talented editor of that respectable Journal. This gentleman has communicated, by means of the same publication, a very great improvement in the before described apparatus, and particularly requests that his fellow journalists, who noticed his former suggestions, will apprize their readers of it.

After correcting several fault and deficiencies which had found their way into his former communication, Mr. Smith remarks, "The first rude experiment I made, and which, as I have already admitted, was published rather precipitately, so thoroughly convinced me that it would lead to important results, that bearing in recollection the anecdote of Columbus and his egg, I could not resist the temptation of putting in my claim to the first thought of a simple apparatus, which will, in all probability, become very general, or will lead to still better methods of saving human life.

"Since the date of my former letter, I have made at least thirty trials of cork collars, or jackets, in various forms, in the floating bath, and the result has been the most complete success; nor do I fear committing myself when I assert, that, for a few shillings, a simple life-preserver may be made, which can be applied as readily as a man can put on his coat and waistcoat, and which shall buoy him up higher in the water than any man can swim without it. In addition to these properties, a little extra cork will render it capable of floating two or three persons, or even more. It may also be instantly applied without taking off the clothes, if necessary.—I have already adverted to the defects of the first collar suggested. It was a mere circular piece of cork, of an uniform thickness of about two inches, the head passing through the central opening.—When resting on the shoulders, it stood out horizontally at right angles with the body, somewhat like a Queen Elizabeth's frill or ruff.

"This kind of collar, if it contains about three pounds of cork, will accomplish every thing which I promised in my letter; but it is liable to an objection, of which, in my eagerness to convey the hint to the public, I was not aware, but which is now completely obviated. In order to have all the advantages of the buoyancy of the cork, it should be wholly, or nearly immersed in the water: for this purpose it was necessary that the collar should rest on the shoulders, or at the greatest practicable distance from the chin, in order to elevate the head as much as possible above the surface of the water. To keep it down to the shoulders, the most obvious method was by bandages passing under the arms, or across the back, and tied or strapped over the breast. It was found, however, that unless the bandages were drawn so tight as to be inconvenient by pressure, the collar would rise from the shoulder a little, and, of course, the head become proportionably depressed. The upper circumferent rim of this collar being out of the water, if there be any considerable ripple or swell, the waves are apt to splash over the face. Such were the defects of the first apparatus, which I have thus minutely detailed, because I know that very many persons have, in consequence of my first letter, procured cork collars of that description.

"In order that the collar, while it rests upon the shoulders should be immersed either wholly or in a great degree in the water, it should be shaped, not as originally described, but ought to be sloped gradually from the central hole to the circumferent rim, so as to resemble in shape a double convex lens. This may easily be understood by an inspection of the figures. Fig. 1, represents a back view of the collar, with two pieces of strong tape firmly stitched to its under rim, and hanging down at right angles with it. To the end of these are to be fixed a cross strap, with a buckle, to go round the chest, and fasten in front. This belt, although not shewn at fig. 1, may be seen at fig. 2. The two tapes *a* and *b* (fig. 1) are to be of such a length, that when the strap or belt is fastened to their ends, it may lie close under the arm pits, which will keep the back rim of the collar from rising from the shoulders. A small leather strap, which is not shewn in fig. 1, is also secured from the under rim of the front of the collar. This, by being passed through a small buckle sewed on to the cross belt, will keep the collar from rising in front. When the tapes and straps are thus adjusted, which may be done in a very few seconds, if the wearer enter the water he will be buoyed up in an upright position, which, if he cannot swim, is the best position he can retain. While thus floating, the whole of the collar, unless it is unnecessarily buoyant, will be immersed in the water; and the wearer will find himself so entirely at his ease, that if the collar be used for the purpose of learning to swim, a week's practice will effect the purpose. When in the act of swimming, part of the back rim of the cork will be out of the water; but this is of no importance, if there be sufficient buoyancy in the part which is immersed. The dimensions of these collars will, of course, vary with that of the wearer. That with which a great many experiments have been made, and which is found quite sufficient to float a person of thirteen or fourteen stone weight, is of the following weight and dimensions:—The whole collar, about sixteen inches in diameter. The thickness of the part which comes in contact, or nearly so, with the neck, is three inches, from which it tapers off towards the edges to about half that thickness. The weight of such a collar is about three pounds. It only remains to explain why the hole for the head to pass through is oblong. The head being narrower from side to side, than from back to front, the hole is cut thus to prevent a waste of cork, and to bring the collar as near as possible to the neck. The inner rim of the circular hole may be padded with a little linen or flannel, to prevent the friction of the cork against the skin.

"Having thus described as minutely and as clearly as I can, the construction and mode of wearing the simple collar, I shall pass on to another kind of preserver, which many people may prefer, as it buoys up the wearer higher in the water than the mere collar, guards his breast and back, keeps him warmer in the water, and is better adapted for swimming. It is composed of a collar, or a half collar, attached to a kind of front and back stays. A B, fig. 3, is an oblong piece of light sail-cloth or strong linen, of length and breadth proportionate to the stature and bulk of the wearer. It has an aperture in the centre, through which the head passes; the part A falling down in front, as far as the waist, and the part B hanging down behind. To the front and back are stitched pieces of cork, of size and shape according to the fancy, or the bulk and weight of the wearer. That we shall here describe is similar to one which we have tried with complete success and satisfaction. The cork for the front and back may be of one piece, hollowed out a little to fit the shape; but we are of opinion that it adapts itself better to the body, and lies closer, when composed of several parts. The reader will perceive we have six pieces of cork in front, and six in the back, ranged in rows of three. In our specimen (fig. 3) the pieces which lie upon the middle part of the back and front of the body are about seven inches broad, while the side pieces are only four, making the whole breadth fifteen inches, leaving half an inch of the linen or sail-cloth on each side. The upper row are about nine inches long, and the lower row about six inches. The back corks are nearly of the same dimensions, but rather of thinner cork, as the same quantity of buoyancy is not necessary, nor indeed proper, behind as before, because the position of the head throws the body, when in the water, into a sloping position, as if leaning forwards. The corks in front, in our specimen, are somewhat more than an inch thick, and weigh about two pounds; those in the back being rather thinner, weigh about one pound and a half; so that the whole jacket, independent of the half collar, weighs about three pounds and a half. The collar (C, fig. 3) is firmly stitched to the upper part of the front sail-cloth, and, when worn, projects out, horizontally, about five inches. Its thickness, nearest the neck, is about three inches, from which it is cut down to a blunt edge, as may be easily understood by inspecting figure 2. The weight of the collar may be about half-a-pound, making the whole preserver four pounds, independent of the sail-cloth and belt. There is more cork in this specimen than is requisite, as it was made for the purpose of being worn over the clothes, which it is always desirable to preserve; so that the wearer, when he reaches shore, may not be, as is too often the case, naked and wholly destitute of apparel. A preserver of this description, will enable him also to carry off a considerable quantity of money in his pocket, if he should happen to possess it. When this simple apparatus is used, the wearer passes his head through the central aperture in the sail-cloth (fig. 3), and the front and back instantly arrange themselves, so that all that remains to be done is, to fasten them together. A strap or belt, formed of diaper web or saddle girthing, &c. (D, fig. 3) is secured to the back collars, at such a distance from the neck as to pass just under the arm-pits; so that when buckled in front, the whole jacket is prevented from slipping up, which it would otherwise do, owing to its great buoyancy.* A piece of strong tape (E) is stitched to the lower row of the back corks, and tied tight in front, over the centre of the lower row of the front corks. When the preserver is thus arranged, which may be done in a few seconds, the collar projects horizontally, as seen at fig. 2, and the front corks are brought into close contact with the breast. The back corks, which are not exhibited in fig. 2, are brought equally tight, and the body is braced up most comfortably, and protected behind and before from external injury; while the buoyancy of the whole keeps the head elevated, much higher than swimmers in general can carry theirs, the half collar, which may easily be made into a whole collar by adding a back part, greatly helps the wearer to remain upright in the water when necessary, and prevents the body turning round, or lying 'lob-sided,' as it is apt to do when a mere cork waistcoat is applied. The belt or strap should be braced tight, and kept as close to the arm-pits as possible, as the body is thereby prevented from coming into contact with the cold water.

"With respect to keeping on the clothes, there can be no question that they should always be retained, if possible, as the wearer can by that means sustain the cold much longer than when naked; besides, as we before observed, saving his apparel and money.

"We have already said that there is in the preserver here described, much more cork than is requisite, and we feel confident that if the front cork were one pound and a half, the back cork one pound, and the collar half-a-pound, it would be found sufficient. However, as it was our intention to use our apparatus with our ordinary clothes on, even to the shoes, it was necessary to have a little extra buoyancy."

A. B.

* The buckle and strap or belt when passed round in front are put through two loops in the front cork, represented by two white stripes hanging down just under the collar.

ON RAIN AND SNOW.

Sir,—It is very generally supposed, that the higher we ascend from the earth the greater is the degree of cold, and the truth of the supposition is confirmed by the unanimous testimony of aerial voyagers, and our own experience in ascending mountains. Such being the case, Sir, may I ask any of your intelligent Correspondents, how it is that though so great a quantity of water is held in solution by the atmosphere, as is evidenced by continued heavy rains, and the bursting of water-spouts, that whole sheets of ice are not formed in the air, and that the snow in the north of Europe, where the cold is very intense, descends in flakes similar to those of England?

I am, &c.

EUROPUS R.

OBSERVATIONS ON THE MAY-BUG, AND ITS RAVAGES ON PLUM, AND OTHER TREES, AND ALSO THE MEANS OF PREVENTING THE MISCHIEF.

Franklin's American Journal.

Sir,—Being convinced, by observation, and by reading several papers on the subject, that our plums were stung by an insect for the purpose of depositing its egg, and having often seen the egg and the worm when hatched, I was determined both to learn the history of the insect, and to endeavour to prevent the mischief it caused.

The insect of which I speak, is called by some, the May-bug, or Doree-beetle. It belongs to the order *coleoptera*,* and it deserves the attention of every one interested in agriculture and horticulture. In three months after the eggs are deposited, either in the plum, cherry, apricot, peach, nectarin, or in the earth, this insect assumes the form of a small grub or maggot. If it be deposited in fruit, it works its way to the kernel, and the circulation being destroyed by its ravages, the fruit falls to the ground. The worm then crawls downwards, and finds its way to the roots of vegetables, on which it subsists for *three years*, going lower and lower into the earth every winter as it increases in strength and size. When it has attained the size of half an inch caliber, and from an inch to 1½ inches in length, and has remained in the grub state for three years, committing every sort of waste and destruction, it digs its way down in the earth, to the depth *of six or seven feet*, when it scoops out for itself a commodious habitation. It here shortens itself, swells, and finally bursts its last shell, and assumes the form of a chrysalis. This occurs in January or February, and in a little time, the beetle is formed. It remains in an inert and imbecile state, under ground, until the beginning of May, when it again commences its ravages, and after stripping the trees of their leaves, and perpetuating its species, it either returns to its holes and perishes, or else (its thirst being very great at the close of its career) it flies to ponds and rivers, and is seen no more. This is the formidable insect that preys on the industry of man. This is the *corn grub*, the *cut worm*, the *wood maggot*, the *potatoe worm*, the *cabbage worm*, and, in short, occasions the loss of our Indian corn, of our cabbage, of our potatoes, of our fruit, and of our trees. There are many varieties of this mischievous insect, but this chesnut coloured beetle is the worst, for its life continues to four years, and at every stage it does an immensity of mischief. It has unfortunately happened, that the rotation of crops in our district, has been favourable to the increase of this insect. Clover grounds and grasses, of every kind, being its hiding place during the day, whilst in the fly or beetle state. They are this year, more numerous than I have ever known them, at least it so appears to me now that I have begun to understand their movements. I have thus far, at certain points, defended myself from their attacks, and if I ultimately succeed, I shall be well repaid for the labour it has cost me.

It is *possible* that pungent odours *may* deter them from alighting on a tree, but I doubt it; *actual manual* labour is the only preventive to the scourge. As soon as I became acquainted with their movements, and saw, or rather heard that they had commenced their destructive work, for they only leave their holes at dusk, I began to work. I spread a large sheet or waggon cover under a tree, and giving the trunk a sudden blow with the flat of the hand, the beetles fell on the cloth. Some young plum trees had from 40 to 60 large beetles clinging to their limbs and leaves; but the slightest touch makes them drop as if dead. As soon as they dropped, I had them gathered and thrown into a *tin* pail of water, that was brought for the purpose. In this way I cleared 50 trees in half an hour. Two persons held a light, and two picked up the beetles. The quantity that we picked up the first night, is incredible. At dusk, the second night, we began again, and had not quite as many as the first night. They were reduced in number every succeeding night; and last night I only found one or two on each tree, whereas, on the English walnut, and European ash, and other trees near them, I saw them as thick as ever. One plum tree, that stood a little out of our way, but which we had always stripped of the beetles, was forgotten last night, and I observed, this morning, that several of the plums were stung. In a few nights, I think that these trees

* *Scarabæus Melolontha.* Linn.

will be safe, for when they once commence laying their eggs, they disappear. The trouble is not worth a thought, compared to the benefit derived from it; I hope by ploughing deeply in the fall, and early in April, that I shall in a few years, get rid of these destructive insects. I am induced to believe, that the same set of insects frequent the same tree, and return to the same holes, that they occupied during the day. They are not more than ten minutes from the time they first fly from the ground until they all fasten themselves on a tree, and I think that if I could have staid that time at one tree, but very few would have been found afterwards on *that* tree, but I was obliged to go very quickly from tree to tree; of course many alighted on the same tree, after we left it. No one in my neighbourhood, this season, was aware of their existence; nor has any one pursued the same method of extirpation that I have; but I have taken great pains to make every one acquainted with the minute history of the beetle, and of my mode of destroying them; I hope that many others, now, will go seriously to work by fall ploughing, and by watching them in the month of May. I have entirely banished the peach worm, or fly, and I am certain I can rid myself of the beetle.

I tried small bonfires, but although I destroyed myriads of ephemera, and many millers, yet but few beetles were either attracted by the light, or deranged by the odour.

I observe, too, that the locust is making its appearance, my woods are full of them. I am fearful that they are going to be troublesome.

A.

MESSRS. APPLEGATH AND COWPER'S PRINTING PRESS.

(Concluded from page 259.)

Though in these figures, all the material motions of the machine are displayed, yet some of the minute parts, which produce the various movements, have been omitted, in consequence of the diminutive scale of the figures, which is only about one-third of an inch to a foot.

The supply of the blank paper is laid upon a support, or table, A, fig. 1, from whence the sheets are taken, one by one, by a boy, standing upon an elevated platform, who lays them out upon the table, B, which has a number of narrow linen tapes or girths passing across its surface. These tapes are formed into endless bands, which extend round the cylinders, or rollers, C and D, fig. 2, in such a manner, that when the rollers are turned round, the motion of the tapes will carry the sheet of paper along with them, and deliver it over the roller, E, where it is seized between two systems of endless tapes, passing over a series of rollers to keep them extended. These endless tapes are so adapted, in number and position, as to fall between the pages of printing, and also on the outsides, or beyond the margin of the printing; they may, therefore, remain in contact with the sheet of paper on both sides during its whole passage through the machine; by which means, the paper being once received or taken in between the two systems of endless tapes, it will be capable of continuing its motion along with the tapes, in order to bring it into a situation to be printed on both sides, without destroying the register (or coincidence of the pages on the opposite sides of the sheet.) F and G represent the two main cylinders which effect the pressure upon the paper. They are mounted upon strong axes, which turn in stationary bearings affixed to the main frame of the machine. H and I are two intermediate cylinders, situated upon axes between the main cylinders. Their use is to effect the inversion of the sheet of paper, in order to print the opposite side.

We must now describe the manner in which the two systems of endless tapes before mentioned are arranged, to give a clear idea of the operation of the machine. We will suppose one system of tapes to commence at the upper part of the roller, E, from whence they proceed in contact with the under portion of the circumference of the main cylinder, F; they then pass over the upper part of the intermediate cylinder, H, and under the intermediate cylinder, I, from whence they proceed to encompass a considerable portion of the main cylinder, G; and by passing in contact with the rollers, *a*, *b*, *c*, *d*, and *e*, they arrive again at the roller, E, from whence they commenced, thereby forming one of the systems of endless tapes. The other system we will suppose to commence at the roller, *h*. They are equal in their number to the tapes already described, and correspond also with them also in their place upon the cylinders, so that the sheets of paper may be securely held between them. The second tapes descend from the roller *h* to the roller E, where they meet and coincide with the first system, in such a manner that the tapes proceed together under the main cylinder F, over the cylinder H, under the cylinder I, and round the main cylinder G, until they arrive at the roller *i*, where they separate; having remained thus far in actual contact, except at the places where the sheets of paper are held between them. From the roller *i*, the paper descends to the roller *k*, and by passing in contact with the rollers *m*, *n*, and *o*, they arrive at the roller *h*, from whence they commenced. Thus the two systems of the endless tapes are established and arranged so as to be capable of circulating continually, without interfering with each other.

The cylinders, F, G, H, and I, as also the roller E, are connected by toothed wheels, as represented in the perspective view fig. 1, so as to cause their circumferences to move with one uniform velocity, and thereby prevent any sliding or shifting of the two systems of tapes over each other during their motion, as much of the perfection of the printing depends upon this circumstance. The separate forms of types for printing the two sides of the sheet, are placed at a certain distance asunder, upon one long carriage, which is represented in a detached state at fig. 3. This carriage, with the forms of type secured upon it, is adapted to move backwards and forwards upon steady guides or supports attached to the main frame of the machine, in such a position that the surfaces of the types may be operated upon by the circumference of their respective cylinders, F and G, to produce the impression as the carriage moves backwards and forwards. This reciprocating movement of the carriage is effected by a pinion fixed upon the end of a vertical spindle, K, fig. 2, engaging in the teeth of an endless rack, L L, which is connected by a system of levers with the type carriage, in such manner that when the pinion is turned round, it engages at alternate periods in the teeth formed upon the opposite sides of the rack, L L, and, consequently, on the opposite circumference of the pinion; thereby a continuous motion of the pinion communicates a reciprocating motion to the rack and carriage. The vertical spindle K, is turned by a pair of bevelled wheels from the pinion P, fig. 1, which receives its motion by an intermediate wheel, Q, from the toothed wheel upon the end of the main cylinder, G.

The mechanism for furnishing and distributing the ink upon the surfaces of the types in this machine, is very ingeniously arranged, and performs its operations with great certainty. It is one of the most important points, and the most difficult to effect in printing machines. Two similar and complete systems of inking apparatus, one situated at each end of the machine, are adapted to ink their respective forms of types; we will therefore describe, by reference to fig. 2, the inking apparatus situated at the right hand end of the machine. It consists of a cylindrical metal roller, N, which has a low rotary motion communicated to it by a catgut band passing round a small pulley, upon the end of the axis of the main cylinder, G. The roller, N, is adapted to carry down a thin film of ink upon its circumference, by turning in contact with a mass of ink disposed upon a horizontal plate of metal, the edge of which plate is ground straight, and fixed by screws, *r*, *r*, at a small adjustable distance from the surface of the said roller. V represents an elastic composition roller, which is mounted upon a frame turning in an axis, *p*, extending across the main frame of the machine. This roller is connected by cranked-levers, with a small eccentric circle fixed upon the end of the axis of the cylinder, G, fig. 1, which causes it to move round the axis, *p*, and remain for a short period in contact with the surface of the ink-roller, N, (as seen by the position at the left hand of the machine, fig. 2,) thereby receiving a portion of ink upon its surface; it then descends and rests with its whole weight upon the surface of a flat metal plate or table, T, which is affixed to the type carriage, as seen in fig. 3; so that the reciprocating motion of the carriage causes the ink-table, T, to receive ink upon its surface from the elastic roller, V. In this situation, when the type carriage returns, the surface of the table, T, is obliged to pass under three small elastic rollers seen at R, which are mounted upon pivots in a frame, with liberty of motion up and down, in order that the rollers may bear with their weight upon the surface of the table.

The frame in which they are centered has also a slight end motion given to it by the inclined form of the end of the table, T (as seen in fig. 3), bearing against a roller fixed upon the said frame. Thus the small composition roller, R, operates in a very complete manner to equalize the supply of ink over the surface of the table, T, and by the farther motion of the type carriage, the ink-table is caused to pass under four small elastic rollers (seen at S), which, in like manner, bear with their weight upon the surface of the table, (but without end motion) and thereby take up the ink upon their circumferences. The type carriage then returns, for the table, T, to receive a new supply of ink, and by the form of types passing under the elastic rollers, S, the letters become inked in a very perfect and uniform manner. Whilst the operation of inking the types is going on at one end of the machine, the printing is performed at the other end on one of the sides of the sheet from the types last inked, and *vice versa*. The type carriage is caused to move steadily along with the circumferences of the cylinders, F and G, by having racks, *y y*, formed on each side of the forms of types (fig. 2,) which engage with sectors, or portions of toothed wheels, *x x*, upon the ends of the said cylinders; at which part the surfaces of the cylinders are covered with a blanket or felt, to give elasticity, and cause them to press equally upon the paper, as in ordinary printing presses.

The machine is put in motion by a strap, *y y*, passing round a pulley, X, fig. 1, upon the axis of which a pulley or pinion is fixed, engaging with the teeth of the large wheel upon the end of the main cylinder, G. Thus the various cylinders, with their two systems of tapes, are caused to revolve with an uniform movement in the direction of the arrows, fig. 2, whilst the type carriage travels alternately backwards and forwards upon its guides, as before mentioned.

The operation of printing is performed as follows:—The sheets of blank paper are laid, one by one, upon the table, B, so as to bear upon the linen tapes which extend over its surface. In this situation, the rollers C and D are caused to move a portion of a revolution, by the operation of a lever fixed upon the axis of the roller, D, being acted upon by another lever fixed on the cog-wheel of the main cylinder, F. This motion advances the sheet of paper sufficiently to enable it to be seized between the two systems of endless tapes at the point where they meet each other, or between the rollers *h* and E. As soon as the sheet of paper is carried clear off the table, B, the rollers C and D are caused to turn back again to their original position, by the operation of a weight, W, and cord, *w*, fig. 2, ready to advance a second sheet of blank paper into the machine. The sheet of paper is carried along between the system of tapes, and applies itself to the circumference of the main cylinder, F, upon the blanket before-mentioned; and by the continuous motion of the cylinder, the sheet of the paper is pressed upon the surface of the form of types as they pass under the cylinder by the reciprocating motion of the carriage.

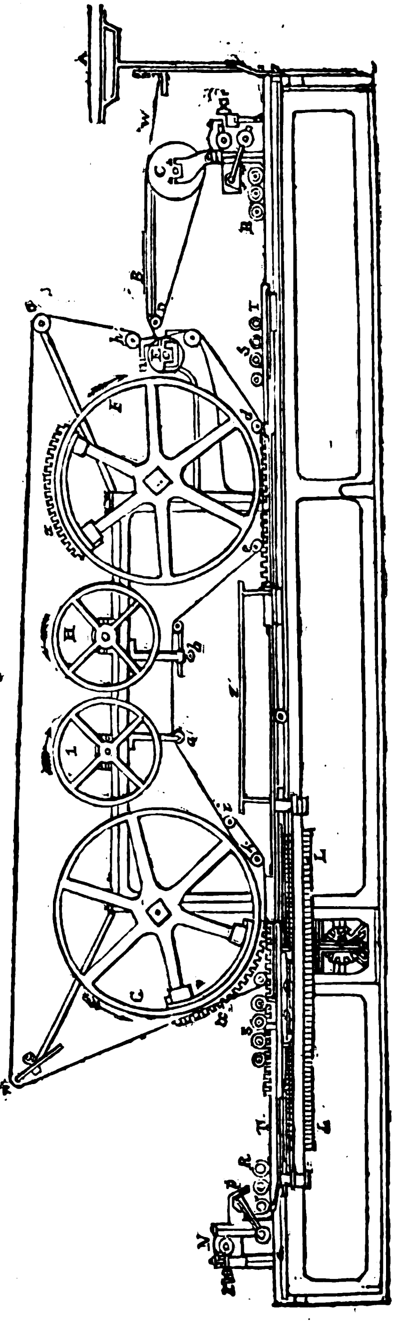

Fig. 2

Fig. 3.

By this means, one of the sides of the sheet receives its impression at the same time that the form of types situated at the opposite end of the carriage is receiving the ink, as before described. Now, by the continuous motion of the machine, the sheet of paper advances in company with the endless tapes, round the intermediate cylinders, H and I, until it applies itself to the blanket upon the surface of the main cylinder, G; at which place it will be found in an inverted position, so that the printed side of the sheet is in contact with the blanket and the blank side of the sheet downwards, which, upon meeting with the other form of types at the proper instant, is pressed upon their surface sufficiently to produce the impression. Thus having arrived at the point *i*, where the two systems of tapes separate, the printed sheet is delivered upon the board, Z, where it is received by a boy, and laid upon the pile.

Engravings of this machine have appeared in several periodical publications, and in the Supplement to the Encyclopædia Britannica, in all of which it is called "Bensley's Printing Machine." This is a mistake, as Applegath and Cowper are the original inventors and patentees of the identical machine from which those engravings were made. It must have been merely from the circumstance of its being in Mr. Bensley's office that his name has been erroneously affixed to it.

With these machines are now printed, the Morning Chronicle, English Chronicle, St. James's Chronicle, Whitehall Evening Post, Morning Herald, Examiner, Sunday Times, Bell's Messenger, John Bull, and Atlas newspapers. The Mechanics' Magazine, and Pulpit. The machine by which the MorningHerald is printed, throws off 2400 newspapers per hour, printed on one side; which is the customary way of printing newspapers, in order to allow time for the other half of the paper to be composed.

ON STOVES, AND THE WARMING OF APARTMENTS.

Sir,—In No. 151, of your valuable Magazine, you published an interesting notice on the subject of common fire-places, and refer the writer of that article, Mr. Corin, to your number 147, in which is published a description of a fire-place by Dr. Arnott. But that reference does not answer the important query of Mr. Corin, *where* such improvements are to be procured. I have read Dr. Arnott's paper, and think his suggestions of great value, but it would materially enhance their value, (as on all similar communications of new improvements) if the author would state where such are to be procured, or to what artist, a person desirous of adopting his method, may apply.

I am so sensible of the great defects of our present plan of fire-places for warming apartments, and of their insufficiency for the purpose, and of maintaining that uniformity of temperature so essential to comfort, that I would gladly adopt any practical improvement recommended by decided success. I occupy a large house with spacious apartments, which are very insufficiently warmed by common fuel and half-register stoves, opening into large chimneys.

Dr. Arnott's plan, of a glazed front to encircle the fire, promises well, and I shall be glad to learn where such is to be got.

I shall also be glad to be informed, by any of your intelligent Correspondents, what form and description of stove is best adapted to introduce into a common entrance hall or passage, for communicating warmth through the lower part of the house and staircase; and where the most approved is to be procured.

In the 36th number of the Journal of Arts and Sciences, edited at the Royal Institution, is a comparative review of different methods of warming and ventillating buildings, in which the relative advantages of Mr. Silvester's and Mr. Perkins's stove is considered. But here again we are left in ignorance where we can apply for the practical benefit we are taught in theory to approve. Mr. Silvester's stove is highly commended, but, from the brief account of it, given in the above quoted number of the Journal, it would seem not well adapted for private dwelling houses, as it is stated to be requisite that it should be placed from 15 to 20, or even 30 feet *below* the room or hall to be heated. A greater benefit could not be conferred upon society at large, than a simple practical improvement in the method of warming apartments with the smallest consumption of fuel.

I am, Sir,
Your obedient Servant,
A SUBSCRIBER.

August 16, 1826.

CHEAP COVERING AND ROOFING FOR COTTAGES.

Steep strong canvass in a mixture of two-thirds of coal tar to one-third of strong pitch, and of two-thirds of fine river sand, to one-third of kelp, to the consistency of thick paint. Pieces of timber of two inches broad by three inches thick, are sufficient for the roofing, which may be either flat or slanting, as most usual. Nail on the soaked canvass, extended tightly from timber to timber, and give it a good coat of the mixture, when it will stand all weathers, and will not take fire. Stout brown paper is used for out-buildings, in a similar way, at Sheerness.

THE RELATIVE VALUE OF FUEL.

From the Operative Chemist.

Whatever kind of fuel it may be considered best to employ, it is extremely desirable that it should be as dry as possible, otherwise a great part of the heat it contains will be lost in converting the water in the fuel into vapour, which of course escapes up the chimney without producing any useful effect.

Fuel is often unnecessarily exposed to the weather, or put in wet places; and the injurious effect of introducing damp into a close fire-place is never considered.

Pit Coals.

There is considerable difference between the pit-coals; and it has perhaps been too little attended to by those who are the chief consumers of this expensive article. The subject has not even been studied with much attention, except so far as relates to the production of gas; and the facts that have been established by these researches are not very useful in other applications of fuel.

Caking-coal, also called binding-coal, crozzling-coal, is obtained in great abundance from the extensive coal-fields in Northumberland and Durham; and is that which is sold in the London market as Newcastle coal.

When heated, this coal breaks asunder into small pieces; and the heat being raised to a certain degree, the pieces cohere, and form a solid mass, from which property it is called caking-coal. It lights easily, and burns with a lively yellow flame. It requires to be frequently stirred or broken up, particularly when it cakes very hard; but different varieties differ considerably in this property. Of the Newcastle coals, the best Wall's End make a brilliant and pleasing fire, burn away quickly, and do not cake hard, hence it is preferred for heating rooms; but the Tanfield Moor burn slowly, cake very hard, and afford a strong and long-continued heat, and is used in furnaces and forges. The other varieties are of an intermediate character.

Caking-coal gives out a great quantity of heat, and, with attention, burns a long time; consequently where it can be procured at a reasonable price, it is commonly preferred.

From the trials of Mr. Watt, it appears that a bushel of Newcastle coals, which weigh, on an average, 84 pounds, will convert from eight to twelve cubic feet of water into steam, from the mean temperature of the atmosphere; and that a bushel of Swansea-coal will produce an equal effect.

Dr. Black states to the effect, that seven pounds ·91 of the best Newcastle coal will convert one cubic foot of water into steam, capable of supporting the mean pressure of the atmosphere.

In some experiments tried by Messrs. Parkes, it appears, that by their improved method of constructing boilers, an effect was obtained, equivalent to converting one cubic foot of water into steam from the mean temperature, with seven pounds ·45 of coal, in the case where the greatest effect was produced; but at a mean, eight pounds ·15 of coal were necessary to produce the same effect; which is only one quarter of a pound less than the mean of Mr. Watt. From a mean of several experiments, Smeaton makes it require 11 pounds ·4 of coal to produce the same effect; but the kind of coal is not described.

Mr. Tredgold found that after the brick-work, &c. of the boiler of a steam-engine was warmed, a little less than one pound of Wall's-End coals would make a cubic foot of water boil, from the mean temperature of 52°. To produce the same effect with inferior coals, a stronger draught, and more time and attention, was necessary.

Splint-Coal,

Or hard coal, called slaty cannel coal by Kirwan, is esteemed equally valuable, for many purposes, as the Newcastle caking-coal. It is obtained near Glasgow, in Ayrshire, Scotland, and in several of the English and Welsh coal-fields.

A greater heat is necessary to make it kindle than is required for caking-coal; and consequently it is not so well adapted for a small fire; but a large body of splint-coal makes a strong and lasting fire. It does not produce so much flame, nor so much smoke as caking-coal, and does not agglutinate or bind together.

The splint-coal of Scotland was considered by Smeaton, to be equal to the Newcastle coal for steam-engines.

Cherry-Coal,

Or soft-coal, constitutes, says Dr. Thomson, the greater part of the upper seams of coal in the Glasgow coal-fields; and it is also abundant in Fifeshire. He considers the Staffordshire coal to be of the same species; and the Edinburgh as intermediate between it and splint-coal.

It readily catches fire, and burns with a clear yellow flame, giving out much heat; and the flame continues till nearly the whole of the coal be consumed. It burns away more rapidly than either caking or splint-coal, and leaves a white ash. For most purposes it is less economical. It is easily distinguished from caking coal, by its not melting or becoming soft when heated. It makes a more agreeable fire, and does not require to be stirred. It requires care and management in an open grate, even to burn the small fragments which are made in breaking up the pieces to a fit size for the fire. Hence the small coals are often mixed with clay and made into balls. When these balls are dry, they make an excellent addition to the fuel for an open fire, producing a very durable heat.

Mr. Watt states that 100 weight of good Wednesbury coal will produce the same effect as one bushel of Newcastle coal.

Wood.

In some places wood is used for fuel; its effect in producing heat is found to depend considerably on its state of dryness. Several experiments, made by Count Rumford, shew the effect of dry wood to be much greater than that of unseasoned. Unseasoned wood contains about one-third of its weight of water. The kind of wood is also a cause of some difference; from the experiments of Count Rumford, lime-tree wood gives out most heat in burning.

With his improved boilers Count Rumford made 20 pounds ·10 of ice-cold water boil with one pound of dry pine wood. The same weight of pine wood unseasoned, would produce less effect by one-seventh. Beech wood afforded much less heat than pine; for one pound of dry beech made 14 pounds ·33 of ice-cold water boil. A cubic foot of dry beech weighs about forty-four pounds.

According to Fossombroni, wood produces heat enough in its combustion to evaporate twice its weight of water, or to prepare two-thirds of its weight of salt. Count Rumford's trials make the effect of wood about one-third more, which may fairly be attributed to his superior skill.

Peat.

Considered only as a fuel, may be divided into two kinds. The first is compact and heavy, of a brownish black colour, and with scarcely any vestiges of its vegetable origin remaining. This is the best kind. When it is once lighted, it preserves fire a long time.

The second kind is light and spongy, of a brown colour, and seems to be a mass of dead plants and roots which have undergone very little change; it inflames readily, and is quickly consumed.

Peat gives out an odour, while it is burning, which is disagreeable to those who are not accustomed to it. It affords a mild and gentle heat; but is not a good kind of fuel for supplying furnaces for boilers; it is much better adapted for flues. It is of various qualities; some burn quickly with a bright flame; others burn slowly, and, according to Clément and Desormes, afford one-fifth of the heat that would be given out by an equal weight of charcoal. This nearly coincides with the ratio given by Blavier and Miché.

The weight of a cubic foot varies from 44 to 70 pounds; and the dense varieties afford about 40 per cent. of charcoal; the other varieties nearly in proportion to their density.

(To be Continued.)

PARKER'S ROMAN CEMENT.

Sir,—I shall be glad if any of your Correspondents, or the makers of the above cement, will inform me the cause of its failure when taken abroad; whether it arises from the climate, from its passage, or whether the sample which I have received, in St. Petersburg, was damaged before it left England.

Lately having occasion to take out of a small coal-gas works, an old wood tank, lined with lead, and knowing that tanks, vats, &c. had been made in England to last for years, with no other lining than this cement, I resolved to give it a trial. I procured some of the best from a merchant at this place; and having a good dry wall to work upon, applied three coatings of cement, according to directions, and gave it two months to dry. At the expiration of that period, water was allowed to flowin to the tank; but it made its escape faster than it could be supplied by a one inch cock.

I am, &c.
GULIELMUS R.

AIR BALLOONS.

An aerial voyage, remarkable for its duration, was accomplished at Paris, on the 19th of September, 1784. The Duke de Chartres, afterwards Orleans, and the noted Egalité, employed Roberts to construct for him a silk balloon, which should be filled with hydrogen gas; it had 56 feet in height, and 36 feet diameter, being composed of a cylinder terminated by two hemispheres; a construction, which was rightly supposed to give much additional solidity to the machine; a small bag on Meusnier's plan had been introduced within it, and the boat was besides furnished with a helm and four oars. This balloon, bearing the duke himself, the two artists, and another companion, and having 500 pounds of ballast, was allowed to rise very slowly, with a buoyancy of only 27 pounds. At the height of 1400 feet, the voyagers perceived, not without uneasiness, thick dark clouds gathering along the horizon, and threatening the approach of a thunder-storm. They heard the distant claps, and experienced something like the agitation of a whirlwind, although they had felt not the slightest concussion in the air from the discharge of cannon. The thermometer suddenly dropped from 77°, by Fahrenheit, to 61°, and the influence of this cold caused the balloon to descend within 200 feet of the tops of the trees, near Beauvais. To extricate themselves, they now threw out more than forty pounds of ballast, and rose to an elevation of 6000 feet, where it was found that the confined gas had so obstinately retained its heat, as to be no less than 42° warmer than the external air. The duke became alarmed, and betrayed such impatience to return again to the earth, that he is said to have pierced the lower part of the silk bag in holes with his sword. After narrowly escaping the dangers from wind and thunder, the balloon at last descended, having performed a course of 185 miles in 5 hours.

Another still more so, both for time and adventures, was performed by M. Testu, on the 18th of June, 1786, from Paris, with a balloon 29 feet in diameter, constructed by himself of glazed tiffany, furnished with auxiliary wings, and filled as usual with hydrogen gas. It had been much injured by wind and rain during the night before its ascension;- but having undergone a slight repair, it was finally launched with its conductor at four o'clock in the afternoon. The barometer then stood at 29·68 inches, and the thermometer as high as 84°. Though the day was cloudy, and threatened rain, the balloon had at first been filled only five-sixths, but it gradually swelled as it became drier and warmer, and acquired its utmost distension at the height of 2800 feet. But to avoid the waste of gas, or the rupture of the balloon, the navigator endeavoured to descend by the reaction of his wings; this force being insufficient, however, he threw out some ballast, and at half past five he softly alighted in a corn field, in the plain of Montmorency. Without leaving the car, he began to collect a few stones for ballast, when he was surrounded by the proprietor of the field and a troop of peasants, who insisted on being indemnified for the damage occasioned by his idle and curious visitors. Anxious now to disengage himself, he persuaded them that his wings being broken, he was wholly at their mercy; they seized the stay of the balloon, which floated at some height, and dragged their prisoner through the air in a sort of triumph towards the village; but M. Testu, finding that the loss of his wings, cloak, and some other articles, had considerably lightened the machine, suddenly cut the cord, and took an abrupt leave of the clamorous and mortified peasants, and rose to the region of the clouds, where he observed small floating particles floating in the atmosphere; he heard the thunder rolling beneath his feet, and as the coolness of the evening advanced, the buoyant force diminished, and at three-quarters after six o'clock he approached the ground near the abbey of Royaumont; there he threw out some ballast, and in the space of twelve minutes rose to a height of 2400 feet, where the thermometer was only 66 degrees. He now heard the blast of a horn, and descried huntsmen below in full chase. Curious to witness the sport, he pulled the valve and descended at 8 o'clock, between Etouen and Vaiville, when rejecting his oars, he set himself to gather some ballast. While he was thus occupied, the hunters gallopped up to him, he mounted a third time, and passed through a dense body of clouds, in which thunder followed lightning in quick succession; the thermometer fell to 21°, but afterwards regained its former point of 66° when the balloon had reached the altitude of 3000 feet. In this region the voyager sailed till half-past nine o'clock, at which time he observed the final setting of the sun. He was now quickly involved in darkness, and enveloped in the thickest mass of thunder clouds; the lightnings flashed on all sides, and the loud claps were incessant. The thermometer, seen by the help of a phosphoric light, which he struck, pointed at 21°, and snow and sleet fell copiously around him. In this most tremendous situation the intrepid adventurer remained the space of three hours, the time during which the storm lasted. The balloon was affected by a sort of undulating motion upwards and downwards, owing, he thought, to the electrical action of the clouds. The lightning appeared excessively vivid, but the thunder was sharp and loud, preceded by a sort of crackling noise. A calm at last succeeding, he had the pleasure to see the stars, and embraced this opportunity to take some refreshment. At half past two o'clock the day broke in, but his ballast being nearly gone, and the balloon again dry and much elevated, he resolved to descend to the earth, and ascertain to what point he had been carried. At a quarter before four o'clock, having already seen the sun rise, he safely alighted near the village of Compeine, about 63 miles from Paris.

PLEASURE VESSEL.

Westminster, August 24, 1826.

Sir,—Being about to have a pleasure vessel (cutter) of nine tons built, and having seen in your excellent magazine several very able articles on naval architecture, and being myself totally uninformed on the subject, I am induced to inquire of some of your intelligent correspondents, what would be the dimensions of a vessel of such content, so as to ensure her being a *good sea boat* as well as a *fast sailer*; and also, whether an iron keel is, or is not an advantage. As I intend to have her built under my own inspection, I am anxious to obtain as much information towards rendering her a complete model for sailing as possible, and purposing to put into practice the most likely means to procure so desired an end, I have presumed to trespass on your pages, in hope that some one, acquainted with both theory and practice, may not think it too much trouble to give me an answer.

A LANDSMAN.

THE COCOA TREE.

This is a small tree with pale bright green leaves, somewhat resembling in shape those of the orange tree. The leaves are picked from the trees, three or four times a year, and dried in the shade; they are then packed in small baskets. The natives, in several parts of Peru, chew these leaves, particularly in the mining districts, when at work in the mines or travelling; and such is the sustenance that they derive from them, that they frequently take no food for four or five days, although they are constantly working. I have often been assured by them, that whilst they have a good supply of cocoa, they feel neither hunger, thirst, nor fatigue, and that without impairing their health, they can remain eight or ten days and nights without sleep. The leaves are almost insipid; but when a small quantity of lime is mixed with them, they have a very agreeable sweet taste. The natives put a few of the leaves in their mouths, and when they become moist, they add a little lime or ashes of the molle to them, by means of a small stick, taking care not to touch the lips or the teeth; when the taste of the cocoa diminishes, a small quantity of lime or ashes is added, until the taste disappears, and then the leaves are replaced with fresh ones. They generally carry with them a small leather pouch containing cocoa, and a small calabash holding lime or ashes; and one of these men will undertake to convey letters to Lima, a distance of one hundred leagues, without any other provision. On such occasions they are called *chasquis or chasquerors*, and this epithet is also given to the different conductors of the mails. The Incas had men stationed on all the principal roads, for the transmission of any article belonging to the Inca, who, according to the quality of the road, had to carry it to different distances, some one league, others two, and others three. These men were continually employed, and when one of them arrived, he delivered to the one in waiting whatever he was charged with, and gave him the watch-word *chasqui:* this man ran immediately to the next post, delivered his charge, and repeated *chasqui*, and then remained to rest until the arrival of another. By these means the court of the Incas was supplied with fresh fish from the sea.—*Stevenson's South America.*

FIFTEENS IN A PACK OF CARDS.

Sir,—Upon turning over the Mechanics' Magazine, vol. v. I find, at page 331, a Correspondent, signing G. S. endeavours, for the information of cribbage players, to give them, what he calls, a correct table of the number of fifteens to be made out of a full pack, and, at the same time, he alleges that various persons have given incorrect answers to the problem, in most of the public Journals.

As I consider myself an adept at that game, and was instrumental in giving one of those public answers, I claim the privilege of setting Mr. G. S. right in his calculation of the number to be made of the six's and threes. Supposing one 6 and three 3 3 3's to be counted together, only 16 can be made of them, and not 24 as he has stated, which will reduce the total of 17,272 to 17,264; in other respects I give him much credit for his accuracy.

I take this liberty, principally upon the ground of the work being published for general instruction, and that the public may not fall into the same mistake as your Correspondent has. By your taking an early opportunity of noticing this, you will particularly oblige,

Your's, most respectfully,
A CRIBBAGE PLAYER.
Liverpool, August 24 1826.

METHOD OF MAKING TAR AT ARCHANGEL.

They dig a hole in the ground, of sufficient size, some two or three fathoms deep, and little more than half way down, they make a platform of wood, and thereon heap earth about a foot deep, except in the middle, where a hole is left in the form of a tunnel. They then fill the pit with fir billets, piled up from the platform, and rising about a fathom or more above ground, which part they wall about with turf and clay to keep in the fire. They command the fire by quenching; for which use they make a lixivium of the ashes of fir. When all is ready, they set fire at the top, and keep the wood burning, but very leisurely, till it has sunk within a foot or two of the partition; and then they heave out the fire as fast as possible; for if it once laid hold of the tar, which is settled down into the lower pit, it blows all up forthwith. These tar-pits take up a great deal of trouble, and many men to tend them during the time of their burning, that the fire may descend even and leisurely, whereby the tar may have time to soak out of the wood, and settle down into the pit. As it comes from the wood, it is pure tar, but in the pit it mixes with water, which issues from the wood also, therefore it is afterwards clarified.—(*Life of Sir Dudley North.*)

INQUIRY.

A correspondent wishes to know 'how he shall proceed to make an accurate delineator, or where such is to be procured?'

NOTICES TO CORRESPONDENTS.

Our Chatham correspondent is informed, that A. D. of Woolwich, merely sent us a brief notice of his contemplated improvement in paddle-wheels; we are, therefore, unable to judge of its practicability.

Mr. Josiah Churchill, 160, Queen Street, Portsea, is desirous of hearing privately from Mr. Monnow, on the subject of his tallow lamp, the price it is charged, &c.

Communications have been received from Mr. Hawkes—Aquarius, Mr. Fayspill—A. B.—J. J.—Ella—G. G.—A Mechanic—James Collett—1 and 2 make 3—J. F. E.—D. H. of Yeovil—Mr. Barnard—and Count Burquoy, of Serftenbag castle, Bohemia.

Our next number will contain *The Diorama*, with a description and plate of its machinery, &c. &c.

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Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE

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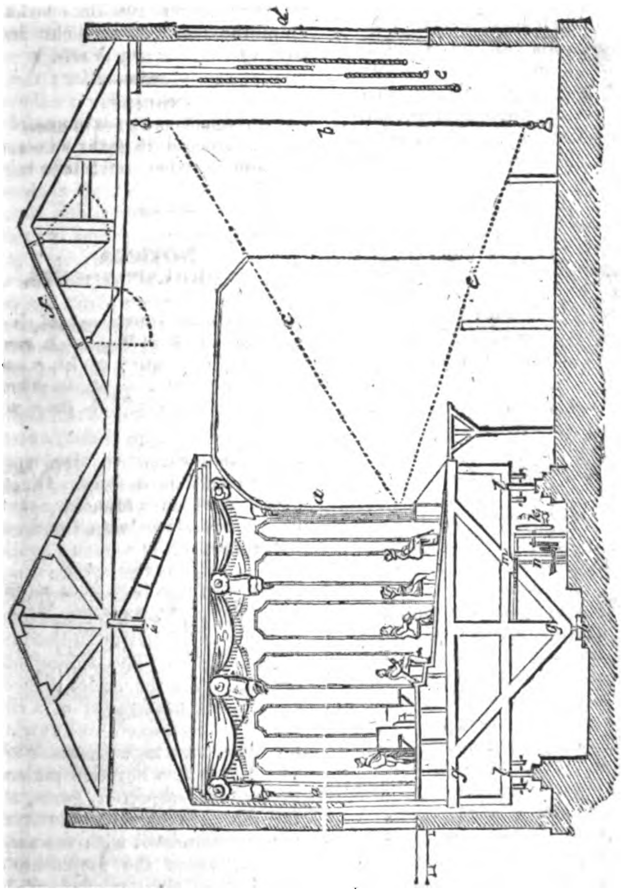
Obscurity in writing is commonly an argument of darkness in the mind: the greatest learning is to be seen in the greatest plainness.

BISHOP WILKINS.

THE DIORAMA.



All the world is familiar with the optical enchantments of the exhibition under this title, but comparatively few are acquainted with the details of the mechanism by which these extraordinary effects are produced. The skill of the painters (Messrs. Bouton and Duguerre) is not, however, the only nor even the chief thing to be admired; for without the co-operation of the mechanist, it may be truly said, the exhibition would be shorn of half its beams. It is wholly to the peculiar mode of directing the daylight upon and through the pictures, that those beautiful effects of light and shade, which we here so much admire, are produced. This mode is the subject of a patent which has been granted to John Arrowsmith, Esq., of Air Street, Piccadilly; but it is admitted to be "in consequence of discoveries by himself, and communications made to him by certain foreigners residing abroad."

The prefixed drawing exhibits a section of the interior of the building in the Regent's Park, with one of the pictures exhibiting.

a a, is the amphitheatre where the spectators are seated; *b*, the painted picture distended upon a frame, or by weighted rollers hung from the top of the building; the sides of the space between the spectators and the picture are occupied by partitions or opaque screens, fixed to confine the view much in the same way as the proscenium of a theatre; the dotted lines, *c c*, shew the actual reach of view allowed to the spectators, and how far the impressions of distance produced are the illusory effects of art. The picture is transparent, and receives the principal part of its illumination from the large window, *d*, in the rear. Between this window and the picture certain coloured screens, *e e e*, made of thin silk or cotton, are suspended by cords, so as to cast different tones of light and shade upon particular parts of the scene; and by moving these screens the light is at times thrown upon and withdrawn from the picture, so as to represent the effect of passing clouds, storms, &c. Those parts of the picture which require to be illuminated from the front receive their light from the sky-light, *f*, in the roof of the building; and this sky-light is furnished with moveable blinds, of coloured silk or cotton, for the purpose of throwing more or less light on the picture, and imparting any hue that may be required.

It can of course make little or no difference whether you visit the Diorama on a fine sunshine day, or during cloudy weather; the effect of sunshine being produced by the coloured screens through which the day-light is directed on the picture.

We come now to explain the manner in which one view is changed for another. Two pictures are usually exhibited in one building, (though the number, we presume, is not necessarily limited to two,) and these pictures are kept stationary while the amphitheatre, with the seats and the spectators, is turned slowly round from the one to the other; the view of one picture closing as the other opens. This change is repeated from time to time, during the whole of the day, leaving ten or fifteen minutes for the examination of each scene. The machinery by which the spectators are carried round is exhibited in the prefixed section. *g g g*, is a strong frame wall of timber, which turns round upon a pivot, *h*; on this frame-work the floor and seats which support the spectators are erected; and from it also the sides of the amphitheatre rise; these are suitably bound together and to the floor, and at the top an iron frame, extending from the circular cornice, meets in the middle, and holds the upper pivot, *i*, which works in a beam of the roof; *k*, is a winch underneath, the power of one man, applied to which, causes the whole to turn round; *l l*, are wheels running on a circular bed of level masonry, for the purpose of better supporting the superstructure, and taking off the friction. To the under side of the frame work a segment of a circular rack, *m*, is affixed concentric with the pivots on which the whole moves; into this rack a bevelled pinion upon the upright shaft, *n*, gears, and by turning the winch, the train of wheels connected with the shaft and pinion, causes the amphitheatre to make the circular motion before described.

There is nothing extraordinary, it must be confessed, in the mechanical effort by which the spectators, instead of the scenes, are thus shifted; neither, perhaps, is the object attained worth all the cost and trouble attending it. The rotary motion, though slow, is still sensibly felt, and the transition from one picture to another is little less abruptly marked than it would be if you were to pass from one gallery into another, to view them. No illusion, indeed, seems to be aimed at, as far as the position of the spectators is concerned; for the pictures hitherto exhibited have all been of scenes so far removed from each other—the Valley of Sarnen and Canterbury Cathedral—Roslyn Chapel and the City of Rouen, &c.—that you could not, by any possible sketch of fancy, or abstraction of mind, imagine yourself transported from the one to the other. We will not say, but that by a better pairing of the pictures, and a more adroit mode of managing the transition from the one to the other, this contrivance of moving the audience might not be made highly subservient to optical illusion; we remark only, that as it is, little beyond a slight matter of convenience is gained by it, and that at a most disproportionate waste of toil and expense.

The patentee himself seems to attach no great importance to this part of the exhibition, very justly "confining his claims to originality, to the new mode of throwing daylight upon or through painted scenes, and of varying the brilliancy of the light, as well as giving different tones and tints to the picture, by the intervention of several screens or shades of different colours."

WHY IT IS WARMER UNDER ICE THAN ABOVE IT.

Persons who, in winter's cold, fall accidentally through the ice, are surprised by the comparative warmth of the subjacent water, and the aquatic animals, that in summer sport upon the surface of their element, retire below in winter, as to retreats of a more genial description.

In this there seems something inconsistent with the established laws of nature; for if water were obedient to the same laws of refrigeration as all other liquids, such as spirit, oils, quicksilver, &c. our rivers and lakes, instead of being frozen at top and warm below, would be equally frozen throughout. But here, as in most cases where nature deviates from her customary modes of action, philosophy has discovered the happiest consequences from her aberration; for were water, like other liquids, subject to be equally frozen throughout, its innumerable inhabitants would run the risk of being annually exterminated, and the many important purposes to which running streams are subservient in the economy both of nature and art, would be suspended by every severe frost, twice and thrice the length of time they are at present, in as much as the influence of the summer's sun would be so much longer required, to reduce to a state of fluidity, a body not partially but entirely frozen. This important peculiarity in water was, we believe, first observed by the Florentine Academicians, and it is among the most curious and interesting discoveries of that zealous and active association of experimentalists. Having filled a large thermometer tube with water, they plunged it into a mixture of salt and snow. The water presently began to contract in bulk, and descended in the tube; but instead of continuing to do so till it reached the freezing point, after a short time it commenced expanding; the expansion went on till a portion of the water froze, and was then very suddenly increased. The temperature at which water thus begins to expand by cooling, is 40° Fahrenheit, and water cooled down to 32°, that is 8° below 40°, occupies the same space as when heated to 8° above 40°; in other words, the density or specific gravity of water is at its maximum at 40°. Now as the temperature of the earth is in winter always greater than that of the atmosphere, the cooling of large bodies of water must take place from above, by the contact of cold air and chilling blasts. The whole mass is thus lowered to 40°, after which, the water becoming specifically lighter as it becomes colder, remains upon the surface, where it sinks to 32°, and is converted into a film of ice, which being a bad conductor of heat, thickens slowly, and affords farther protection to the warmer fluid beneath.

SCIENTIFIC MEMORABILIA.

Discovery of Oxygen.

The 1st of August is a red letter day in the Annals of Chemical Philosophy; for it was on that day, in the year 1774, that Dr. Priestley discovered dephlogisticated air, or, as it has been since termed, oxygen. Lavoisier says, in his Elements, that "this species of air, (meaning oxygen) was discovered almost at the same time by Mr. Priestley, Mr. Scheele, and myself." But the real state of the case, Dr. Priestley avers to have been this:

"Having made the discovery sometime before I was in Paris, in 1774, I mentioned it at the table of M. Lavoisier, when most of the philosophical people in the city were present; saying that it was a kind of air in which a candle burned much better than in common air, but I had not then given it any name. At this, all the company, and M. and Madame Lavoisier as much as any, expressed great surprise; I told them I had gotten it from *precipitate per se*, and also from *red lead*. Speaking French very imperfectly, and being little acquainted with the terms of chemistry, I said *plomb rouge*, which was not understood, till M. Macquier said I must mean *minium*. Mr. Scheele's discovery was certainly independent of mine, though, I believe, not made quite so early." [*Doctrine of Philogiston established, &c. published after Dr. Priestley's retirement to America, in* 1800.]

Dr. Prie tley is allowed, on all hands, to have been a man of singular honesty and ingenuousness; and he shews so much anxiety in his writings, to assign to his predecessors and cotemporaries, their due share of merit, that we may rest well assured, he would not have denied M. Lavoisier any honour to which he was fairly entitled.

Scheele, who had certainly made the discovery without any knowledge of Priestley's prior claims, called the gas, *empyreal* air, and he has detailed its properties and several modes of procuring it, with great accuracy and minuteness.

The Duodenary Scale.

It is a curious fact, that the celebrated Charles XII. of Sweden, a short time before his death, seriously deliberated on a scheme of introducing a duodenary scale of notation into his dominions. The scale generally used by the ancients, and now universally by the moderns, is the *denary* scale, derived from the familiar practice of counting with the ten fingers; but, in point of fitness for arithmetical computations, this scale must be allowed to be inferior to the *duodenary*, or scale of twelves. The root *ten*, of the denary scale, is only divisible into two equal parts, *two* and *five*, while the root *twelve*, of the duodenary scale, is divisible by two, three, four, or six, without any remainder being left. Hence it is plain, that fewer fractions would occur from the division of numbers, expressed by the duodenary scale, than from the division of numbers expressed by the denary. Charles seems, also, at another time, to have had a strong desire of changing the index or root of the arithmetical scale, from *ten* to *sixty-four*, because 64 is both a square and a cube number, and when continually divided by two, is, at last, reduced to unity. "This idea," says Voltaire, "only shews that he delighted in every thing extraordinary and difficult."

Old and New Styles.

The Julian calendar intercalated one day every four years, in order to preserve the correspondence between the common year and the year of the seasons; but there was still such a difference, in favour of the latter, as amounted, in the year 1582, to an error of ten whole days. In the Gregorian, calendar, (which is our new style) 97 days are intercalated every 400 years; and this has brought the common year and the year of the seasons, so near a perfect equality, that the error, during the lapse of many centuries, cannot exceed a day. It is a remarkable fact, however, that as far back as 1079, and in a country so unenlightened as Persia, Omar, the astronomer, proposed an intercalation, more exact than either the Julian or Gregorian. He suggested that eight days should be intercalated every 33 years, by which simple means there would be only an error of one minute in a whole century!

Mineral Waters.

Mr. Lane was the first who ascertained the solubility of iron in water impregnated with fixed air. *Phil. Trans*. 1769. "By this means," says Sir John Pringle, in a discourse on the different kinds of air, delivered at the anniversary meeting of the Royal Society, 30th of Nov. 1773, "the nature of the metallic principle in mineral waters was clearly explained, and the whole analysis of these celebrated fountains, so often attempted by chemists and others, and still eluding their laboured researches, was thus, in the most simple manner, brought to light."

(To be Continued.)

COMPARATIVE PROPORTIONS OF THREE 70 HORSE POWER STEAM ENGINES, CONSTRUCTED BY MESSRS. BOULTON AND WATT, MR. MAUDSLEY, AND MR. FAWCET.

Sir,—As a great deal has been said from time to time, respecting the most accurate method of calculating the horse power of a steam engine, I beg to make the following statement for the information of your intelligent readers.

Boulton and Watt, Mr. Maudsley, and Mr. Fawcet, of Liverpool, have each lately finished and set to work, in three steam vessels, of similar tonnage, three pairs of 70 horse power engines. The two 70s, furnished by Boulton and Watt, are of the following dimensions.

Diameter of each cylinder, 44½ inches; length of stroke, 4 ft. 6 in.

Those by Mr. Maudsley, are,

Diameter of each cylinder, 47 in. length of stroke, 4 ft. 6 in.

By Mr. Fawcet, of Liverpool, are,

Diameter of cylinder, 46½ inches; length of stroke, 4 ft. 3 in.

Query.—Which of these engines is the most correct in its proportions?

I am, Sir,
Your obedient Servant,
A CONSTANT SUBSCRIBER.

Sir, I have been accustomed, during the warm weather, to drink frequently a tumbler of water, in which I put a tea-spoonful of cream of tartar. I have constantly found that if the tumbler is left for a few hours without being washed, and with any of the sediment remaining, the glass cracks. Can any of your correspondents assign a cause for this?

I am, Sir, &c.
A SUBSCRIBER.

MACHINERY NOT INJURIOUS TO THE WORKING CLASSES.

Sir,—As the almost unexampled difficulties, which at present depress the workmen, in nearly every department of trade, are supposed, by them, to be owing to the introduction of machines, which supersede the necessity of manual labour, and as some of the work-people in the manufacturing counties, have been excited to destroy the machinery of their employers, doubtless the happiest effects would follow, if the erroneousness of their opinions on this subject could be proved to their conviction; and the utter hopelessness of attempting to improve their condition, by the destruction of their master's property, clearly brought within the scope of their understandings. In the hope of doing something towards the attainment of this desirable object, I have thrown into a condensed form, the chief reasons why the working classes are not injured by the use of machinery, and have endeavoured to explain how they are acting against their own interests, by decrying every invention that tends to facilitate labour, and lessen the cost of manufacture.

It appears so obvious to a superficial observer, that the introduction of machinery must lower the demand for workmen, and contribute to keep down their wages, that the mistaken views, commonly entertained on this subject, are hardly to be wondered at. I can imagine a workman, thinking within himself, of the eagerness with which his services would be required, and what high wages he would now get, if Arkwright had never invented the spinning jenny, or Watt the steam-engine. I should like to be near to inform him, that if all Europe were set to work to weave cotton, with the engines in use before the time of Arkwright, they would not be able to produce so much as the manufacturing population of a single county in England, Lancashire, now produces, with the aid of the inventions of the above-mentioned illustrious mechanics. Such, however, is the truth, and the cotton trade now employs several thousand persons, in its different departments, not a hundredth part of whom were employed, or could have been employed in this business before the introduction of machinery; for the cost of manufacturing being then so much greater, the purchasers would have been proportionably fewer, and the trade could never have reached its present enormous extent. So, in this case, we see that the use of machinery has been the means of much increasing the demand for workmen, instead of diminishing it. There are, likewise, several occupations connected with this and every other manufacture, in which the most perfect machinery that could be constructed, could not abridge the labour in the smallest degree, but, on the contrary, would tend to increase the demand for it; if, by means of some new machinery, the time and expense requisite to fit cotton for the purposes of clothing, should be much diminished, a greater quantity would, of course, be manufactured; and the number of merchant vessels employed in carrying cotton, dyes, barilla, &c. would be proportionably increased. These inventions could have no effect in shortening the distances between England and America, or compressing the bulk of the articles; consequently, the shipping interest, and every thing connected with it, would be immediately and substantially benefitted. We should both export and import more. By means of our unrivalled skill in the various departments of weaving, we are enabled to bring the cotton from India, manufacture it into cloth, and then re-export it to the place from whence it came, there to sell it cheaper to the Indian than he can make it himself, though the cotton grows at his own door, and the English goods have to bear the expense of the enormous extent of carriage from India to England and back again. Without our machinery, these astonishing results could not have been obtained, and the cotton would never have been manufactured, consequently, the artizans who work at this machinery, would never have been employed.

If a method is discovered of abridging the labour in any manufacture, the workmen in this trade immediately raise their voices against it; but they should recollect, that if they do prevent persons in their immediate neighbourhood from using it, they cannot exercise a similar control over those that live at a distance, who will, undoubtedly, bring it into operation; and thus, undersell their work, which is produced without the assistance of the improved processes, and, consequently, considerably dearer. In confirmation of this, I might instance a circumstance which occurred in Dublin, and which, I believe, is related in the first volume of the Mechanics' Magazine. A machine for making nails more expeditiously than by the common method was invented in Birmingham, and imported into Dublin, the nailers were instantly in arms, attacked the house of the importer, seized the machine, and broke it to pieces. What was the consequence? By degrees the nailing business was given up in Dublin, and the nails were imported from Birmingham, where they could be made cheaper; whereas, if the Dublin workmen had not foolishly destroyed the machine, nails might have been exported from thence to foreign parts, and the trade might eventually, have employed many more hands with the machines, than it ever could without. The silk-weavers are now in alarm at the introduction of foreign silks, the alarm, I believe, is groundless, but if you wish to remove all *liability* of being undersold by the French, I should say, improve your machinery as much as possible, rack your invention in every possible way to find out methods of abridging your labour. English ingenuity will not be disheartened and cannot be surpassed by foreigners; henceforth it will become a trial of skill between this country and France, and it will be hard indeed, if, with our celebrity for mechanism, and the talents of our artizans, we do not gain the superiority.

But suppose our work-people should oppose the introduction of machinery, they cannot excite a fellow-feeling among all the workmen in every silk-manufacturing town in France; they would, consequently, be thrown out of employment, and become the objects of derision to our less foolish neighbours. But perhaps it may be asked, would not you consider it a great evil, if, in a large manufacturing town, two-thirds of the population should be suddenly bereft of work, and left to shift for themselves? I answer, undoubtedly it would; indeed so great, as almost to overbalance the good which might hereafter result from the change, but such a case could not *possibly* happen; persons are too much attached to old methods, too unwilling to relinquish the course they have been accustomed to, to permit us to entertain the idea, that a body of men would *suddenly* make such a change in their established practices, as to discharge two-thirds of their workmen, even on the fairest prospect of advantage. The change, if it take place at all, must be gradual, so gradual, as entirely to remove those inconveniences, which sudden innovation would produce; prejudice opposes it; and here, prejudice, so much vilified, has its advantages, since the struggle, which it creates, leads, in the end, to the prevalence of a dispassionate spirit of inquiry, which rejects all the hare-brained schemes which ignorance and folly daily beget, which separates the metal from the dross, and admits no novel contrivances as substitutes for the ancient, but whose utility have been sanctioned by experiment, and their superiority over the old, incontestably demonstrated.

VINDEX.

INSTRUMENT FOR MEASURING STANDING TIMBER.

Mr. James Rogers, of Marlborough, has taken out a patent for an improved method of ascertaining the solid contents of standing timber; or, more properly speaking, for an instrument to determine the angles, from the measure of the tangents of which, such solid contents may be deduced. The following description we extract from Mr. R.'s specification.

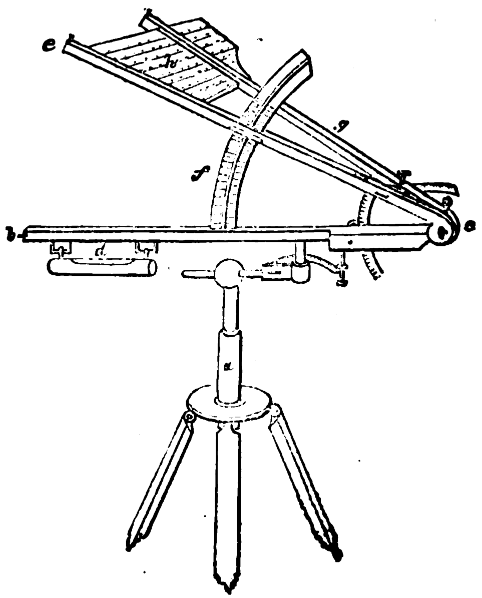
The drawing on the next page, presents a view of the instrument proposed to be employed. It is planted upon a tripod stand, in the same manner as a theodolite. An upright stem arises from the top plate, at the end of which is a ball, with a hole perforated through it, to receive the stem of the instrument; *b c*, may be called the base limb, which is to be placed in an exactly horizontal position, and adjusted by the suspended level, *d*. The limb, *e*, rises on a joint at *e*, and slides upon a vertical arch, *f*, which is graduated. At the point, *c*, there is an eye piece, through which the surveyor looks along the side of the bar, *b*, to a small point or rising edge at the end of the bar. The part of the tree cut by this line of observation will, if the instrument is properly adjusted, be perfectly horizontal with the eye-piece.

An eye-piece is also placed at *c*, on the upper side of the rising limb, for the purpose of looking along this limb to a point or rising edge, *e*, in its extremity. The surveyor elevates this limb, until that part of the tree intended to be noticed, is exactly cut by the line of observation, and the angle subtended between that and the horizontal is shewn upon the vertical arch, *f*.

It is here to be remarked, that the graduations upon the arch, *f*, are not angles of altitude, but marks or graduations answering to feet and inches of a tangent line, extending from the horizontal point upwards, taken at a given distance from the tree; consequently there are two or more rows of divisions, answering to the several distances at which the instrument may be planted. Twenty-four feet and forty-eight feet are proposed distances, and the graduation upon the arch, *f*, are made accordingly. For lofty trees, the longer distance is to be used: for shorter trees, the distance of twenty-four feet will be sufficient.

The horizontal angles which are to determine the diameter of the trunk, at the several points of observation are ascertained by the limb, *g*, which slides laterally upon an arch or graduated plate, *h*, divided upon the same principle as the arch, *f*. The limbs, *b* or *e*, being fixed, so as to coincide with one side of the trunk, the limb, *g*, is then moved until it coincides with the other side of the trunk, and the angle subtended between the two, shew, by the graduated plate, *h*, the diameter in feet and inches of the trunk at the points of observation.

The length of the trunk, and its diameter in the several parts being thus ascertained by the improved instrument, recourse must then be had to tables, calculations, or the ordinary sliding rule, for the purpose of obtaining from these admeasurements, the solid content of timber in each portion of the tree. There are adjusting screws, and circular racks, and pinions for moving the limbs of the instrument, and altering their position, as circumstances may require; and when crooked arms, or bent parts of the trunk present themselves, the instrument may be turned upon its pin, in the ball at the top of the stem, *a*, and used in an inclined position.



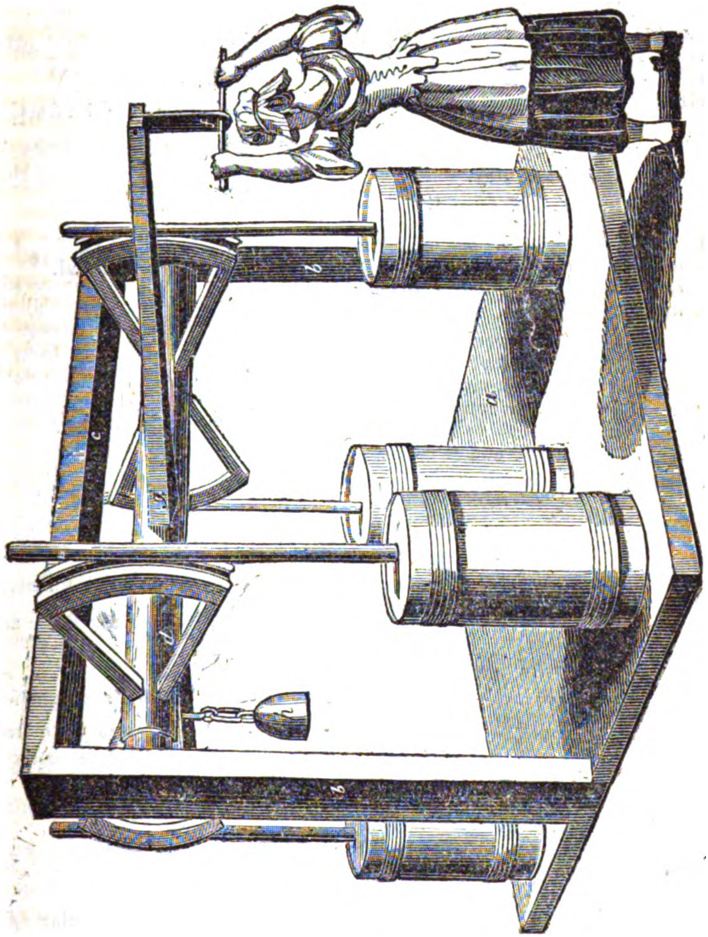
GERMAN CHURNING MACHINE.

Sir,—When travelling through Germany, I saw, at a farm house, a woman working with great ease, four churns at once; and, in the hope that some of my fair country women may have their toils similarly diminished, I send you a sketch of the very simple machinery by which this was effected.

I am, Sir,

Your obedient Servant,

JULIUS.



Description.

a is a square board, at the four corners of which are placed the four churns; *b b* are two side posts, joined at the top by the cross bar, *c*; *d* is a round spindle, working in sockets in the side posts *b b*; to this spindle are attached four arms of the form of bell cranks; the outer circular rim of each of these arms, is grooved to receive two chains, the one fixed to the upper and the other to the lower end of each churn staff; *g* is a lever which runs through the spindle *d*; *f* a handle, by pulling which down, a circular movement is given to the four arms, and the churn staffs set a working by the chains beforemented; *h* is a weight attached to the opposite end of the lever, and which, on letting go the handle *f*, restores the machinery to its original position. It is evident, that by this oscillatory movement, (which the drawing will more fully explain) the business of the four churns must be as well performed, as if each had its separate attendant. The machinery is of so simple a nature, that the most ordinary workman may construct it at a very small expense.

ON FIGURES.

CHAP. I. CONCLUDED.

CASE 7. *To reduce Fractions, with unlike Denominators, to Fractions, having one same Denominator.*

Rule.—Multiply every numerator into all the denominators but its own; and then multiply all the denominators together for a common denominator.

Ex. 1. Reduce $\frac{2}{6}$ and $\frac{6}{7}$ to fractions having the same denominators.

$$\begin{array}{r} 2 \\ 7 \\ \hline 14 \end{array} \text{ number of the 1st.}$$

$$\begin{array}{r} 6 \\ 6 \\ \hline 36 \end{array} \text{ number of the second.}$$

$$\begin{array}{r} 6 \\ 7 \\ \hline 42 \end{array} \text{ common denominator.}$$

Then, 1st, $\frac{2}{6} = \frac{14}{42}$, and, 2nd, $\frac{6}{7} = \frac{36}{42}$.

Note. From the manner in which this rule is given, by most writers on arithmetic, and the examples with which they illustrate it, most people, who have not a master at their elbow, to explain their author's meaning, are very much puzzled with it. It will be very clear when they look to it. In the example above (pursuant to the rule), I multiply the denominator and the numerator, of the 1st fraction, by the denominator of the 2nd, when it (the fraction) must still be of the same value. And again, the numerator and denominator of the 2nd, I multiply by the denominator of the first, when *it* must also remain the same. It is the same with regard to three or more fractions.

Ex. 2nd. Reduce $\frac{7}{12}$, $\frac{6}{7}$, and $\frac{9}{11}$ to fractions of the same denominators.

$$\begin{array}{r} 7 \\ 7 \\ \hline 49 \\ 11 \\ \hline 539 \end{array} = \text{number of 1st fraction.}$$

$$\begin{array}{r} 6 \\ 12 \\ \hline 72 \\ 11 \\ \hline 792 \end{array} = \text{number of 2nd.}$$

$$\begin{array}{r} 9 \\ 12 \\ \hline 108 \\ 7 \\ \hline 756 \end{array} = \text{number of 3rd.}$$

$$\begin{array}{r} 12 \\ 7 \\ \hline 84 \\ 11 \\ \hline 924 \end{array} = \text{common denominator.}$$

Then, 1st, $\frac{539}{924} = \frac{7}{12}$, 2nd, $\frac{792}{924} = \frac{6}{7}$, and 3rd, $\frac{756}{924} = \frac{9}{11}$.

Examples for Students to practice.

1st. Reduce [illegible], [illegible], and [illegible], to fractions having the same denominators.

2nd. ——— $\frac{11}{12}$, and [illegible]

3rd. ——— $\frac{9}{[illegible]}$ and [illegible]

4th. ——— $\frac{15}{20}$, [illegible], [illegible], and [illegible].

CASE 8. *To find the value of a Fraction.*

Rule. Multiply the numerator by the number of the next inferior denominator, (that is, if it be the fraction of a pound, multiply the numerator by 20,) and divide the product by the denominator, then, if there be any remainder, multiply it by the next denominator (that is, by 12), and divide the product as before, and so on, and the quotients together shall be the value of the fraction required.

Ex. 1. Required, the value of $\frac{9}{10}$ of a pound sterling,

$$\begin{array}{r} 9 \\ 20 \\ \hline 10)\ 180 \\ 180 \\ \hline 0 \\ \hline \end{array}$$

(18 sh. $=\frac{9}{10}$ of 1l.

Ex. 2nd. Required the value of $\frac{7}{5}$ of half a crown.

$$\begin{array}{r} 7 \\ 30 \\ \hline 5)\ 210\text{d.} \end{array}$$

(42d. = 3s. 6d. $=\frac{7}{5}$ of half a crown.

In this the value is more than a half crown, because $\frac{7}{5}$ is more than one whole.

Note. When we multiply the numerator (9), of *Ex.* 1st. by 20, we reduce those 9l. to shillings; but as we have not nine whole pounds, but only $\frac{9}{10}$ of 1l. or $\frac{1}{10}$ of 9l.

Then we have only $\frac{1}{10}$ of those 180s. which, by dividing the latter by 10, we find to be 18s.

Examples for Students to practice.

1st. What is the value of $\frac{6}{4}$ 1l. sterling?

2nd. ——————— $\frac{11}{20}$ of 1l. ditto?

3rd. How much is $\frac{7}{9}$ of $\frac{1}{3}$ of 10 yards of cloth?

4th. ——————— $\frac{19}{25}$ of 9 miles?

5th. ——————— $\frac{2}{7}$ of one day?

6th. ——————— $\frac{2}{3}$ of 1 hogshead of wine?

7th. ——————— $\frac{3}{8}$ of $\frac{5}{7}$ of 10 leagues.

Case 9. *To reduce Fractions of one denominator, to that of another, which shall be of the same value.*

Rule. Having found how many of the inferior denominators make one of the next superior denominator, multiply the numerator of the fraction by that number, if you are finding an inferior denominator; but if you are finding a superior denominator, multiply the denominator by it.

Ex. 1. Find out the value in a pound of $\frac{7}{9}$ of one shilling

Then, as we want a higher denominator, we multiply the denominator by 20, thus:

$$\begin{array}{r} 9 \\ 20 \\ \hline 180 \\ \hline \end{array}$$

thus $\frac{7}{9}$ of 1s. $=\frac{7}{180}$ of 1l.

Ex. 2. Reduce $\frac{7}{180}$ of 1l. to the fraction of one shilling.

Now, as we want an inferior Denominator, the Numerator is to be multiplied by 20. Thus

$$\begin{array}{r} 7 \\ 20 \\ \hline 140 \end{array}$$

thus $\frac{7}{180}$ of 1l. $=\frac{140}{180}$ of 1s. $=\frac{7}{9}$ of one shilling

Examples for Students to practice.

1st. Reduce $\frac{7}{11}$ of 1l. to the fraction of 1s.

2nd. ——— $\frac{10}{19}$ of a crown to the fraction of a guinea, (21s.)

3rd. ——— $\frac{7}{28}$ of one guinea to the fraction of 1l.

4th. ——— $\frac{13}{43}$ of one day to the fraction of one year.

5th. ——— $\frac{15}{23}$ of a foot to the fraction of one yard.

6th. ——— $\frac{35}{165}$ of a year to the fraction of a day.

7th. ——— $\frac{7}{17}$ of 9l. to the fraction of 1l.

Miscellaneous Questions on the above Rules in the Reduction of Fractions.

1. A gentleman met five friends, and told them he would divide $\frac{1}{5}$ of his money, 10l. 15s. 9d. equally amongst them. Required, each man's share.

2. I have $\frac{71}{5}$ of 1l. Required the value of the fraction.

3. I gave one-sixth of my money, which was 21l. to a man, desiring him to give one-seventh of that sum to his daughter. How much had he left, and how much had the daughter?

End of Chapter 1, and of Reduction of Vulgar Fractions.

I am, Sir, &c.
1 and 2 make 3.

August 26, 1826.

HEAVING THE LOG.

The log used at sea for measuring the velocity of a ship, or the rate at which she runs, is a piece of thin board of a sectoral or quadrantal form, loaded on the circular side with lead sufficient to make it swim upright in the water; to which is attached a line of about 150 fathoms, or 300 yards long, called the log line, which is divided into certain spaces, called knots, and wound on a reel, which turns freely for the line to wind easily off. About 10 fathoms of stray or waste line are left next the log before the knotting or counting commences, that space being usually allowed to carry the log out of the eddy of the ship's wake. The mode of using or of heaving the log is this:—One man holds the reel and another the half-minute glass; an officer of the watch throws the log over the ship's stern, on the lee side; and when he observes the stray line, and the first mark is going off, he cries turn! when the glass holder instantly turns the glass, crying out *done!* then watching the glass, the moment it runs out, he says *stop!* upon which, the reel being quickly stopped, the last mark run off shows the number of knots, and the distance of this mark from the reel is estimated in fathoms: then the knots and fathoms together show the distance run in half a minute; or the distance per hour nearly, by considering the knots as miles, and the fathoms as decimals of a mile; thus if 7 knots and 4 fathoms be observed, then the ship runs at the rate of 7·4 miles an hour. It follows, therefore, that the length of each knot or division of the line ought to be the same part of a sea mile as half a minute is of an hour, that is, $\frac{1}{120}$part. Now it is found that a degree of the meridian contains nearly 366,000 feet; therefore $\frac{1}{60}$ of this, or a nautical mile, will be 6100 feet; the $\frac{1}{120}$ part of which, or 51 feet nearly, should be the length of each knot, or division of the log line. But because it is safer to have the reckoning rather before the ship than after it, therefore it is usual now to make each knot equal to 8 fathoms or 48 feet. But the knots are made sometimes to contain only 42 feet; and this method of dividing the log line was founded on the supposition that 60 miles, of 5000 feet each, made a degree; for $\frac{1}{120}$ of 5000 is 41 $\frac{2}{3}$, or in round numbers, 42 feet. And although many mariners find by experience that this length of the knot is too short, yet rather than quit the old way, they use sand-glasses for half minute ones that run only 24 or 25 seconds. The sand, or half minute glass, may be tried by a pendulum vibrating seconds, in the following manner. On a round nail or peg, hang a thread or fine string, that has a musket ball fixed to one end, carefully measuring between the centre of the ball and the string loop over the nail 39 $\frac{1}{5}$ inches, being the length of the seconds pendulum; then make it swing or vibrate very small arches, and count one for every time it passes under the nail, beginning at the second time it passes; and the number of swings made during the time the glass is running out, will show the seconds in the glass.

It is not known who was the inventor of this method of measuring the ship's way, or her rate of sailing; but no mention of it occurs till the year 1607, in an East India voyage, published by Purchase; and from that time its name occurs in other voyages, in his collections; after which it became famous, being noticed both by our own authors and by foreigners; as by Gunter, in 1623; Snellius, in 1624; Metius, in

1631; Oughtred, in 1633; Herigone, in 1634; Saltonstall, in 1636; Norwood, in 1637; Fournier, in 1643; and almost all the succeeding writers on navigation of every country. Various improvements have lately been made of this instrument by different persons.

NEGLECT OF NATIVE TALENT.

Sir,—Perhaps no country in the world can boast so much excellence in arts and sciences as our own; yet I am inclined to think that in no country is less notice taken of the ingenious artizan, or the meritorious mechanic, than in the British Empire; probably because the instances of superior ingenuity are more numerous than in any other division of the globe, or because of the sacred aphorism, that "a prophet is seldom esteemed in his own country." Certain it is, however, that other countries frequently reap the benefit of our supineness in this particular, and one instance I wish to notice, as being not only corroborative of these facts, but serving to shew how far some of our neighbours in the European part of the world are behind us in the most important and useful inventions, and even such as are very commonly known and used in England. About twenty years ago, an ingenious person who had made many improvements in the art of concentrating and conveying heat, so as to lessen the consumption of fuel by full one half, and to accelerate the operation in an equal degree, both for culinary uses and in other valuable works, offered his services to a branch of the executive part of our Government; but though his plan was approved, and his skill commended, some obsolete system prevailed over obvious improvement, and the man was neglected, his services declined, and the advantage lost to the public. One of the Russian Emissaries, however, who was privy to the circumstances, availed himself of this opportunity, and sent the man to St. Petersburgh, in the service of the Autocrat of that increasing empire; there he made many and very useful improvements, but his political principles not agreeing with the practices and maxims of an arbitrary state, he rendered himself obnoxious to the ruling authorities, and was ultimately obliged to decamp. He then went into the employment of a Norwegian nobleman, who had great possessions of mines, foundries, furnaces, and iron works of various descriptions, and who had a spirit for enterprize and improvement equal to his ability to promote and encourage them. Among many other deficiencies, which he discovered among the Swedish miners, he found them totally ignorant of the simple method of producing a regular permanent *blowing*, such as is requisite for *soldering*, and many other operations; and as a strong continued *blowing* of air was required for a particular purpose, this was the first task he had to perform. It is hardly necessary for me to describe a thing so manifest, and I believe so generally known; but perhaps it is not known to every one, and I will, therefore, just mention that he caused a large leathern reservoir to be placed between the furnace, and three or four pairs of bellows, all of which worked into it by alternate strokes, from suitable cranks, by the same shaft, and from this reservoir a pipe conducted the air to a furnace, which air from a *plenus* within the reservoir, was forced through in an undeviating constant current.

After the return of this mechanical adventurer, and after Norwegians, Russians, Danes, and Swedes, had seen, appreciated, and obtained the benefit of his talents, our own wise and worthy governors sought his services, and sagaciously accepted the last of that skill, which they had once the power to have retained and monopolized; and this I fear is not the only instance by many in which a contemptuous neglect of native ingenuity has banished the advantages and benefits of useful discoveries and improvements to foreign countries.

Your's, &c. &c.

R. JACKSON.

NIGHTINGALES.

Sir,—Will you, or any of your correspondents favour me, through the medium of your valuable Magazine, with an answer to the following queries,* *(from actual practice,)* which, though not exactly scientific, are yet among those things to which scientific men apply as recreations.

1. What is the *best* and *simplest* trap for catching nightingales?

2. What is the best, cheapest, and most easily prepared food for the same?

3. Which is the best method of making German paste for larks, &c.?

Answers to the above as soon as possible will oblige

AVIARUS.

SHIP VENTILATOR.

An apparatus has been invented by a Dr. Wuettig, for ventilating vessels, which appears extremely well calculated for the purpose. It consists of an iron furnace, into which is placed a hollow copper globe, with two aspirating pipes, and an evacuation tube. As soon as the fire is lit in the furnace, the evacuation tube begins to draw, and the draught increases, as the globe becomes heated, so that when it is red hot, the draught is very great. If the fire is kept burning for an hour or two, about once or twice a day, it will exhaust the atmosphere of the hold, to the extent of about 300 or 400 cubic toises; and the pure air will, of course, flow in to supply its place.

MR. DOWNTON'S CONTINUALLY FLOWING PUMP.

Mr. Jonathan Downton, shipwright, of Blackwall, has taken out a patent for a new pump, by means of which, an uninterrupted stream of water may be procured. It consists of a lifting pump with three suckers or moveable valve boxes, and one fixed valve box at bottom. The rods of the two upper suckers are hollow, and that of the lower one passes through the hollow rod of the second, and the two thus combined, rise through the hollow rod of the upper sucker. These united rods are kept steady in a vertical position, by a cross-piece at top, through which the solid rod of the lower sucker ascends, across the upper part of which rod, a slot frame is fixed, (composed of two parallel sides, connected by semicircular ends) in which a roller works that runs on one of three cranks made on the same horizontal axis. The two hollow rods, which terminate at a due distance below the axle, to allow of a free motion to each part, have each a metal cap attached to them, fitted up as stuffing boxes, and furnished with hollow screws, from the sides of which caps, solid rods ascend to the level of the crank axle, having slot frames on them, similar to the first, which surround rollers of the same sort that are on the other two cranks.

The three cranks of the axle are arranged so as to make the three pump rods come successively to their highest elevation in equal times (which may be done by making each crank form an angle of 60 degrees with the others); by which means, an uninterrupted stream of water will be produced from the head of the pump, as one of the three rods will be always ascending at the times when the others may be stationary, from the cranks being either at their highest or lowest position.

Mr. Downton describes the crank axle as being turned by means of a winch, and has added a fly wheel to it, to equalize its motion and facilitate the labour; but it is evident that it may be also made to revolve by steam, water, or other powers, in various other manners.

IMPROVEMENTS IN WHEEL CARRIAGES.

Sir,—The universal use of carriages, which afford such extraordi-

* I have read two or three answers to these queries which seemed *good in theory*, but which, when *tried*, did not answer at all, I therefore wish them to be from persons who have tried them, and can vouch for them.

nary comforts to all ranks and degrees of persons, induces me to think you will gladly receive any suggestion for their improvement; which suggestion, permit me to say, is not to be undervalued because it appears, at first sight, trivial and free from expense, as this last ought to be a just cause of approval. There is another reason, which ought to induce a temperate consideration of the subject; namely, that the writer has already made the experiments in question, for his own private use, and experienced all the beneficial results he now suggests to others, having, for upwards of forty years, been in the habit of using four horses, in different ways, for his own and his family's convenience.

All persons are acquainted with the general manner in which the sway bar is suspended from a hook attached to the end of the pole, which it is self-evident can admit of no extent of lateral motion as the hook soon resists the movement of the ring from which the sway bar is drawn, and from any irregular effort of the kind, the pole is endangered, and sometimes broken. The hook also rising from the extremity and top of the pole, which is attached immoveably to the under carriage, every rut the wheel falls into, and every obstruction it meets, is transferred to the pole, and operates with the increased power of a lever upon the ring and sway bar, which interrupts the exertions of, and contributes not a little to gall, the foremost pair.

The elevation of the pole also enables the wheel horses to resist the motion of the carriage descending a hill, but the effect of such elevation is to diminish the powers of the foremost by elevating the line of draft, which ought to slope from the shoulder to the sway bar *downwards*, and not move in an horizontal line. I have avoided all those incongruities by reversing the iron work, and attaching it underneath the pole, and in place of a hook having a round pin of iron, from three to four inches long, upon which the ring of the sway bar acts, which being circular, admits movement in every direction, without the twist derived from the hook; and being placed under the pole, and bound to it in the rear, in the way it is retained upon the pole, or in any other way deemed more convenient (I hold it by a trace to support the ring of the sway bar without the effect of noise—the consequence of two irons acting upon each other), and the consequences were manifold.

I. The pole rose and fell within the space of four inches, without having any kind of influence upon the pull of the leaders.

II. The effect of a swerve, upon the part of the leaders, could not affect the pole, for they could turn to the right or left, until the sway bar touched the wheeler at the outside, where it acted with but slight effect; whereas, when it acts through the hook, by pulling the pole after it against the wheeler, it carries with it no very inconsiderable share of the weight the whole carriage sustains, which is thus taken at one side of the line of direction of gravity, and inclines the carriage to overset.

III. The sway-bar, acting under the pole, cannot, under any circumstances, be raised above it, nor get over the rumps of the leaders, and sinking to a certain level under the pole, within four inches, admits of raising the pole, and greatly reduces, in consequence, the weight upon the pole pieces, which it admits of shortening, and in descending hills, in particular, I venture to say, from experience, that it would be found to answer much better than the present mode, whilst the charge for the iron at present in use, would be attained at the cost of a few shillings.

SENEX.

STEAM-BOAT DOCK SUGGESTED.

Sir,—A circumstance mentioned in the newspapers, a few days ago, recals to my mind a plan for the prevention of the like again; and which, if carried into effect, would unite utility and ornament to the city in an eminent degree. A gentleman and his family having taken a wherry, in order to get on board a steam-boat at the tower stairs, were, by the tricks of some of the watermen, purposely upset, and the whole party was immersed in the water to the imminent danger of their lives. This, which was done wantonly, might be easily prevented from happening again; but what I now object to, is the great liability to danger, the flagrant extortions, and the many annoyances to which a passenger is subjected, before he gets on board the steam-boat, and which, if he has once experienced, will be almost sufficient to deter him from encountering them again.

I should propose, as a remedy, that a dock be constructed *above London bridge*, capable of containing about 60 or 70 steam-boats, and by means of which, passengers could step at once on board, without the intervention of a wherry. The land might be purchased now cheaper than a few years hence; as, when the new London bridge is completed, vessels, which are now kept below by the small height of the arches, will be enabled to ascend and unload above the bridge, and will consequently raise the price of the land; the dock, if begun now, would be completed at the same time with the bridge. It would strike a foreigner, or indeed any one with admiration, on his entering London, if he passed under the magnificent arches of London bridge, which, to judge from the drawings, will even surpass Waterloo. The proposed dock should be surrounded by a wall, and a warehouse built, where might be stationed one or two custom-house officers, who could examine the luggage of the passengers immediately on landing. There is, I think, a waterman's society, which would, of course, vehemently oppose any plan which would tend to diminish their profits; let their interested clamours be as vehemently met, and I hope we shall hereafter see an end put to those annoyances, which I know are the means of preventing many persons from making use of those cheap and agreeable conveyances, steam-vessels.

I am, sir,
Your's, &c.
PROJECTOR.

PRESERVING POTATOES IN A DRIED STATE.

Wash them, cut them in pieces, steep them forty-eight hours in lime-water, then forty-eight hours in fresh water; dry them in an oven. One hundred parts of fresh potatoes will give thirty so prepared and dried. In this state they may be kept for years, or ground at once into flour. This flour, mixed with a third part of that of rye, is said to make an excellent bread. The same author proposes to moisten potatoes dried as above, with olive oil, and then to grind them and use them as coffee.

FRESCO.

The French have been for a considerable time endeavouring to revive the art of fresco-painting. Pursuing their experiments, the Chapel of St. Vincent-de-Paule, in the church of St. Sulpice, in Paris, has lately been decorated with paintings in fresco, by a native artist, of the name of Guillémot. This is the third chapel in that church which has received similar embellishments.

INQUIRY.

Sir,—Through the medium of your valuable periodical, I beg to make the following inquiry:—

1st. What will be the elevation of a wane whose base is 100 yards?

2nd. What would be the line of surface of that wane?

3rd. What would be the elevation of a wane whose base is 10 yards?

4th. What would be the line of surface of that wane?

5th. Would the aggregate surfaces of the ten small wanes be equal to that of the large one?

I am, Sir,
Your obedient Servant,
AQUARIUS.

(Correspondents in our next.)

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Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 160.] SATURDAY, SEPTEMBER 16, 1826. [Price 3d.

"In England, the spirit of information, wherever elicited, rapidly spreads over and glows in every link of the electric chain of society. It mounts aspiringly, if it have its origin among the less privileged orders—it descends through all the beautiful gradations of rank, when it has its birth in the higher circles,—it is diffusive, it is all enlightening."

BOWRING'S RUSSIAN ANTHOLOGY.

POLLARD'S EPICYCLOIDAL GRINDING MILL.

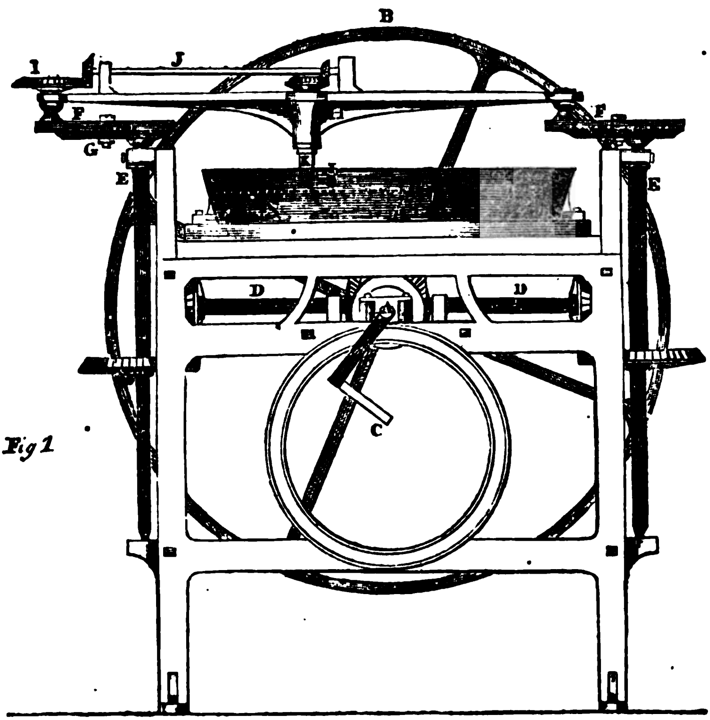


Fig 1

Description by the Patentee.

A, is a horizontal shaft, at one end of which is a regular fly wheel, B, and at the other, a winch C, by which the mill is actuated. DD, are two horizontal shafts, which are turned by the bevil wheel on the shaft A, and, by means of bevil wheels, on the other ends of these shafts, the two vertical crank shafts, E E, are turned. On the top of these crank shafts are moving crank heads, F F, with a chase mortice in each; and, by unscrewing the nuts, G G, both of these crank heads can be slid with the sliding index, H, either backwards or forwards; by which means the scope of the two cranks can be either lengthened or shortened, which will cause the circular runner to traverse over, in its epicycloidal course, a greater or less space in the iron, or marble pan, or flat bed stone, O, as may be required when grinding any quantity of colours or other material. This pan, or bed stone, measures two feet six inches, by two feet two inches wide; the two ends of the sliding index, H, are fixed on the two crank heads, F, F, and, on that part of the crank head which passes through the end of the sliding index, is fixed the bevil wheel, I, by which is put in motion the horizontal shaft, J, that is attached with bevil gear, to the top of the sliding index, H. K, is the central perpendicular shaft, moving in the box of the sliding index; this central shaft has a bevil wheel on the top, which is put in motion by the gear of the small horizontal shaft, J, which receives its motion from the bevil wheel, I, on the crank head, by which means a rotary motion is given to the central perpendicular shaft, K. The lower part of the central shaft is square, on which the iron box, M, is fitted, which can be moved up and down the square part of the central shaft, when the box is not fastened to it by the nut screw, L. N, is the circular runner; its diameter must necessarily be one inch larger than half the diameter of the iron or marble pan, O, or flat bed stone, in order that, in traversing the epicycloidal course, its extremity may always pass over the centre of the pans or flat bed stone. In the centre of the circular runner, N, is fixed a square iron pin, terminating rather conically towards the top, in order that when the pin is in the iron box, M, the circular runner, N, may always act on its own level on the materials then grinding in the pan or bed stone; the mill, when in motion, causing the runner to produce a combined elliptical and circular motion, and to traverse an epicycloidal course in the pan, or bed stone. With the above mentioned motions and course, the septenary system of generating curve lines, by continual motion, is produced upon the materials which are being ground in the pan or bed stone. By these motions, the colours, &c. are constantly removed from and drawn into the centre and about the surface of the pan or bed stone, thus rendering their quality the finest possible, with the greatest care and dispatch.

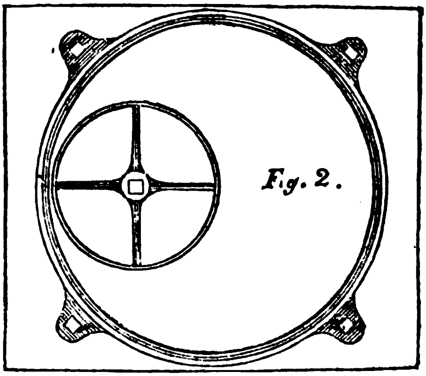


Fig. 2.

It is presumed, that the advantages of these mills to persons in the colour trade, and to painters in general, will be very great. They produce a considerable quantity of colour, ground as fine as it possibly can be, in a very short space of time, and are put in action with a comparatively small power, since a stout lad can work the mill with perfect ease.

For grinding the fine oil and water colours, employed in the fine arts, and those colours used in the potteries and manufactories of porcelain, either a hard glass or composition plate, or concave beds properly prepared, may be used, with circular runners of the same materials; the use of which is highly advantageous, for they are not porous like stone and marble, and do not grind up with the colour; the stone causes an absorption of the colour, and prevents that perfect grinding which is necessary for the artist and the porcelain manufacturer.

These mills may be employed with great advantage by drug grinders, chemists, druggists, manufacturers of black lead, indigo, copper plate printing ink, lithographic ink, Frankfort black, &c. as they will supersede the necessity of triturating mercurial ointments, and other preparations, by the drudgery of the pestle and mortar, a practice so unwholesome, as to make it desirable that it should speedily be done away with altogether.

In large factories, any number of these mills, made to any dimensions, may be so placed and connected together as to be worked by steam, water, or any other adequate power. It is a well-known fact, that the health of persons employed in the present mode of grinding verdigrease, and other pernicious paints, particularly when ground in turpentine, and also mercurial ointments, numerous drugs, &c. is seriously injured. Now the use of these newly-invented mills will entirely obviate this evil, it not being requisite that the workman should expose his head and limbs to the noxious effluvia arising during the process, as he is constantly compelled to do when grinding by hand with the single muller-stone.

Specimens of these machines may be seen by application to Mr. Pollard, *No. 4, Thornaugh Street North, White Conduit Fields.*

COTTAGE ARCHITECTURE.

Sir,—An improved style of architecture, applicable to small country houses, and within the reach of moderate fortunes, is not the least desirable object to be promoted by the ingenuity of our artists. And nothing is more clear than that the few touches and arrangements, which at once distinguish the *tasteful* from the *tasteless* building, may be produced for a very trifle. I was, myself, recently engaged in constructing a cottage of the unadorned Gothic character, and the employment being new to me, and the scene of my operation far distant from the residence of scientific men, I naturally looked round me for published directions, but was astonished to discover how little had, apparently, been done, for the direction of the uninformed.

ELEVATIONS are, indeed, given in various works, though, with the exception of Mr. Robinson's lithographic plates, (which, allowing for a little occasional extravagance are extremely picturesque,) with no great recommendation of beauty. But the details I do not ever recollect to have seen given; such as plans, sections and materials of mullions, reveils, porches, scollop boards, chimneys, string courses, and all those other cheap accompaniments, which so distinctly except a house from the stamp of *commonness*, and attract the spectator's attention. I am unwilling to suppose our architects withholders of such information, upon any of those grounds of self-interest which are now so generally yielding to more liberal feelings. Let me, at all events, suggest the advantage of a cheap, progressive, lithographic delineation; say, in monthly numbers, of cottages, and the parts of cottage-architecture, illustrated with plain directions, and, if possible, accompanied with such observations upon economy, arrangement, &c. as every man's experience usefully points out to him, in almost every day's attendance upon his building. And, if the suggestion be listened to, let me further request some notice of it in your little work.

Your's, &c.

W. V.

DEPOSIT IN STEAM BOILERS.

Sir,—It must surely have escaped the notice of the answerers to this inquiry, in p. 205, No. 41, that let the water be ever so hard, no substance attaches to the sides of vessels in which fat meat has been boiled; therefore I should propose washing the sides and bottom of the boiler with grease before letting the water in, and always repeating the same when the boiler is cleaned out, or occasionally throwing in a small ball of grease—this has been practised with effect, but I have not been able to recollect where.

I am, &c.
Your's obediently,
J. B. B.

INSTRUCTION OF THE WORKING CLASSES.

Sir,—Of all the publications that ever came from the press, none can be more useful or instructive than the Mechanics' Magazine; useful, because its object is to promote ingenuity and invention in all the arts that materially benefit mankind; and instructive, because it is calculated to enlighten the understanding, and excite the emulation of those who most need such an instructor, and among whom it is principally circulated: and with those whose erudition enables them to understand the *formula* and *technicalities* of general science, it must always continue a pleasing *vade mecum.* Yet with all its advantages there is one obstacle in the way which limits its circulation, and impedes the good effect of its influences; that is, the utter ignorance of many mechanical persons, with respect to language and the import of scientific phrases

It is not compatible with the nature of a magazine to teach the first principles of learning; it is properly a store-house, or depository of knowledge, from which no one can judiciously select, unless he has some previous knowledge of the articles which he is about to examine; ignorance in this, as well as in all other instances, makes a man indifferent in his choice, and he cares not to turn over, to compare, or to taste, while he is conscious that, instead of satisfaction, he obtains nothing but doubt and uncertainty, by an irksome and tedious toil, and therefore he gives up the pursuit from a conviction of his inability to continue it successfully. Ignorance is not, however, an insuperable bar; there are methods of removing it; theb arren soil becomes fruitful by cultivation, and an unlettered mechanic may be instructed, so as to realize the genial ray that fertilizes the human mind, and absorb its powers, to the enlivening of genius, and the exaltation of his understanding. Some will say that adults cannot generally submit to the restraint and application necessary for obtaining a knowledge of grammar, and of figures; yet without these, none can reasonably expect to read the Mechanics' Magazine with profit or pleasure. A plan may be suggested which would obviate all difficulties, and remove every objection; namely, to institute lectures at a cheap rate, where mechanics might attend, as at any other place of entertainment, and receive instructions in grammar and arithmetic, as well as mathematics, without restraint or fatigue, requiring only tacit observation and attention without toil. Thus by blending the *utile* and the *dulce*, a pleasurable mode of communicating knowledge might be adopted if mechanical men would support such institutions; and, at the same time, evening tuition, as an auxiliary, should be afforded to those who might require it, or wish for that additional advantage. Such a plan, by way of experiment, I have in view; but wholly unostentations, if I can mature it on a small scale, I shall take the opportunity of announcing its commencement, by duly advertising in your monthly parts.

Your's
Richard Jackson.

There is a great deal of truth in the observations of our correspondent; but he must of course be aware, that his plans have been already fully embraced in that of the London Mechanics' Institution, and other similar establishments; though, perhaps, not as yet realized (for they are as yet in their infancy) to a considerable extent by any of them.

Mr. Jackson's individual efforts may probably have the effect of quickening these public associations a little; and, in this view, as well as on account of the separate good which must attend them, we wish them all success.—Edit.

PREVENTION OF FRICTION IN CALENDERING.

I have been requested to ask, if any of your correspondents can inform a constant reader, if any substitute may be used instead of *wax*, to prevent injurious friction in calendering of cotton prints, &c. especially dark colours, and what that substitute is? Such a discovery would be beneficial to the trade, and oblige some truly well-wishers.

Your's,
Richard Jackson.

SPECIFIC GRAVITY OF FLUIDS—LOVI'S BEADS.

Sir,—In Mr. Farraday's paper, in the Transactions of the Royal Society on the condensation of several gases into liquids, there is the following passage:—

"*I am indebted to Mr. Davies Gilbert*, who examined with much attention the results of these experiments, for the suggestion of the means adopted to obtain the specific gravity of some of these fluids. A number of small glass bulbs were blown, and hermetically sealed; they were then thrown into alcohol water, sulphuric acid, or mixtures of these; and when any one was found of the same specific gravity as the fluid in which it was immersed, the specific gravity of the fluid was taken: thus a number of hydrometrical bulbs were obtained, &c."

Now, sir, though I am averse to ascribe to a gentleman of Mr. Farraday's frank and honourable character, any desire to compliment Mr. Davies Gilbert at the expense of humbler individuals, I can only acquit him of a contemptible flattery, on the supposition that he has never seen what all the world are familiar with—the neat and simple apparatus known by the name of Lovi's beads.

From the following description of these, which I extract from Fyfe's Manual of Chemistry (a work which I feel obliged to you for recommending to my attention), it will be at once seen that Mr. Davies Gilbert's hydrometrical bulbs and Lovi's beads are identical.

"These (Lovi's beads) are merely small glass balls with a little tail, having numbers on them corresponding with the specific gravity of the fluids in which they float. Thus bead 1000 floats in distilled water, and 1850 in oil of vitriol. When we wish to find specific gravity by these, we put in bead after bead till we get one to float, or till we get one to sink, and another to rise to the surface; the specific gravity is denoted by the number on the bead; or it is intermediate to those on the one that sinks, and the other that swims. Thus, if 1075 sinks, and 1074 floats, the specific gravity is 1074½."

I am, Sir,
Your obedient servant,
One of the Prys.

EFFECT OF CULTIVATION ON CLIMATE.

It has often been assumed as an incontrovertible fact, that the clearing of the ground, and the extension of agriculture, have a material tendency to meliorate the character of any climate. But professor Leslie is of opinion (Art. *Climate*, Suppt. Enc. Brit.) that, whether the sun's rays be spent on the foliage of the trees, or admitted to the surface of the earth, their accumulating effects in the course of a year, on the incumbent atmosphere, must continue still the same. The direct action of the light would, no doubt, more powerfully warm the ground during the day, if this superior efficacy were not likewise nearly counterbalanced by exposure to the closer sweep of the winds; and the influence of night must again re-establish the general equilibrium of temperature. The drainage of the surface will evidently improve the salubrity of any climate, by removing the stagnant and putrifying water; but, the professor thinks, it can have no effect whatever in rendering the air milder, since the ground will be left still sufficiently moist for maintaining a continual evaporation, as the consequent dissipation of heat.

ON THE LIGHT OF THE MOON.

Sir,—in a recent number of your excellent publication, (which having mislaid, I am sorry not to have before me,) a correspondent informs us, that the light of the moon is not reflected from the sun, but is proper and identical to that satellite, being produced by some *chemical* combination of the sun's rays with the moon's atmosphere. He also asserts, that a sphere cannot reflect light except from *one point, i. e.* that formed by the angles of incidence and reflection, with the eye of the observer.

I naturally expected that such vagaries would have been speedily confuted by some correspondent of your's, better versed in astronomy than myself; but several weeks having elapsed since its appearance, and thinking it a pity that a great absurdity should be laid before your readers, without being followed by its antidote, I venture to trouble you with the present communication.

In the first place, what does your correspondent mean by "the moon's atmosphere?" He should first make it appear that she *has* one, and of which kind it is?—for the unvarying aspect of every part of the moon's delineated surface, sufficiently proves the absence of aqueous vapours or clouds, which, did they exist, would at times intercept the eye of the astronomer.

It often happens that fifty or sixty degrees of longitude, and eight or ten of latitude of the surface of this earth, are simultaneously curtained in clouds, of which also, at certain seasons, a dense band is girt around its equatorial circumference, of several degrees in breadth. Now, masses of clouds of far less extent than these, would be plainly visible on the moon's surface, presenting bright, luminous, changeable, and transitory patches. The horizontal refraction on the moon's surface does not exceed *five seconds*, while on the surface of the earth it is at least a thousand times greater; consequently, if the moon can be said to have any atmosphere at all, it is evidently more rare than the vacuum we can produce by the best air-pump. Rather too fine this for the lungs of a Londoner,—and, I should think, too light to retain any fluid on the moon's surface less dense than mercury.

But atmosphere or no atmosphere, your correspondent should have stated more clearly what he meant by the production of light by the sun's rays acting *chemically* on *any* atmosphere? That our atmosphere greatly contributes to the production or rather retention of the light we enjoy, every body knows; for without the reflection from it, we should be in the dark every time we turned our backs to the sun; and total darkness would ensue the instant after sunset. But what is there *chemical* in this production of light? It certainly might more properly be called *mechanical*, for is it not one body impinging upon another, according to the mechanical laws of incidence and reflection?

With respect to the idea, that a sphere cannot reflect light from its entire semi-diameter, but only at one small point, at equal angles between the luminary and the eye, your correspondent seems to have been led astray by having heard, that *with a sphere of polished glass, such indeed might be the case.* The continual evidence of our senses, proves to us, that, generally speaking, opaque bodies reflect the light, not with reference to their shape, but to their colours, or liability to absorb part of the rays. It would be superfluous to say more, except to mention a few little *facts*, without a good store of which, and perhaps also a few good and clear analogies, we should do well never to venture on the concoction of any system or theory, let it be ever so flattering to our false pride, our "piety," or ingenuity. It has been through giving scope to such fantasies, that mankind have gravely constituted themselves the buffoons of the creation, and are perpetually seen hunting the will-o'-the-wisp, mounted on a more complete nonentity, a *metaphysical* horse!

A few simple and homely facts respecting reflected light, may be shewn in the following manner.—Exclude all the light from a room, except a small ray of sunshine admitted through a hole in the window shutter. The ray will only be visible at the bright spot, or reflection, on the floor or opposite wall, and by the reflection of the light on the innumerable particles of various substances and shapes, with which the atmosphere of the cleanest and stillest room will then prove to be loaded, and which will shew like so many little luminaries, whose course may be decided by the slightest breath. Upon approaching any object, a book for instance, to the vicinity of the ray, it will still be in darkness, but place a bit of any opaque substance, a ball, a marble, or a bullet *within* the ray, and, assuming the appearance of a little planet or satellite, it will reflect you sufficient light to read distinctly. The common house flies which flit through the ray, will have every appearance of fire-flies,—indeed, if the room be well darkened, a person not knowing the contrary, would not easily believe but that they really were of a bright luminous nature. I beg further to inform your correspondent, that should he, when travelling in a stage on a dark night, wish to consult his watch, he will only be able to do so, upon the coach driving past a wall, or if somebody on the coach box should project the tail of their coat, or a wisp of straw, either of which auxiliaries, will reflect him back the light of the lamps sufficient for his purpose. A stationary wisp of straw projecting from the coach-box, might enable him to read, when without it he would not be able even to see the book.

Your correspondent must surely have remarked the considerable increase of light which is procured us by the presence of a certain quantity of high white clouds. For my part, as I lie in bed of a morning, and happen to perceive that my room is unusually dark for the hour, I immediately conclude that it is either *very* cloudy, or that it is *quite cloudless* and cerulean, and upon opening my window curtains, I find either one or the other to be the case. Of course, the window must not be exposed to the sun. The same observation holds good in the evening, which "draws in" considerably sooner, with a very clear and cloudless sky, than where there are a few clouds to reflect the light.

In the lucid atmosphere of Sicily, the summit of Mount Etna sheds around a kind of moon-light, some time before the sun has risen to the cities at its base. Is this also a *chemical* operation? On the summit of this, and other mountains above 10,000 feet high, the sun's rays possess the same or rather greater initial power than on the plains below: but the air is so clear and so much freer from particles to reflect the light, that upon turning our back to the sun, and elevating the eyes a little above the horizon, we seem to be almost in the dark; provided of course there be no clouds floating beneath,—they very rarely reach the summit of the mountain.

While on this subject of atmosphere, I will venture to observe, that from the strong reflecting power of ours, I am almost inclined to doubt whether an astronomer in the moon, though furnished with the best telescope, would be able to distinguish any permanent geographical delineations on the surface of our earth, as we do on that of the moon, so as to return us the compliment of publishing a good map. I fear that the reflection from our atmosphere must be so great, as to involve the whole surface in one luminous appearance, in which the only variation would be occasioned by certain puzzling changeable spots formed by the congregated clouds, which would reflect more light than the rest of the surface. What discussions concerning the nature of our earth, these appearances may give rise to, amongst the lunar astronomers "and divines," it is not, at this distance, easy to determine. Having no water nor clouds themselves, I fear they will not easily hit on the truth.

Be their speculations, however, what they may, it would be well for both the communities to enact, that unless a man can *prove* himself to be duly and *legally* "*inspired*," he must not expect to force us to believe in his systems and assertions, when such are totally at variance with the evidence of our senses.

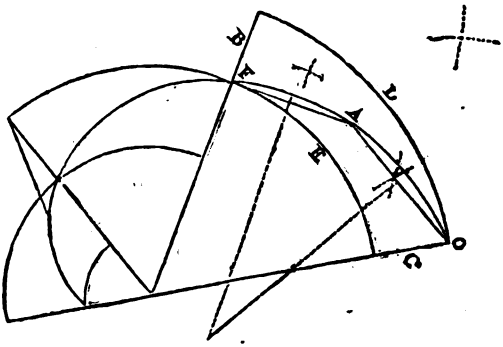
With esteem, I am, Sir,

Your obedient Servant,

F. M.

15th August, 1826.

WATCH-MAKER'S SNAIL



Sir,—A recent number of the Mechanics' Magazine, contains some inquiries of your correspondent *Indicator*, respecting what he calls the *watch-maker's snail*, but which, in fact, is a *spiral line*. I also have no books at hand, or, at least, leisure to look into them; but, it occurs to me that the part of the work which Indicator says he performed *by guess*, may be geometrically described as follows:—

The part of the spiral contained between any two radii is the arc of a circle, the radius of which is enlarged or diminished in proportion to the number of divisions in the primary concentric circles on which the spiral is to be formed; and, in order to have the spiral true, the middle of the space, A, included by the two radii, B C, and the two arcs, D E, must be found. This will shew three points, F A O, through which the arc of a circle is to be drawn. But as the method of doing this is shewn in all elementary books on geometry, I need not describe it, though I have drawn lines from point to point, and erected perpendiculars on each, extending the perdiculars till they coincide, and the point of coincidence gives the radius of the arc required. I have, to shew the principle, confined by myself to three or four concentric circles; but the greater the number, the more gradual will the spiral be. It is evident that the work must be repeated at every division, though, if the radii be equidistant as well as the concentric circles, much trouble may be saved in finding the middle point A.

I am, Sir,

Your's, &c.

D. H.

Yeovil, 23rd August, 1826.

NICHOLSON'S PORTABLE HEATERS.

In 1822, Mr. John Nicholson, civil engineer, took out a patent for two sorts of apparatus, for "more conveniently applying heat to certain instruments of domestic use"--curling irons and Italian heaters; and considering their simplicity and usefulness, we are rather surprised that they have not ere now come into general use.

Fig. 1

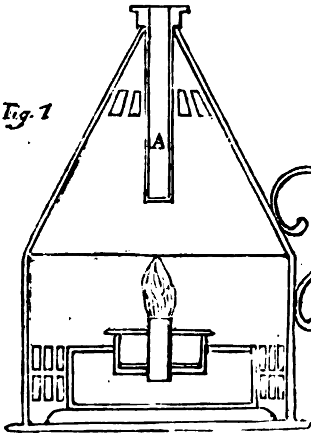


Fig 2

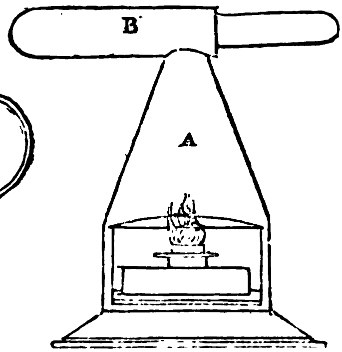


Fig. 1, is a section of Mr. N.'s contrivance for heating curling irons. A, is a cylindrical tube closed at the bottom, for the reception of a pair of curling irons to be heated; this tube is supported by the sides of the outer vessel, of a conical form half way down, and cylindrical below. In the bottom of the vessel a lamp is placed for the purpose of heating the tube, A, above, in which the curling irons are to be introduced; small apertures are made in the external vessel, in order to admit air below, and allow the smoke to escape above.

Fig. 2, represents the apparatus for heating an instrument called an Italian iron, used in smoothing small articles of muslin or othes wearing apparel. A, is a hollow conical casing of metal supporting the iron, B, and fixed thereto or made moveable to suit circumstances; at the lower part is a foot, and within a lamp for heating the iron. Apertures are formed in the sides of the casing, by which the air is admitted, and this becoming heated by the flame of the lamp which plays upon the interior, heat is disseminated over the whole surface of the Italian iron.

The vessels may be varied in form to suit other purposes; and it was also in the contemplation of the patentee to heat by these means the irons of apothecaries and druggists, for spreading plasters; and those used by wine-merchants and others for melting wax in corking bottles.

SCIENTIFIC MEMORABILIA.

(Continued from our last.)

Chinese Astronomy.

The Chinese have been represented, by some of the French Missionaries, as profound astronomers, at a time when all Europe was in a state of barbarism; as being able to calculate the recurrence of eclipses, to adjust the irregular motions of the sun and moon, to measure the distance of the planets, &c. But if even the Chinese did possess such knowledge, of which there is no proof whatever, it must long since have been extinguished. When Adam Schaal, one of the earliest Jesuists, made his way to Pekin, he found that the Chinese knew so little of astronomical calculations, that they had introduced an intercalary month into the wrong year! At a later period, the emperor Kaung-hee, brought the president of his imperial board of astronomy to trial, because he could not calculate the length of shadow which a gnomon would throw, but which was imme diately done by Father Verbiest. This sensible prince put himself under the tuition of the Jesuits, who made a quadrant for him, and translated into the Chinese language, a set of logarithm tables, which were printed, and a copy of which is now in the library of the Royal Society of London; a very beautiful specimen of Chinese typography. Kaung-hee carried these tables and his quadrant suspended from his girdle, and when in Tartary, is said to have constantly amused himself in taking angles and measuring the height of mountains.

Concentration of Cold by reflection.

The fact that frigorific impressions may be collected and concentrated in the focus of a metallic reflector, is one of the oldest in physical science. The experiment was first mentioned about the year 1590, by Baptiste Porta, in the enlarged edition of his *Magia Naturalis*, when the four books, of which it originally consisted, were augmented to twenty, at the very time that his ingenious countryman, Sanctorio, had invented and applied to medical purposes, the air thermometer. Porta relates, that, if a shut eye be held in the focus of a speculum, before which is placed a ball of snow, intense cold will be felt on the eye-lid. Cavalieri, the celebrated discoverer of infinitesimals, in his work on the conic sections, printed in 1632, and entitled *Lo Specchio Ustorio*, extended the experiment to all impressions which he conceived to be propagated in straight lines, not only to those of heat and cold, but to those of sound, and even smell. It was afterwards frequently repeated at Florence, by the Academy del Cimento, with the important addition of the thermometer, which that learned body had the merit of introducing into general practice. Similar experiments were next performed by Mariotte, in France. Speculas and burning glasses appear, in the sequel, to have been allowed to fall into great neglect. We find scarcely any mention of their application to physical researches, till after the lapse of more than half a century. Kraft repeated, at St. Petersburg, during the severe winter of 1740, the frigorific experiment of the Italian philosophers, with a reflector belonging to the Imperial Academy. Ambitious of operating on a grand scale, he selected three huge blocks of clear ice, nearly of a cubical form, each side being two, four, and five feet; but, to save the trouble of transporting them, he carried the speculum out of doors. No sensible effect, however, was then perceived by him, though he used the air thermometer, on account of its extreme delicacy. In 1744, Kraft again resumed the observation, and with scarcely better success, having obtained only a doubtful cold of three degrees. The cause of the failure was evidently his performing the experiment out of doors, and not in a warm room. The blocks of ice had, by long standing, acquired almost the same temperature as their ambient medium. Had the air happened to become suddenly colder, they might, from their relative condition, have excited impressions, even of heat, and thus have perplexed philosophy for many years afterwards.

Such unsatisfactory results from the action of a mass of ice, of a ton weight, seem, for a long time, to have shaken belief in former experiments; and the subject was almost forgotten, when M. Pictet, of Geneva, in 1781, repeated the original observation, on a small scale indeed, but with entire success. Since that time, a pair of brass reflectors, with a wire case for holding charcoal or snow, has been deemed an essential apparatus in every physical cabinet.

The concentration of cold in the focus of a speculum, always excites surprise; and the experiment is often exhibited with a sort of mysterious air, as if it established the distinct and material existence of cold. But, in fact, it is not more difficult to conceive the impressions of cold to be collected, than those of heat. Both these impressions are only relative to the temperature of the atmosphere, which serves as the medium of their transmission. The one process terminates with the deposition of a portion of heat, and the other, with its abstraction.

Amalgamation.

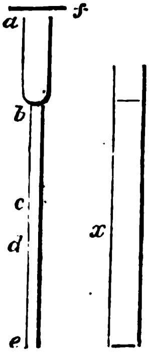
It is scarcely half a century since the process of amalgamation, for procuring gold and silver, by means of their attraction for quicksilver, was practised, in that first of mining countries, Germany; while, in South America, it is nearly as old as the arrival of the Spaniards. The quicksilver mines of Guancabellica, in Peru, were discovered in 1563, and three years thereafter, the Spaniards began to employ amalgamation. It had been already practised in Europe for collecting silver and gold, when they existed in visible metallic particles, but not in the case of ores, where the gold and silver are invisible, even with the aid of a microscope. Soon after its application to ores, in America, an attempt was made, by a Spaniard, to introduce this operation for extracting silver from the ores, in Bohemia, but without success. The process was, thenceforth, quite neglected on this side of the Atlantic, till Baron Van Born became, in 1770, attached to the department of the mines and mint, at Prague. Van Born perceiving the advantages of amalgamation, particularly in the saving of fire-wood, which had become scarce in many parts of Hungary, set about examining the accounts given by authors, of the different processes used in Mexico and Peru; he then repeated these processes experimentally, with the greatest success, and finally published a treatise *on amalgamation*, in which the whole theory and practice of the art was developed. The baron met, however, with much opposition in his attempts to introduce this improvement. He says, that some book-learned chemists, who had never handled a retort, and some mine overseers, declared that it was quite impossible to obtain silver by any such method. Even after he had succeeded in getting silver from the ore, publicly, at Vienna, his detractors came forward with doubts and long calculations, shewing that amalgamation, was inferior to the processes of smelting and cupellation, already in use. At last the new process was tried on a large scale, by order of Joseph II. at Schemnitz; and when the calculators and doubters could no longer deny its superior efficacy, they shrugged up their shoulders, saying, 'Oh, it was only the old process of Spanish amalgamation.'

PETER.

(To be Continued.)

LESLIE'S APPARATUS FOR ASCERTAINING THE SPECIFIC GRAVITY OF POWDERS.

The instrument consists of a glass tube *a c*, (see next page) about three feet long, and open at both ends. The wide part, *a b*, is about 4-10ths of an inch in diameter; the part, *b c*, about 2-10ths. The two parts communicate at *b*, by an extremely fine slit, which suffers air to pass, but retains sand or powder. The mouth at *a* is ground smooth, and can be shut so as to be air-tight, by a small glass plate, *f*. The substance whose specific gravity we wish to find, suppose it to be sand, is put into the wide part of the tube, *a b*, which may either be filled to the top or not. The tube being then held in a vertical position, has the narrow part immersed into mercury, contained in an open vessel, *x*, till the metal rises within to the gauge *b*. The lid is then fitted on air-tight at *a*. In this state, it is evident there is no air in the tube, except that mixed with the sand in the cavity, *a b*. Suppose the barometer at the time to stand at 30 inches, and that the tube is lifted perpendicularly upwards till the mercury stands in the inside of *b c*, at a point *c*, 15 inches (or one-half 30) above its surface, in the open vessel; it is evident then that the air in the inside of the tube is subjected to a pressure of exactly half an atmosphere, and of course it dilates and fills precisely twice the space it originally occupied. It follows, too, that since the air is dilated to twice its bulk, the cavity, *a b*, contains just half of what it did at first, and the cavity, *b c*, now containing the other half, the quantity of air in each of these parts of the tube is equal. In other words, the quantity of air in *b c*, is exactly equal to what is mixed with the sand in *a b*, and occupies precisely the same space which the *whole* occupied *before* its dilatation. Let us now suppose the sand to be taken out, and the same experiment repeated, only with this difference, that the cavity, *a b*, is filled with air only. It is obvious that the quantity being greater, it will, when dilated, be double the bulk, under a pressure of 15 inches, occupy a larger space, and the mercury will rise, let us suppose only to *d*. But the attenuated air in the narrow tube always occupies exactly the space which the whole occupied at ordinary atmospheric pressure, and this space, therefore, is, in the one case, the cavity *b c*, and in the other *b d*. Hence it follows that the cavity, *c d*, which is the difference between these, is equal to the *bulk of the solid matter in the sand*. Now, by marking the number of grains of water held by the narrow tube, *b c*, on a graduated scale attached to it, we can find at once what is the weight of a quantity of water equal in bulk to the solid matter in the sand, and by comparing this with the weight of the sand we have its true specific gravity.



Aware that some solid bodies, such as charcoal, hold much condensed air in their pores, and that probably they retain part of this even when reduced to powder, Professor Leslie obviates the chances of error arising from this source, by comparing the dilatation which takes place under different degrees of pressure, under 10 inches and 20 for instance, or 7½ and 15.

Charcoal, from its porosity, is so light, that its specific gravity, as assigned in books, is generally under 0·5, less than half the weight of water, or ⅐ the weight of diamond; taken in powder by the above instrument, it exceeds that of diamond, is one half greater than that of whinstone, and is, of course, more than seven times heavier than has usually been supposed. Mahogany is generally estimated at 1·36, but mahogany saw-dust proves, by the instrument, to be 1·68; wheat-flour is 1·56; pounded sugar, 1·83; and common salt, 2·15; the last agrees very accurately with the common estimate. Writing-paper, rolled hard by the hand, had a specific gravity of 1·78, the solid matter present being less than one-third of the space it apparently filled. One of the most obvious results was with an apparently very light specimen of volcanic ashes, which was found to have a specific gravity of 4·4. These results are, however, given as approximations merely by the first instrument constructed—*Scotsman*.

MICROSCOPIC MINUTENESS.

Swammerdam, so celebrated for his skill in the dissection of insects, always begun his observations with the smallest magnifiers, from which he proceeded to the greatest; but in the use of them he was so exceedingly dexterous, that he made every observation subservient to that which succeeded it, and all of them to the confirmation of each other, and to the completing of the description. His chief art seems to have been in constructing scissars of an exquisite fineness, and making them very sharp. Thus he was enabled to cut very minute objects to much more advantage than could be done by knives and lancets; for these, though ever so sharp and fine, are apt to disorder delicate substances by displacing some of the filaments, and drawing them after them as they pass through the bodies; but the scissars cut them all equally. The knives, lancets, and styles he made use of in his dissections were so fine, that he could not see to sharpen them without the assistance of a magnifying glass; but with these he could dissect the intestines of bees with the same accuracy that the best anatomist can do those of larger animals. He made use, also, of small glass tubes, no thicker than a bristle, and drawn to a very fine point at one end but thicker at the other. These were for the purpose of blowing up, and thus rendering visible, the smallest vessels which could be discovered by the microscope, to trace their courses and communications, or sometimes to inject them with coloured liquors. This is the way to discover, like Columbus, a new world—but in the cup of a flower, or a morsel of decayed cheese!

MEASUREMENT OF TIMBER.

Sir,—Mechanical and working men may often be deceived, by artful and designing persons, in the purchase of materials for the manufacture of their articles of trade, and, therefore, they should direct their attention to this point in particular. For instance, it may not be generally known that a piece of timber, measured in the whole, will be less in proportion than when cut into two exactly at the middle. An honest workman in hard wood, looks at a tree that girts four feet at one end and two feet at the other end, being 20 feet long; now the measure of this tree will be $\frac{4+2}{2}=3$ =mean girt; then $\frac{3}{5}=0,6$, and $0,6\times 0,6=0,36$; $0,36\times 40$, or twice the length $=14,4$ feet cubical or solid in the whole tree; now cut this in two it will measure, the first piece four feet one end, three feet the other, and ten feet long; the second piece three feet at the large end and two feet at the small end, and ten feet long. Then $\frac{4+3}{2}=3,5$ mean girt, $\frac{3,5}{5}=0,7$, and $0,7\times 0,7=0,49$; $0,49\times 20$ twice the length, $=9,8$=solidity of larger end. Again, $\frac{3+2}{2}=2,5$ mean girt, $\frac{2,5}{5}=0,5$, and $0,5\times 0,5=0,25$; $0,25\times 20$ twice the length=5 feet solid less end; so that $9,8+5=14,8$, which is exactly $\frac{4}{10}$ of a foot more than the measure of the whole stick; therefore, if the wood be worth 5s. per solid foot, the purchaser pays 2s. more for this little stick of timber, if he buys it in two pieces, than if he had purchased the whole at once; and when the tree is very large it will make a larger difference. I have seen an instance in which a person gained 20s. by dividing a tree in this way between two persons; now had they purchased it jointly, and then divided it, they would have saved 20s. between them.

Your's,

R. Jackson.

N.B. The calculation of the admeasurement given, is according to Mr. Bonnycastle and Dr. Hutton's Rules for accurately measuring timber, viz. let, c=circumference, l= length—then $\frac{c}{5}\times\frac{c}{5}\times 2l=\frac{2c^2l}{25}=\frac{c^2l}{12,5}$=solidity; but, by any method of measuring the difference will be the same, or nearly. I am aware, and not a little astonished, that the measuring of timber is generally done in a clumsy way, and very far from being accurate, yet surely without accuracy, strict justice cannot be done, and it is by no means right, that because A has paid too little, B should pay too much; it may be all the same to C who sells to both, but between A and B the case is very different. Now, where it happens that a tree runs very tapering the deception is more practicable; for, let a tree be supposed to girt 14 feet at the greater end, two feet at the less end, and eight feet in the middle, that is $\frac{14+2}{2}=8$, the mean girt; then if you cut it where the girt is $\frac{1}{3}$ of the greatest girt, you will find the greater end to measure more than the whole tree, for, according to the common method, $\frac{8}{4}=2$, and $2\times 2=4$ then $32\times 4=128$ feet, (this is the usual method in practice) that is, 128 feet content of the whole tree; then, taking this example, we shall have $12 : 8 :: \frac{32}{3} : 7\frac{1}{9} =$ length to be cut off, and $24\frac{8}{9} =$ length remaining, the smaller end of which will be $\frac{1}{3}$ of the greatest girt, that is $\frac{14}{3}=4\frac{2}{3}$,

then, $\frac{14+4\frac{2}{3}}{2}=9\frac{1}{3}=$ mean girt of larger piece, and $\frac{9\frac{1}{3}}{4}=\frac{28}{12}=2\frac{1}{3}=\frac{7}{3}\times\frac{7}{3}=\frac{49}{9}=$ square of $\frac{1}{4}$ girt; then $\frac{49}{9}\times 24\frac{8}{9}=\frac{224}{9}\times\frac{49}{9}=\frac{10976}{81}=185\frac{41}{81}$ feet, content of larger end, which measures $7\frac{41}{81}$ feet more than the whole tree, after $7\frac{1}{9}$ feet of the less end have been taken off the length, and this, in common practice, is unavoidable, and plainly shews how ignorance may be imposed upon.

IMPROVEMENT IN THE DIORAMA.

From the description which we gave in our last of this exhibition, our readers would perceive that it derives its principal charm from the employment of shifting skreens of different colours, to produce various evanescent effects of light and shade. We now learn, by an account received from Paris, of a new picture exhibiting at the Diorama there, (and which will, no doubt, make its appearance here in due course) that by also making parts of the painting itself to shift occasionally, and to open on a second painting behind, a combination of effects is produced, far superior to any thing hitherto exhibited. The subject of this new painting is the ancient and ruined abbey of St. Wandrille, in Normandy. While viewing it, an April storm is seen to arise; a pair of folding doors at the end of the chapel are blown backwards and forwards by the wind, and alternately display and conceal a landscape scene, extending over a large tract of country. In the mean time, the clouds are seen in rapid motion, through the roof of the building, sometimes obscuring the sun partially, then concealing it entirely, and then again suffering it to appear. The most curious feature is said to be the management of the light upon some trees which cling round the windows, and in some places overhang the ruined walls of the building. When the sun shines, the shadow of these trees is thrown upon the floor of the chapel; the shadow from time to time waving, as the trees themselves wave with the wind; and becoming more or less vivid as the sun shines out more strongly or is concealed.

SAFETY IN THE CONSTRUCTION OF CARRIAGES.

Sir,—Among other improvements which have been recently suggested in the construction of carriages, Mr. R. Jackson has proposed that the pull or draught shall be from the axletree, and that there should be attached to the centre axle a rotative joint, which turning freely at the neck, may allow the shafts to keep the same position in all situations. The effect of this rotatory kind of motion must certainly be productive of good consequences, with reference to that *part of the carriage* alone, but I fear it would be impossible to suspend the body, except by disconnecting it from the moveable shafts, as was undertaken many years ago by Count Rumford, who introduced two iron circles working upon one common pin, whilst the carriage part was attached to one circle, and the shafts to the other. The consequence intended was to give safety to the individual riding in the carriage, as the horse might, according to the present suggestion, fall upon his side without upsetting the body, and *vice versa*, the hind part of the carriage might be turned over without affecting the horse; but it was found by experiment to add so much to the weight of the draft from the want of compact unity of motion that the idea was given up.

As the whole draft in Mr. Jackson's contrivance is derived from the axle-tree, it may make some difference; but then it is to be considered that the iron work from the axle tree, which comprehends the proposed joint, must in itself sustain the whole weight of the carriage, and from such consequence be liable to break.

I should be inclined to think that the safest and best constructed two wheeled carriage is to be obtained by a suitable union of all the component parts, so introduced into action as to receive from the horse one consecutive impulse, derived (if I may use the expression) from the harmonious distribution of the component parts of the carriage. The rotatory movement sought for, might perhaps be contained *within each shaft*, by separating and conjoining them by a short piece of iron work of two pieces rivetted together, so as to admit of circular movement. I should wish Mr. Jackson to consider how far it might obtain the consequence he seeks, free from any objection.

SENEX.

BREWING SIMPLIFIED.

The art of brewing is exactly similar to the process of making tea. Put a handful of malt into a tea-pot; then fill it with water, the first time rather under boiling heat. After it has stood some time, pour off the liquor, just at you would tea, and fill up the pot again with boiling water; in a similar manner pour that off, and so go on filling up and pouring off, till the malt in the pot is tasteless, which will be the case when all the virtue is extracted. The liquor, or malt tea thus extracted, must then be boiled with a few hops in it, and when it becomes cool enough, that is, about blood heat, add a little yeast to ferment it, and the thing is done. This is the whole art and process of brewing, and to brew a larger quantity requires just the same mode of proceeding as it would to make a tea breakfast for a regiment of soldiers. A peck of malt and four ounces of hops will produce ten quarts of ale, better than any that can be purchased in London, and for which purpose a tea-kettle and two pan mugs are sufficient apparatus. A bushel of malt to 1lb. of hops is the most general proportion; and 18 gallons of good light ale, or table ale, may be produced from one bushel of malt and one pound of hops, which will not cost above 9s. that is, 6d. a gallon, or 1½d. a quart. Brewing utensils, consisting of a mashing tub and oar, a sieve, two coolers, and wicker hose, a spiggot and faucet, together with a couple of nine-gallon barrels, new from the cooper's, cost me no more than 36s. and with these utensils I have frequently brewed, at one time, four bushels of malt. The plan I have adopted is, from one bushel of malt to extract nine gallons of liquor for ale, and afterwards nine gallons more for table beer, both of which will be excellent.

J. B.

CHEMICAL UNION OF BODIES.

It was formerly considered as an axiom in chemistry, that for two bodies to unite chemically, it was necessary for one of them to be in a state of fluidity. Sir H. Davy adduces as a proof to the contrary of this, that crystals of oxalic acid and dry lime readily combine. But here the substances are both of them *soluble* in water, and in a state of division. It may be shown in a much more satisfactory manner by the action of two solid substances on each other, and both of them insoluble in water.

Form a cup of fusible muriate of silver (*Luna corneo*) into this put a small ball of zinc. The action will commence in a few minutes, and in the course of a day or two the ball will be partly or entirely dissolved. The cup will retain its shape, and will be found to contain a solution of muriate of zinc; that part of the cup in contact with the ball, will be reduced to the metallic state, in a very beautiful manner.

G. S. D.

NEW PATENTS.

To James Barron, of Birmingham, in the county of Warwick, brass founder, and venetian blind maker, for his invention of a combination of machinery, or apparatus for feeding fire with fuel, which machinery or apparatus, is applicable to other purposes.—Sealed 24th July—6 months.

To William Johnston, of Caroline-street, Bedford-square, in the county of Middlesex, jeweller, for his invention of certain improvements on ink-holders, which he conceives will be of public utility.—24th July—2 months.

To William Robinson, of Craven-street, Strand, in the county of Middlesex, Esq. for his having invented or found out, a new method of propelling vessels by steam, on canals or navigable rivers, by means of a movable apparatus attached to the stem or stern of the vessels.—24th July—2 months

To William Parsons, of the royal dock yard, Portsmouth, naval architect, for his having invented certain improvements, in building ships or vessels, which improvements are calculated to lessen the dangerous effects of internal, or external violence.—24th July—6 months.

To William Davidson, of Gallowgate, in the county of Glasgow, surgeon and druggist, for his new invented process or processes, for bleaching or whitening, bees' wax, myrtle wax, and animal tallow.—1st August—2 months.

To Thomas John Knowlys, of Trinity college, Oxford, Esq. and William Deusbury, of Bousal, in the county of Derby, colour manufacturer, for their having invented certain improvements in tanning.—1st August—6 months.

To Count Adolphe Eugine de Rosen, of Princes-street, Cavendish-square, in the county of Middlesex, in consequence of a communication made to him by a certain foreigner, residing abroad, for an invention of a new Engine for communicating power, to answer the purposes of a steam engine.—1st August—6 months.

To Joseph Browne Wilks, of Tandridge-hall, in the county of Surrey, Esq. for his invention of improvements, in producing steam for steam-engines and other purposes:—2nd August—6 months.

Mechanic's Magazine.—In obedience to the suggestion of the Lord Chancellor, at the hearing of the suit concerning this work, in which Messrs. McCoy and Sidney, as Assignees of Messrs. Knight and Lacey, of Paternoster-row, printers and publishers, are plaintiffs; and Mr. J. C. Robertson and Messrs. Hunt and Clark, are defendants, the parties to such suit have agreed to arbitrate their differences, and in the mean time to avoid the injury to the Magazine which is caused by a double publication; and that the subscribers may no longer be embarrassed by uncertainty as to the genuine series, it is arranged, that, until the determination of the arbitrators, it shall be published exclusively by the assignees, at 55, Paternoster-row: and that Mr. Robertson shall, in the mean time, edite the work as before.

Bowden and Walters, solicitors for the plaintiffs,

Jno. Evans, solicitor for the defendants.

ERRATA.

Page 298, col. 1, l. 29 and 32, ——, c. 2, l. 12, 17, 22	for "number" read *numerator*.
——, line 6 from bottom, ——, last line, Page 299, col. 1, line 5 from bottom ——, last line ——, col. 2, lines 2, 4, 6, 11, and 19,	for "denominator," read *denomination*.

Page 299, col. 1, lines 25 and 26 to be joined in one, and only a semicolon between them.

Page 300, col. 1, line 4, "How much had he left, and how much had the daughter?" read "How much had *I* left, and how much had the father and daughter each?"

NOTICES TO CORRESPONDENTS.

If the patentees of Yandall's Califver and Refrigerator will furnish us with a particular description of it, we may probably think it deserving insertion; but the notice sent us is an advertisement merely, and would convey no information to our readers.

T. M. B.—Medicus (who will find a letter addressed to him at Peel's coffee-house on Monday next)—John Smith—F. M.—P. P.—A Landsman—Colin—Mr. Richardson—Mr. Jones—F. M.—W. Mc F.—J. Barnard—Amphibious—Justitious—A Builder—H. W.—1 and 2 make 3—Amicus—A. B. by E. C.—and Antifumus.

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Mechanics' Magazine,

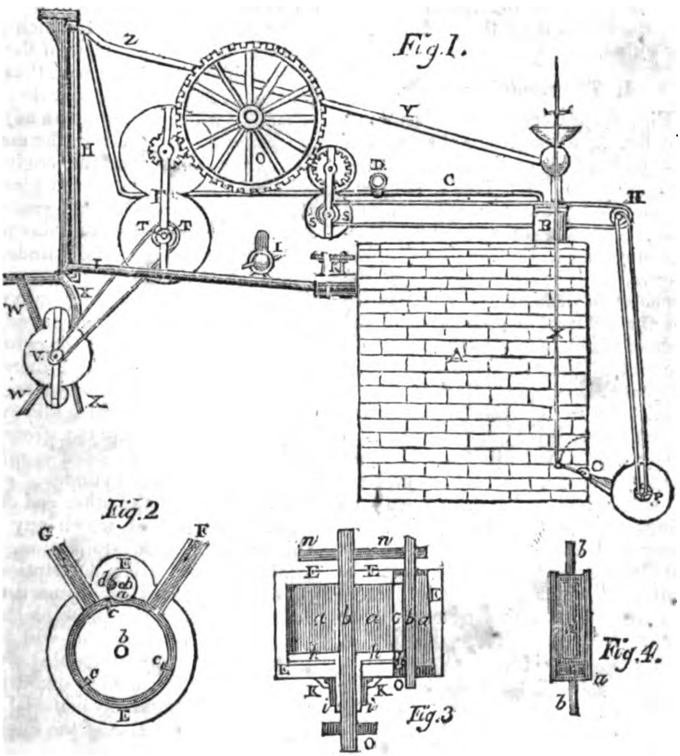
MUSEUM, REGISTER, JOURNAL, AND GAZETTE

No. 161.] **SATURDAY, SEPTEMBER 23, 1826.** **[Price 3d.**

"Thinkers are as scarce as gold; but he whose thoughts embrrace all his subject, pursues it uninterruptedly and fearless of consequences, is a diamond of enormous size."

LAVATER.

EVE'S PATENT STEAM ENGINES.



EVE'S PATENT STEAM ENGINES.

The improvements which Mr. Eve claims by his patent consist of the following five particulars:—

I. The application of revolving cones to rotary engines, for the purpose of compensating any loss by friction.

II. A steam generator so constructed of tubes, that the heat of the furnace shall cause the water to circulate constantly through these tubes, so that they shall be less liable to burn out or become oxidated.

III. An arrangement of one or more revolving cock or cocks, for the purpose of supplying the genrator with water, in lieu of the ordinary forcing-pump.

IV. A new safety apparatus, by which the elasticity of steam in boilers is ascertained by weight applied directly instead of indirectly, as with the ordinary steel-yard valve.

V. An arrangement of cog-wheels, with a compound engine in such a manner, that the steam after having acted as high pressure, may be used with low pressure, with greater effect than in any engine now in use.

The manner in which each of these improvements is effected, we shall now proceed to explain; taking the specification of the patêntee for our guide.

I. *The revolving Cones.*

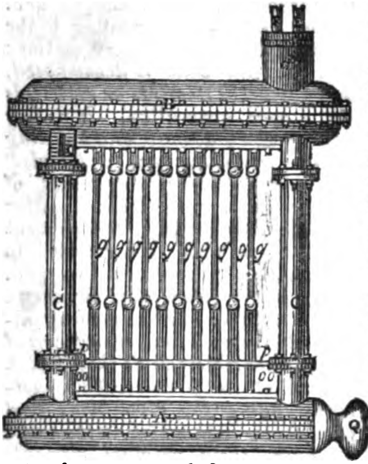
Fig. 2, presents an end section; and fig. 3, a longitudinal section of this part of an engine, constructed according to Mr. Eve's simplest manner.—*a a* are the cylinder and cone, revolving in contact in opposite directions, the cone having one groove, and being one-third of the diameter of the cylinder, which latter has three wings or pistons, *c c c*, the ends of which, as they revolve, touch the outer case, E, and do not admit any steam to pass. The steam is admitted through the pipe, F, and acting on the wing, *c*, causes the cylinder to revolve until the said wing passes the pipe, G, where the stratum of steam lodged between each two wings is allowed to escape; the wing which has thus passed, falls into the groove, *d*, of the cone, the bottom of which groove it touches in passing, thus allowing no steam to escape between. The said wing, *c*, then passes again by the steam-pipe, F, and is acted upon as before described, and so on in rotation. The cylinder, *a*, which is firmly fixed to its axis, *b*, rests on one side, on the outer case, E, through which the axis projects; but as there is some friction produced by the revolution of the said cylinder at its two ends, touching the outer case, Mr. Eve has placed a false end, *h h*, under the opposite end of the cylinder, which false end slides on the axis, *b*, freely, and has a thread out at the end, by means of which, and the adjusting nut, *i*, the cylinder, if worn at the two ends can be easily tightened and adjusted. The adjusting nut is confined by the collar, K, which collar is screwed to the outer case. The conical shape of the small runner, which can likewise be moved upwards or downwards in the outer case, serves to keep the two convex surfaces of the cylinder and cone in contact; so that no steam can escape between them. Mr. Eve conceives that from the conical shape of the runner, the longer the engine will be in use the better it will work, and the more steam-tight it will become.

By referring to fig. 4, which presents a longitudinal view of the conical runner, it will be seen that the groove, *d*, is cut into a separate piece of metal, which slides by an adjusting screw up and down in the empty space, X, so that when the engine is adjusted, the groove or the piece of metal into which the said groove is cut, can be moved up and down, so as to fit the wings of the cylinder by means of the adjusting screw, O. Two cog-wheels, running into each other, are attached on the outside of the engine to the axis of the cylinder and cone, and are placed there for the purpose of producing a corresponding revolution of the said cylinder and cone, causing the groove of the cone to present itself regularly to the wings of the cylinder. *e* is a pinion, fixed to the other end of the axis, by means of which any machinery can be put into motion.

Mr. Eve has given descriptions of two other modes of construction, founded on the same principle as the preceding; by means of which the power gained may be doubled, by the application of a double quantity of steam, but without any material augmentation in the size of the engine.

II. *The Steam Generator.*

The next fig. is a side view of the generator. A, the lower conduit pipe; B the steam receiver; C C are two pipes in which the water descends from the steam receiver to the lower or conduit pipe; *d* is the dome connected with the steam receiver, from which dome the steam enters into the steam-pipe, F, and into pipe E, which latter leads to the safety apparatus: *g g g g g g g g g g* are ten pipes which communicate with the lower conduit pipe, and the upper pipe or steam receiver.



p is the grate and fire-place, over the middle of which the smaller combination of pipes are placed: *o o* is the ash-pit; Q is an end which screws into the lower conduit pipe, by means of which the same may be cleaned out when necessary; the number of sections, number of pipes composing each section, and the manner in which the pipes are bent, is arbitrary. The generator or boiler is fed with water through the orifice *o*. The heat of the furnace will cause the water to circulate constantly through the tubes, thereby preventing the steam from driving the water out of them, and by which means they are, in a great degree, prevented from burning out or oxidating. The tubes are from ⅛ to ¼ inch thick, and 1 and 2 inches diameter; they may be of copper, iron, or any other metal which is sufficiently strong to bear the pressure. This pressure will be comparatively small, on account of the small size of the pipes, although steam of the highest pressure be used. Mr. Eve's horizontal pipes are 1¼ inch thick, and 9½ inches diameter; the vertical pipes ½ inch thick, and 4½ inches diameter. To the orifices of each of the section pipes, where they enter into the horizontal tubes, there are valves attached, so that in case of a rupture in one of the sections to which they belong, the unbalanced pressure of steam will force the water so rapidly into the particular section that is ruptured, as to cause the valves to close, thereby preventing any waste of steam, and detaching the ruptured section from the rest of the generator, whereby the engine need not be stopped, but will only lose so much of its power as the proportion of one section to the remaining sound ones would be. The two large vertical, as well as the two large horizontal tubes, are imbedded in brick-work, and the sections only are exposed to the heat of the fire; it is, therefore, inferred, that no steam will be found or generated in the former, while the action of the fire will cause the steam and water to ascend rapidly through the small pipes into the steam receiver, while the water in the steam receiver, being heavier than the water combined with steam in the smaller pipes, will descend through the vertical tubes into the lower conduit tube, thereby causing a continual circulation through all the tubes, great and small. The steam will of course accumulate at the top, and through the dome find its way to the steam-pipe and safety apparatus. In case the circulation should be too rapid, and to prevent the possibility of the water being forced into the steam-pipe before it descends again through the vertical pipes, Mr. Eve has placed a piece of sheet iron, perforated with small holes, similar to a strainer, in the middle of the steam receiver, all across from end to end.

(To be concluded in our next.)

TRANSFORMATIONS OF MATTER.

Mr. Allen's Lectures at Guy's.

Sir,—In a recent number of your useful miscellany, an ingenious Correspondent has favoured us with a minute, and, I dare say, an accurate calculation of the length of time that it would have taken Archimedes to move this globe, through the space of one inch, with the precise length of the lever, and the space through which its end, the furthest from the fulcrum, would have to travel in the operation. With full confidence in that gentleman's ability, I flatter myself that he will be no less ready to favour us with another calculation more connected with realities, and with "our best hopes and interests," although it will, I fear, cost him many more places of numbers, than the one of the lever. I should first crave your indulgence for not being able to state the question without some circumlocution, but, in a matter of such delicacy, I should not like to be misunderstood.

You must, Sir, have perceived how much, of late, it has become the fashion to boast of the rapid strides which science and philosophy are now taking in their march through Europe, and especially in this most favoured portion of it. But surely it ought to be the duty of the authorities and upholders of social order, to see that, in these great strides, the unhallowed feet trample not upon the flowers of the garden of faith, and bruise not the very stem of the tree of life! I am reluctantly led to these remarks, from the perusal of a portion of a lecture, delivered to the students of Guy's Hospital, by Mr. William Allen, who being a profoundly religious man, and a member of the "Society of Friends," we are the more pained and surprised to find lecturing in direct hostility to law and authority. He says, "If the human powers fail in attempting to account for the nature of the changes in inert matter, how must its difficulty be increased when we come to consider organised bodies? Here, in consequence of the addition of the living principle, the attractions of inert matter are surprisingly modified; a seed contains rudiments capable of being expanded into a large tree: every tree has its peculiar form, and is capable of producing the rudiments of others. Here carbon, hydrogen, and oxygen, which, left to themselves, would form compounds chiefly binary, being absorbed by the organs of the plant, form part of its substance, and are converted into living matter, under a more complicated order of affinities. The vegetable having flourished during a limited time, is deserted by the living principle, and the elements of which it is formed, the carbon, hydrogen, and oxygen, attract each other according to the laws which regulate inert matter; *and thus the body is decomposed, and furnishes elements or materials for a new generation. It is like pulling down a house, and building another with the same materials.*" "Through every varying forms of animated beings, the original matter is continually passing; the element azote, in animals, being added to the carbon, hydrogen, and oxygen. Hence it will follow, that air, earth, water, together with the present animals and vegetables, *are composed of the same materials as those which existed at the first creation, notwithstanding the revolutions and changes through which, in the series of ages, these original elements must have passed,*" &c.

This may be very sound "philosophy" of Mr. Allen's, but it is of such a "pulling down" description, as I thing the Attorney General ought to "pull him up" for! Is it not pulling down the real orthodox, "resurrection of the body," of which it is written "For if the dead rise not, then is not Christ raised." Cor. xv. v. 16. It would evidently be unfair to attribute any bad or subversive *intentions* to the lecturer, but I think that he, as well as all other lecturers, should be warned against allowing their philosophy to take such extended flights, and against their too common practice of destroying one set of physical supports of a legally established system, without giving themselves the trouble to set up any others in their stead. That Mr. Allen intends, and is fully competent to establish another theory of physical resurrection, for the one he has attempted to destroy, it would be libellous to doubt, but as the lecture I have quoted, was the last of a series, many months may elapse before he may have an opportunity of discharging this sacred debt, which he owes to the public and to authority. In the mean while, therefore

I hasten to communicate a philosophical succedaneum which has just crossed my mind, but which I cannot put into any creditable shape, without the previous assistance of your mathematical correspondent above alluded to. My idea will be found to have many objections, but what system has not? That which most inclines me to despair of making any thing of it, is, that another philosophical lecturer, though of a different class, named Irving, has declared that "the pouring out of his last bottle" is at hand, by which I am told, is meant, the destruction of this world; now should such an accident happen so soon, I shall not, by my plan, have time to produce the physical resurrection even of an earth-worm, much less of the entire human species,

We know, as Mr. Allen informs us, that all fluids, gases, solids, especially organized ones, consist of the same particles of matter, which, in the different modes of carbon, hydrogen, lime, azote, silica, oxygen, &c. &c. circulate and succeed each other in a variety of changes and re-productions, limited only by the *number* of particles of the above-mentioned modes of matter, employed to play the changes. Like the changes, therefore, upon the notes of the gamut, or upon a peal of bells, must not the changes and combinations of our stock of particles of carbon, azote, &c. at length be exhausted? Then might it not, some day or other occur, that the very same particles of matter, so many and no more than were collected on any given day in the body of any one human being, after circulating for millions of ages, through earth and air, cloud and ocean; through fish, beast, insect, man, and plant, should at length exhaust their number of changes and transpositions, and become again united in another identity, without the millionth part of a hair, or of a globule of blood being wanting, to render it the self same physical body of a man as before?

It certainly must take a very long while to bring about any one instance of such actual "building up again with the same materials,' and Mr. Allen having remained silent on this important part of the question, I have been tempted to apply for a solution of it, through the medium of your useful publication. Your mathematicians will only have to enquire *how many particles of matter are concerned in the business, and then calculate the number of changes and transpositions, such a number of particles are capable of furnishing*. The answer will give us a complete refutation of Mr. Allen's chemical philosophy, according to which, a body once decomposed, is dispersed throughout the universe, and never brought together again.

F. M.

August 30, 1826.

MAGIC SQUARES.

Mr. Editor,—Perhaps the following method of filling up a magic square of odd numbers, such as of 9, 25, 49, 81, 121, 169, &c. cells after numbers have been placed in any two of the cells by a bystander, may afford amusement to, and exercise the powers of, your juvenile readers.

A. B.

SQUARES.

1.

17	24	1	8	15
23	5	7	14	16
4	6	13	20	22
10	12	19	21	3
11	18	25	2	9

2.

100	142	4	46	88
136	28	40	82	94
22	34	76	118	130
58	70	112	124	16
64	106	148	10	52

3.

$23\frac{3}{7}$	$31\frac{3}{7}$	$5\frac{1}{7}$	$13\frac{1}{7}$	$21\frac{1}{7}$
$30\frac{2}{7}$	$9\frac{5}{7}$	12	20	$28\frac{2}{7}$
$8\frac{4}{7}$	$10\frac{6}{7}$	$18\frac{6}{7}$	$26\frac{6}{7}$	$29\frac{1}{7}$
$15\frac{3}{7}$	$17\frac{5}{7}$	$25\frac{5}{7}$	28	$7\frac{3}{7}$
$16\frac{4}{7}$	$24\frac{4}{7}$	$32\frac{4}{7}$	$6\frac{2}{7}$	$14\frac{2}{7}$

4.

10	24	xxii	viii	6
22	xiv	x	4	8
xvi	xii	2	16	20
iv	0	14	18	xviii
ii	12	26	xx	vi

DEFINITIONS.

1. A CELL is one of the divisions. Each of the preceding squares has 25 cells.

2. The NUMBER OF THE CELL is that which corresponds with the progressive numbers, from one to 25 in square 1. Thus: 40, in square 2, is in the seventh cell; and 2, in square 4, is in the thirteenth cell. Note. The middle cell of an outside row may be made the first cell; in which case, the numbers of the cells change with it. Example

5.

11	10	4	23	17
18	12	6	5	24
25	19	13	7	1
2	21	20	14	8
9	3	22	16	15

The first cell in square 1, is 4th in square 5.

3. The RATIO is the uniform difference between the progressive numbers in the cells. In square 1, the ratio is 1; in square 2, 6; in square 3, $1\frac{1}{7}$; in square 4, 2.

4. Where the numbers in the cells increase with the numbers of the cells, the RATIO is direct; where the contrary, it is INVERSE. In square 6 it is direct; in square 7, inverse.

6

$9\frac{1}{2}$	1	$7\frac{1}{2}$
$3\frac{1}{2}$	6	$8\frac{1}{2}$
$4\frac{1}{2}$	11	$2\frac{1}{2}$

7

3	10	5
8	6	4
7	2	9

5. The SUM is the total of each row, whether vertical, horizontal, or diagonal. Thus the sum of squares 1 and 5, is 65; of square 2, 330; of square 3, $94\frac{2}{7}$; of square 4, 10; and of squares 6 and 7, 18.

6. A COURSE is a number of successive cells, equal to the number of cells in a row. One of the diagonals always forms a complete course. In square 1, the course is 11, 12, 13, 14, 15. If the course contains three cells, this diagonal is the second course; if five, the third; if seven, the fourth; if a thousand and one, the 500th. A course always proceeds diagonally till it is completed; when a new course begins in the cell immediately below the last cell of the finished course, and so on till the square is finished.

7. PLUS denotes that the numbers in the cells are to be added; MINUS, that they are to be subtracted. Note. Square 4, contains both plus and minus numbers. The Arabic numerals are plus; the Roman, minus. It is a better way to distinguish them, by using black ink for the plus, and red ink for the minus. Where a square consists of plus and minus numbers, the following is an easy method of casting them up. If the sum is plus, add it to the minus numbers in any row, and the plus and minus numbers will then be equal. If the sum is minus, add it to the plus numbers, and the same thing will take place. E. g. In square 2, the top horizontal row contains 40 plus, and 30 minus. Add the sum, 10 plus, to the latter, and the two will be equal.

CHARACTERS AND ABBREVIATIONS.

= Equal to. 5 and 3 = 8
÷ Divided by. 20 ÷ 5 = 4
N. Number in the cell.
C. Number of the cell.

D. Difference.
D R. Direct ratio
I R. Inverse Ratio.

RULE.

D of N ÷ D of C = Ratio.

Application.

1. Square 2. Suppose 100 and 22 to have been placed in their present cells. The difference of numbers is 78; 22 is in cell 4, and 100 in cell 17.

D of N 78 ÷ D of C 13 = D R 6.

I proceed diagonally from 100 to 106, 112, and 118, which ends the 4th course. I then begin another course at 124, and carry it on to 148. I then go back from 100 to 94, 88, 82, &c. till the square is finished.

2. Square 2. Suppose 100 and 22 to have been placed in the same cells. I will now make the middle cell of one of the outside vertical rows, say the left hand vertical row, the first cell. 22 will now be in cell 1, and 100 in cell 15.

D of N 78 ÷ DC 14 = $5\frac{4}{7}$.

8.

100	$105\frac{4}{7}$	139	$33\frac{1}{7}$	$66\frac{4}{7}$
61	$94\frac{3}{7}$	$127\frac{6}{7}$	$133\frac{3}{7}$	$27\frac{4}{7}$
22	$55\frac{3}{7}$	$88\frac{6}{7}$	$122\frac{2}{7}$	$155\frac{5}{7}$
$150\frac{1}{7}$	$44\frac{2}{7}$	$49\frac{6}{7}$	$83\frac{2}{7}$	$116\frac{5}{7}$
$111\frac{1}{7}$	$144\frac{4}{7}$	$38\frac{5}{7}$	$72\frac{1}{7}$	$77\frac{5}{7}$

The sum is $5 \times 88\frac{6}{7} = 444\frac{2}{7}$

Square 2 is the neatest and easiest way of filling up, when the above cells contain the above numbers. Therefore, before you begin to fill up, consider whether it is best to place your first cell in a horizontal row, or in a vertical row.

When the reader understands the above, he will be able to construct a magic square, every row of which shall amount to any given sum. E. g. 17 in a row, or 289 cells; sum 1819. The central number will be 107 = 1819 ÷ 17. If the ratio employed be 1, there will be no need of minuses. If 1, minuses would be required.—If the sum fixed upon be 1825, the central number will be $107\frac{6}{17} = 1825 \div 17$. The easiest ratio then will be $\frac{1}{17}$. The eighth course will then be, from corner to corner, $106\frac{16}{17}$ to $107\frac{15}{17}$.

(To be Continued.)

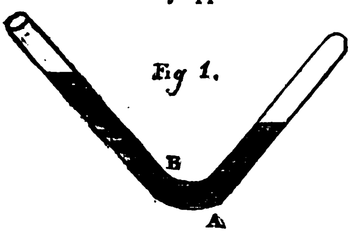
SIMPLE AND CHEAP METHOD OF EXPERIMENTING WITH GASES.

The greatest obstacles to experimental research that have hitherto presented themselves to young chemists, and even to proficients in the science, are the expense of the requisite apparatus, and the want of room to contain them. This has especially been the case with respect to apparatus for experimenting on gases. To remove these obstacles, the following contrivance has been invented by Mr. William Kerr.

A glass tube, from six to twelve inches in length, and from two to five lines wide, so as to be capable of holding from two to six drams, is to be hermetically closed at one end, and bent a little below its middle, so as to form two branches, of which the shut branch will be somewhat shorter than the other, diverging from each other nearly at a right angle. The vertex of the tube should be widened on the concave side, and this done more toward the shut than the open branch, as in figure 1. (next page.) The vertex, A, of the convex side of the curvature, does not correspond with B, that of the concave side, but is beneath the shut branch.

The gas evolved from the mutual action of two bodies, of which at least one is a liquid, may be collected in the shut branch in the following manner. Let the tube be held in the hand by the open end, so that this be the highest, and the shut end the lowest part of the tube; then the liquid is to be poured in till it begins to ascend above the vertex. The shut extremity is now to be elevated as high as the open end, while the vertex is depressed, so as to be the lowest part of the tube. In this position the shut branch will remain full, the liquid within it being supported by the pressure of the atmosphere on the small portion of the fluid, that is above the vertex, in the open branch. If a solid body, of greater specific gravity than the liquid be now introduced into the open end of the tube, it will fall down to the vertex, and any gas evolved from its surface will rise through the liquid, and be collected in the shut branch, while the liquid will ascend in that which is open. Owing to the vertex of the convex side being beneath the shut branch, while that of the concave is nearer the open one, the whole, or almost the whole of the gas evolved, from any bit of solid matter resting on the most depending part of the curvature, will ascend into the shut branch. In this manner the gas is collected unmixed with common air, and if the experiment requires the application of heat, the bent tube may be placed in a sand-bath; so that by means of such tubes, experiments may be performed on small quantities of gases, not only more economically, but, it is hoped, more accurately than is commonly done on larger quantities, with a more costly apparatus.

Fig 1.



A bent tube of the form described, may be also used for discovering the quantity of gas absorbed by a liquid.

For example, the quantity of oxygen absorbed from atmospheric air by a solution of the proto-sulphate of iron. The air being confined in the sealed branch, by the solution contained in the open one, will be exposed to the pressure of the column of liquid; and as the open end may be corked, the solution can absorb no other gas but that contained in the tube. The quantity absorbed may be known by tying, at the commencement of the experiment, a waxed thread around the tube, at the boundary of the air and liquid.

Other gases may be absorbed by other liquids, in nearly the same manner; for instance, carbonic acid by milk of lime; only when any other gas than atmospheric air is introduced into the tube, the whole tube must be previously filled with water. The water in the open branch, with the exception of a small quantity sufficient to confine the gas, is then to be sucked out with a straw or small glass tube, and the milk of lime substituted for it.

A bent tube of a small size answers best for collecting gas; and one of a larger size for the absorption of gases.

If the experiment to be performed requires any considerable time, the curvature of the tube may be passed through a slit made in a thin board, the slit being of such length, that the branches of the tube may rest upon the board at the extremities of the slit. Experiments may be going on, at the same time, in several tubes, placed in as many slits in the same board, which may be made to form part of a very convenient portable frame, for holding a number, both of bent tubes for gases, and test tubes for precipitations.

Fig. 2.

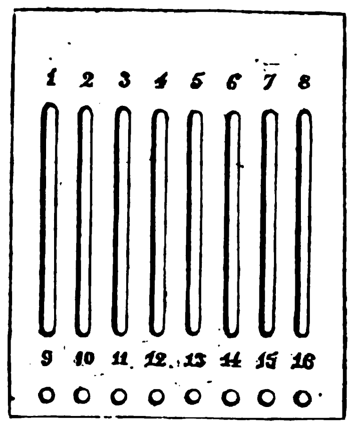


Fig. 2 is the plan of a board which may be made of mahogany, eight inches square, and one-quarter of an inch thick. In it there are eight slits for bent tubes, and at one end it is pierced with eight holes for test tubes. This board forms the top of the frame. Another board of the same dimensions, parallel to the former, forms the sole; and these two boards are connected together at the corners, by four small wooden pillars. The whole frame need not weigh more than eleven ounces. It may be placed on a table or shelf, and may be lifted from one place to another, loaded with all the tubes it is intended to contain, without disturbing any of the processes going on in these.

The slits and holes should be numbered, and a register kept of the processes going on in each of the tubes, by which they are occupied.

It is hoped that bent tubes will be found useful to students at universities, to travellers, and to those who cannot carry large, brittle, and expensive apparatus along with them.

To those who have not the means of purchasing expensive chemical apparatus, the bent tubes will recommend themselves by their cheapness; each of them superceding, for small experiments, a retort, a pneumatic trough, and a receiver.

In the laboratory of the chemist they will also be useful, by enabling him to perform experiments, in the small space of eight or nine inches square, which would have otherwise required eight or nine retorts, and as many receivers.

An addition may be made to these tubes, by which the quality of the gas evolved at any period of the experiment may be examined, without disturbing the process going on.

SINGULAR APPLICATION OF GALVANISM.

It happens too often, in that excruciating affection, the tooth-ache, that the dentist, not being able from any external marks, to distinguish the diseased tooth from the sound ones which adjoin it, is obliged to begin pulling away at random, so that, to get rid of one that is decayed, the unfortunate patient must run the hazard of losing two or three, which might have served out their century. For a long time there was no known check against this blundering sort of work; but very recently, the extraordinary discoveries which have been made in galvanism, have developed a test for the detection of bad teeth, or rather the preservation of good ones, of infallible certainty in its application. The method is thus described by professor Aldini. "He (the dentist) first insulates the patient, and places in his hands an electric chain; he then applies a small piece of wire to the wisdom tooth, and draws it gradually over its surface; he then applies it to the next tooth in the same manner, and proceeds in the like method with the rest, until he comes to the diseased tooth, which is discovered by violent pain being produced, and an involuntary commotion in the body. It has always been remarked when the tooth is extracted, that it exhibited a carious part, which, in its proper situation, was not visible." Need we add, that no person ought to submit himself or his children to the forceps of a dentist, without seeing that he makes use of this most necessary precaution?

METHOD OF BURNING LIME WITHOUT KILNS.

The practice of lime-burners in Wales was, formerly, to burn lime in broad, shallow kilns; but, in some parts, they now manufacture that article without any kiln at all. They place the lime-stone in large bodies, which are called coaks, the stones not being broken small, as in the ordinary method, and calcine these heaps in the way used for preparing charcoal. To prevent the flame from bursting out at the top and sides of these heaps, turfs and earth are placed against them, and the apperture partially closed, and the heat is regulated and transfused through the whole mass; so that, notwithstanding the increased size of the stones, the whole becomes thoroughly calcined. As a proof of the superior advantage which lime burned in these clumps, or coaks, has over lime burned in the old method, where farmers have an opportunity of taking either lime at the same price, a preference is invariably given to that burned in heaps. This practice has long prevailed in Yorkshire and Shropshire, and is also familiar in Scotland.—L.

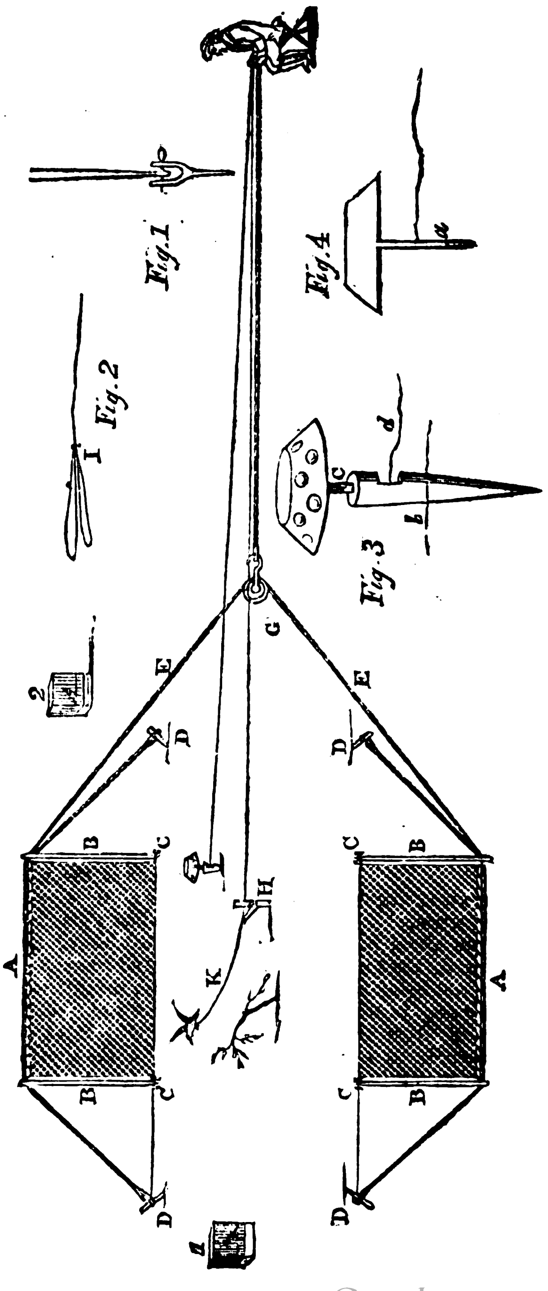


Fig. 1
Fig. 2
Fig. 3
Fig. 4
A
B
C
D
E
G
H
I
K
a
b
c
d
1
2

Mr. Editor,—Having for many years past had a great deal of leisure time, I took delight in bird catching, the manner of which I learnt of a very noted and experienced bird fancier; and seing in the 122nd Number of your Magazine, the request of Ornithologist's friend respecting it, I have sent you a drawing and description of the process, which I hope will be found sufficiently clear and intelligible.

I am, Sir,

Your constant Reader,

JOHN TRUMAN.

Salisbury, July 27, 1826.

A A, is a bird's eye view of the nets when set, fourteen yards by four.

B B B B, four staves, six feet long, to throw the nets.

C C C C, four irons, eight inches long, as fig. 1, for the staves to play backward and forward upon.

D D D D, four pegs, a foot long, also set in the ground to keep the nets tight on the lines.

E E, a line eight yards long, which goes round the pully, G, to the top of the foremost staves.

F, the main cord to throw the nets.

G, a running pulley, that the power may be equal at each net.

H, a small piece of wood, eight inches long, set in the ground, with a joint to raise the call bird.

I, a small pack thread with two loops, as fig. 2, one of them to go over the call bird's head, on the back part; the other the breast, so that the knot may come between his legs.

1 2, small square cages placed near the nets.

K, a small twig with the call bird on it.

Fig. 3 and 4, represent a glass, which is to be placed between the nets. It consists of a piece of walnut wood, painted red, eight inches long at the under part, and six at the top, sloped away like the roof of a house, so that the under part may be three inches thick, and the top but half an inch. On both sides small watch glasses of different sizes, and gilded with leaf silver, (quicksilver being too bright,) are inserted. *a*, is a peg by which this glass is fixed into *b*, a stake eighteen inches long, the size of a man's wrist, pointed at the end, so as to be easily driven into the ground; *c*, a hole four inches deep, which receives the peg, *a*; *d*, a string fastened to the peg, by means of which it is made to play backwards and forwards, like a child's apple and nut, or a whirly-gig. This glass is only used in clear, white, frosty mornings, in October and November; when it furnishes fine sport, the larks playing at it to admiration.

It is needless to say the birdman should be provided with a mallet, a reel, and other convenient things to set his nets with.

MARINE LIFE PRESERVER.

Sir,—Mr. Egerton Smith, the editor of the Liverpool Mercury, has lately been making *a great say* about what he calls a *new* marine life preserver, of *his invention*; nay, such is the self-complacency with which he regards it, that he actually compares his good luck in hatching it to the happy thought which led Columbus to the discovery of a new world! Now, as cork has been applied during many years to the same purpose, in a manner very similar, I must confess I see no novelty whatever in this pretended invention. Be this, however, as it may, I must tell you of another marine life-preserver, which I saw a few days ago, and which to *me* was a novelty. I saw a gentleman in the water with something round his body that kept him buoyant without the least exertion. Sometimes he was erect, at other times on his side, then on his face, now on his back, turning, in fact, any way and every way, just as if it was his own element. I was, I confess, surprised at all this, and waited till he came out, and then took the liberty of drawing nearer to him, when I found that what I saw round his body was a kind of circular, hollow, flexible case, made to contain air, which by turning a cock, or some such contrivance, he soon expelled, and then folding it up into about the size of a pocket book, he laid it on the ground, and afterwards put it into his pocket; this hollow belt, if I may so call it, appeared to me to be of some woven material. Did this inclose a larger kind of wizen or gut, or by what other means could it be rendered at once so pliant and to hold the air so well? Perhaps some of your correspondents can throw some light upon this, for which I should feel particularly obliged, as I am myself fond of the water, and if I could make one of these, I should become at once

AMPHIBIOUS.

September 9th, 1826.

[We suspect this to be a puff prelusive of the belt alluded to, and would have been better pleased had our correspondent at once favoured us with all the information in his power concerning it. For the sake, however, of the invention—which appears to be one of merit—we excuse the device by which it is introduced to our notice, and shall willingly give insertion to a description more particular.—ED.]

NEW METHOD OF FINDING THE AREA OF CURVILINEAR SPACES BY EQUIDISTANT ORDINATES

Sir,—As your useful miscellany is calculated to afford instruction to inquirers, I beg permission, through this medium, to transmit a few brief rules in mensuration, (originals) which may be of use to some of your numerous subscribers. I shall esteem it a favour if you will oblige me by inserting, monthly, a small portion of the matter contained in these papers, (not intending to infringe too much on your valuable pages); and, in the mean time, beg to remain

Your most obedient servant,

HENRY FORD.

Fisher's Street, Sandwich.

Introductory rule to find the area by equidistant ordinates.

The rule given by mathematicians for this purpose is as follows:—

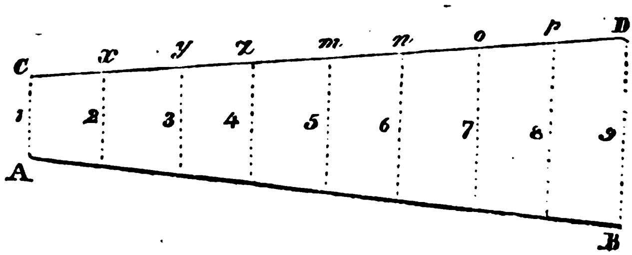
To the sum of the first and last ordinate, add four times the sum of the even ordinates, and twice the sum of the uneven, which being divided by three, and multiplied by the common distance between each ordinate, will give the area. Or it may be expressed thus:

Put A, the sum of the two extreme ordinates, and B, the sum of the even ones, C, the sum of the uneven:

then $\frac{A + 4B + 2C}{3} \times D = A$ the area, and D the common difference.

Illustration.—Admit A B (see fig. below) = 32 rods, yards, feet, links, to be a base line; and C D, a curve line, containing 9 equidistant ordinates, as under; put n for the number of ordinates

then $\frac{AB}{n-1} = \frac{32}{9-1} = \frac{32}{8} = 4 = D.$



The common difference—and give ordinates.

No. 1 = A C = 3 equal parts.
2 = x = 4,6 . . do.
3 = y = 5,8 . . do.
4 = z = 6,5 . . do.
5 = m = 7,4 . . do.
6 = n = 7,8 . . do.
7 = o = 8,4 . . do.
= p = 8,9 . . do.
9 = B C = 8,96 . do.

Then per rule A C + B D = 3+8,96 = 11,96 = A, and for the sum of the ordinates corresponding to even numbers

to No. 2 = 4,6
4 = 6,5
6 = 7,8
8 = 8,9
27,8 = B

also ordinates to the uneven numbers.

To No. 3 = 5,8
5 = 7,4
7 = 8,4
21,6 = C

then per rule $\frac{A+4B+2C}{3}$ D =

$\frac{11,96+\overline{27,8\times 4}+\overline{21,6\times 2}}{3}\times 4 =$

$\frac{11,96+111,2+43,2}{3}\times 4 = \frac{166,36}{3}\times 4$

= 55,45,3333 × 4 = 221,813332 the area. This rule I call the A B C rule, for the use I propose to make of it in the following calculations.

New method per common rule and abbreviations.

Common rule.			
A C = 3	- -	- = 3,8	trapezoidal abbreviation.
x = 4,6	- -	- = 5,2	containing 8 spaces.
y = 5,8	- -	- = 6,15	
z = 6,5	- -	- = 6,95	
m = 7,4	- -	- = 7,6	
n = 7,8	- -	- = 8,1	
o = 8,4	- -	- = 8,65	
p = 8,9	- -	- = 8,93	
B C = 8,96			
		55,83	
		×4	

÷ n = g)61,36

mean ordinate = 6,81777777
× A B = 32

13,6355554
area computed 204,533331

per common rule = 218,1688864

221,52 = area of trapezoidal spaces.
− 218,1688864
÷2) 3,3511136
∴ 1,6755568
+ 221,52 } method of correction.

223,1955598 true area.

Remarks. By the above, the A B C rule gives the area too little, being only a small quantity more than the quantity contained in the eight trapezoids. The ensuing examples will evidently prove a defect in the A B C rule. The new method which I have made use of comes as near the truth as possible.

Concerning the method of correction, the common rule is made to come less than the trapezoidal, and their difference divided by 2, added to the greater quantity, is considered to be the true area.

Note.—If the length of the base be divided by the number of ordinates, the quotient divided by 2 will be the correcting quantity to be added.

Other variations conformable to the new system will be observed in the ensuing examples, which are given to illustrate the theory.

(To be continued.)

SCIENTIFIC MEMORABILIA.

(*Continued from p.* 315.)

Production of a Vacuum.

It was long a favourite notion of the schools, that the production of a vacuum was a thing impossible even to supernatural power. This dogma was first shaken by a circumstance which happened to some workmen employed by the grand duke of Tuscany. Having sunk a deep well, they endeavoured to bring the water to the surface by a common sucking pump, but found to their surprise that they could only make it ascend to the height of about 30 feet. The celebrated Galileo was consulted in this emergency, and the conclusion to which he came on the subject was that which all subsequent experience has confirmed; namely, that although nature does dislike a vacuum there is a certain limit to her antipathy, equivalent to the pressure of a column of water 34 feet high.

The idea of constructing a machine for the purpose of rarefying air first occurred to Otto Guericke, who, after many fruitless attempts, succeeded by means of a sucking pump, in withdrawing a considerable portion of air from the interior of a copper ball. With this awkward and imperfect air pump, he performed several notable experiments. One of these is often exhibited at the present day. It consists in exhausting a hollow brass globe, composed of two hemispheres closely fitted to each other. When a portion of the interior air is removed, the pressure of the exterior atmosphere is such as to resist considerable force applied to separate the hemispheres. This is called the Magdeburgh experiment, and was first publicly exhibited in 1654, before the deputies of the empire and foreign ministers assembled at the diet of Ratisbon.

The original air-pump, invented by the Burgomaster of Magdeburgh, was greatly improved by Hooke, who, in conjunction with Boyle, performed by its means a variety of new and important experiments, illustrative of the mechanical properties of the atmosphere.

Modern Theory of Vision.

There is scarcely any fact in philosophy with which men are now more familiar than, that objects are made visible to us by the reflection of images of them on the retina of the eye; but, strange to say, sixteen centuries (speaking of our modern æra) had elapsed before this was known even to the most learned. The Platonists, the Stoics, indeed all the sects of ancient philosophers, held that vision was effected by the emission of rays *out of the eyes.* Even our own countryman, Roger Bacon, assented to this opinion; giving this reason for it, that every thing in nature is qualified to discharge its proper functions by its own powers, without any extrinsic help. Baptista Porta's experiments with the camera obscura, about the middle of the sixteenth century, convinced him that vision is performed by the passage of rays of light into the eye, and not by visual rays proceeding from it; and he was the first who conceived and fully established this to be the fact. There are thousands of experiments which prove this to be the mechanical process of vision; but there is none, perhaps, which shews it more conveniently or satisfactorily than the following:—Take the eye of an ox newly killed; strip the skin and fat carefully from the back of it, till only the thin membrane called the retina remains to terminate it behind; let any object be then placed before the front of the eye, and the picture of that object will be seen distinctly figured, as with a pencil, on the retina.

Art of Bleaching.

About sixty or seventy years ago, the art of bleaching was scarcely known in Great Britain. It was customary to send all the brown linen manufactured in Scotland, to Holland to be bleached. It was sent away in the month of March, and not returned till the end of October, being out of the hands of the merchant more than half a year. The principal Dutch bleaching grounds were in the neighbourhood of Haarlem, and the great success of their bleachings was ascribed to the superior efficacy of their water, which, according to the fashionable theory of the time, was sea-water, filtered and rendered sweet by passing through their sand downs. Indeed it was long a prejudice on the continent, that no water was efficacious for bleaching but sea-water.

The Dutch mode of bleaching was to steep the linen for about a week in a potash lye poured over it boiling hot. The cloth being taken out of this lye, and washed, was next put into wooden vessels containing butter-milk, in which it lay under a pressure for five or six days. After this, it was spread upon the grass, and kept wet for several months, exposed to the sun-shine of summer.

About the middle of the last century, the Dutch process of bleaching was introduced into Scotland by an Irish gentleman, whose descendants at this day figure among the higher ranks of the British metropolis.

For the first improvement of this tedious process, manufacturers were indebted to Dr. Home of Edinburgh, who proposed to substitute water acidulated with sulphuric acid for the sour milk previously employed. This suggestion was, in consequence of the new mode of making sulphuric acid, contrived some time before by Dr. Roebuck, which reduced the price of that acid to less than one-third of what it had previously been. It is curious that when this change was first adopted by the bleachers, there was the same outcry against its corrosive effects as we have seen some years ago, when oxymuriatic acid was substituted for crofting (bleaching on the grass). No allegation, however, could be worse founded, and it was completely destroyed by the publication of Dr. Home, (*Essay on Bleaching*) who demonstrated the perfect innocence and the superior efficacy and cheapness of sulphuric acid, when properly applied, over sour milk. Another advantage resulted from the use of sulphuric acid, which was of the greatest importance to the merchant. A souring with sulphuric acid required at the longest only twenty-four hours, and often not more than twelve; whereas when sour milk was employed, six weeks, or even two months were requisite, according to the state of the weather. In consequence of this improvement, the process of bleaching was shortened from eight mouths to four, which enabled the merchant to dispose of his goods so much the sooner, and consequently to trade with so much less capital.

The bleaching art remained in this state, or nearly so, till 1787, when a most important change began to take place in it, in consequence of a discovery which originated in Sweden, about thirteen years before. In 1774, there appeared in the *Memoirs of the Royal Academy of Stockholm*, a paper on manganese by Scheele. Among other experiments to which he subjected this mineral, he mixed it with muriatic acid, put the mixture in a retort, and applied heat. He perceived a smell similar to aqua-regia. This induced him to collect what came over in a receiver, and he found it to be muriatic acid, altered in a remarkable manner by the action of the manganese on it. Its smell was greatly heightened, it was become less soluble in water, and it possessed the property of destroying those vegetable colours on which it was allowed to act. Mr. Berthollet repeated the experiment of Scheele on this new acid, in 1785, and added considerably to the facts already known. He shewed that this new acid (called by Scheele *dephlogisticated muriatic acid*) is a gas soluble in water, to which it gives a yellowish green colour, an astringent taste, and the peculiar smell by which the acid is distinguished. When water impregnated with this acid is exposed to sunshine, it gradually loses its colour, while, at the same time, a quantity of oxygen gas is disengaged from the water. If the liquid be now examined, it will be found to contain, not the new acid, but the common muriatic acid. This experiment Berthollet considered as exhibiting an analysis of the new acid, and as demonstrating that it is a compound of muriatic acid and oxygen. On that account, he gave it the name of *oxygenated muriatic* *acid*, which was afterwards shortened into *oxymuriatic acid*, an appellation by which it is still known among bleachers. The property which oxymuriatic acid possesses of destroying vegetable colours, led Berthollet to suspect that it might be introduced with advantage into the art of bleaching, and that it would enable practical bleachers greatly to shorten their process. At what time these ideas first struck his mind, is not exactly known; but at the end of a paper on dephlogisticated muriatic acid, read before the Academy of Sciences at Paris, in April, 1785, and published in the *Journal de Physique for May of the same year*, he mentions, that he had tried the effect of the acid in bleaching cloth, and found that it answered perfectly. This idea is developed still farther, in a paper on the same acid, published in the *Journal de Physique* for 1786. In 1786 he exhibited the experiment to Mr. James Watt, who, immediately upon his return to England, commenced a practical examination of the subject, and was, accordingly, the person who first introduced the new method of bleaching into Great Britain.

(To be continued)

EAST LONDON MECHANICS' INSTITUTION.

(From a Correspondent.)

A Lecture was delivered at this Institution, on Monday evening last, on astronomy, by Mr. J. Children, one of the members. Mr. C. is, we understand, himself a mechanic, and has not had the advantage of a liberal education. Notwithstanding these disadvantages, he delivered a very able lecture, and, by the familiarity of his illustrations, made his subject intelligible to all. His apparatus, which is of a very ingenious description, is, we are informed, almost entirely constructed by himself; and some of his transparencies, exhibited by means of a magic lantern, were very beautiful. The lecture was well received throughout; and, at its conclusion, the members testified the pleasure they felt, by loud and continued applause. Mr. C. will continue the subject on Monday next.

NOTICES TO CORRESPONDENTS.

The article SAUL'S TRANSPLANTING INSTRUMENT, which appeared in our 154th number, was inadvertently taken from the GARDENER'S MAGAZINE without the concurrence of either the Editor or Publishers of that work. We trust they will accept this acknowledgement of the use we have made of their valuable publication.

H. H. informs us that the suggestion of Senex (in our last number) for an improvement in the mode of hanging the sway-bar to the pole of a carriage, appears so sensible to several of our readers, that they would be much obliged to him to elucidate his ideas by a drawing. A reply by Mr. Jackson to Senex in our next.

C. Nella acquaints us, that Mr. Bowring has presented the Exeter Mechanics' Institution with the manuscript of the excellent lecture which he recently delivered there, (of which we gave a notice at the time) and that it is shortly to be published in a cheap form.

Communications received from T. M. B.—F. M.—J. B. F.—Mr. Jackson—H. O.—Lion—X.—Colonel Beaufoy—A Mechanical Novice—A. D.—Suburbanus—S. D.—M. F. G.—and Dr. Sully.

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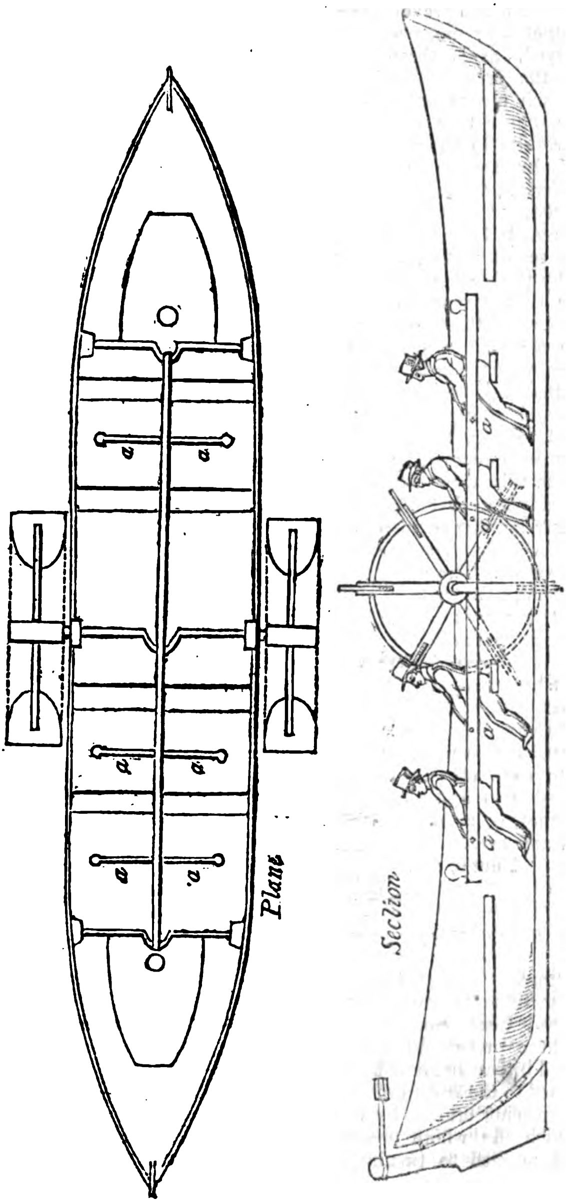
Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 162.] SATURDAY, SEPTEMBER 30, 1826. [Price 3d.

PLAN FOR THE SUBSTITUTION OF PADDLES FOR OARS.



Sir,—It appears to me, that besides the power of the steam engine in moving the paddle wheels of a steam-boat, a great advantage is derived from the machine of a paddle wheel itself, in moving a vessel by its continued action, which prevents the loss of the impetus or momentum in the body moved, as is the case with oars, by the cessation of power between each stroke of the oar. I likewise suppose that no small advantage results by the paddle wheel being close by the side; the power is thus applied more directly on the body moved. A farther advantage certainly results from the water disturbed in moving the body, being acted on by the paddle wheel, at the same time that it moves or propels the vessel. With these ideas, it occurs to me that a paddle wheel constructed with such a number of paddles, that one should always be immersed and acting, to be worked by manual labour, might be more efficacious in moving a boat than oars. With this view I send you a sketch of a plan, that may be applied to any number of men, and to all sizes of vessels, from a row boat to a large vessel. The motion would be nearly similar to rowing, and the labour not greater; and the men may work either standing, or sitting, according to the size of the vessel. A paddle wheel worked with a crank of about six inches, may be applied very well to a small boat to be worked by one man, or two men, by sitting opposite to each other. The plan given, is meant to apply to a crank of nine inches, or even more.

I am, Sir,

Your's, &c.

A. B. W.

Description.

The engraving in front exhibits a plan and section of a double-banked eight-manned boat, constructed on the plan here proposed; *a a* are handles fixed into a straight beam or pole, fastened to the main crank and two end steadying cranks, by working of which the whole power of the men is applied to turning the paddle wheels.

IMPROVED MODE OF TRAVELLING.

"A long time has elapsed since we inserted in our columns a paper relative to a mode of travelling which has been discovered, whereby the rapidity of moving to and from places of great distance from each other might be effected in so short a time as to remind one of some of Munchausen's flights.—It, however, occasioned considerable attention, and the projector has gone on perfecting his system, in which he has succeeded, and completed a tunnel, through which a carriage is propelled by the atmosphere.—We have had the honour of being the first to travel in this novel mode, and will endeavour to give a short account of the means which are used to produce it. —The adaptation of this propelling principle is such that the rate of travelling might be increased to 100 miles per hour; and that for the transit of passengers, information, and merchandize, it is one of the most important discoveries of any age whatever, and must prove of the greatest consequence to the commercial word. The tunnel has in the bottom a rail-way, on which runs a carriage, closed at one end all round within an inch of the tunnel; the tunnel is connected at each end with air pumps, which are worked by steam, and exhaust the air within at either end, by which the atmosphere at the other forces the carriage on; the exhaustion of air can be changed from one end of the tunnel to the other instantaneously, and the motion of the carriage is at the same moment reversed. The vacuum occasioned by the exhaustion is so trifling that not the slightest inconvenience is felt when placed in it, which, if any did exist, could not, however, be experienced by travelling in the carriage, for the vacuum is filled before persons in the carriage pass over the space. The atmosphere acts in this tunnel precisely with the same certainty and effect that a fall of water does on a wheel."—*Brighton Gazette.*

(From a Correspondent.)

We believe the invention here referred to is that for which John Vallance, Esq. of Brighton, took out a patent about two years ago; and which was considered so visionary at the time, that nobody dreamt of ever seeing it realized but the enthusiastic patentee himself. Not that in theory there was any thing so very absurd in the plan, for it depended on a fact well enough known and established in physics—namely, that when any sort of vessel or chamber is first exhausted of air, and then a stream of air allowed to pass freely into it, that stream will drive the heaviest as well as lightest bodies with equal facility and speed before it. But when Mr. Vallance proposed, in pursuance of this principle, to construct series of immense cylinders, which were to reach from town to town, no matter how far distant from each other, and to have waggons and carriages, goods and passengers, propelled through these cylinders by means of an alternate exhaustion and admission of air, the impracticability of so *vast* an application of the principle appeared to every one too palpable to admit of question for a moment. There was such a thing as the air-gun, to be sure; but that only propelled musket balls to the distance of some two or three furlongs, while this *great gun* of Mr. Vallance's was to shoot in a twinkling, men and things of all weights and sizes from London to Brighton, to Falmouth, to the Land's End, to John O'Groats, or any where else!!! "O wonderful, wonderful, and most wonderful, and yet again wonderful, and after that out of all whooping."

Wonderful, however, as it seemed, the thing, if we may believe our Brighton contemporary, has actually been accomplished. The projector has "gone on perfecting his system" till he has "produced a tunnel through which a carriage is propelled by the atmosphere." The gentleman, too, who bears testimony to the achievement, has himself "had the honour of being the first to travel in this novel mode."—It may seem scarcely reasonable to entertain a doubt on the subject, after such evidence as this; but we hope, nevertheless, to be excused for suspending our judgment till we have a more particular account of this gentleman's novel travelling than the "short" one with which he has here favoured the public, and some few points cleared up which he has left, strangely enough, wholly unexplained.—Our "honoured" contemporary, for example, has said nothing of *the length* of his travels "in this novel mode;" that he is not *far travelled* is, we think, more than probable. Neither has he informed us *how long* it took him to travel such space as he did travel. He says, indeed, that "the rate of travelling might be increased to 100 miles per hour," but increased *from* what? Now, in the absence of all information, both as to the length of tunnel through which the carriage was propelled, and as to the time which the transit occupied, how can any conclusion be drawn from this experiment as to the practicability of the scheme on an extensive scale, or as to the advantages to be gained by it? Mr. Gazetteer assures his readers that "the vacuum occasioned by the exhaustion is so trifling that not the least inconvenience is felt when placed in it;" and considering that dogs, cats, and other four-footed things are known to die in vacuo in less than half a minute, it would be of some importance to such of our biped race as may long for a trial of this "novel mode of travelling," could they depend on Mr. Gazetteer's assurance.—But, from what he adds on the subject of the said vacuum, we rather suspect that he must have been in a trance while passing through it, and have come out of it as ignorant of its effects as when he went in. "If," says he, "any (inconvenience from the vacuum) did exist, it could not, however, be experienced by travelling in the carriage, for the vacuum is filled *before* persons in the carriage pass over the space." The deuce it is! Mr. Gazetteer does not perceive that if this were the case, there would be no occasion for a vacuum at all, but that the whole of this fine scheme would itself be reduced to as complete a vacuum as ever was conceived.

VARIATION OF THE NEEDLE.

Sir,—In answer to the letter

signed "A Subscriber," and dated "Wakefield, August 16, 1826," I beg leave to state, that the Annals of Philosophy, of Feb. 1821, contain a table of the "morning, noon, and evening, monthly mean variation of the magnetic needle, for three years and nine months," and I entertain no doubt, but that the maximum westerly variation occurred at this place, in March, 1819. I, however, much regret that corresponding observations with a similar instrument, have not been undertaken, and published by different individuals in various parts of the globe, as it would have been satisfactory, by the experience of others, to verify the accuracy of my own observations, and the justness of the conviction I entertain of the universal retrocession of the compass.

Should your correspondent be inclined to engage in such a task, a description of the instrument and method of using it, will be found in the Annals of Philosophy, for August, 1813, and May, 1817; and I especially recommend that great attention be paid to the pivot on which the needles traverse, and the orifice of the agates by which the needles are suspended. The former should be a well-formed obtuse cone, and the latter truly bored, and free from all roughness, as a small degree of friction will cause great errors in the observations. Notwithstanding the wind is totally excluded from all access to the needle, it nevertheless produces a very strong effect upon it, and in a capricious manner; that is, by occasional puffs, which will cause the needle to vibrate so extraordinarily, as to render the observations useless.

In the month of March, 1818, the variation at noon was 24° 41′ 37″ west. In the same month, 1819, 24° 41′ 42″; and in March, 1820, 24° 39′ 33″. In the year 1657, during the latter part of the protectorship of Oliver Cromwell, the variation at London was at Zero, that is, the *magnetic* and the *true* north coincided. 1657 deducted from 1819 leaves 162, the period of the greatest western declination of the magnetic needle; and if it may be supposed that the same period elapses between the true north, and the limit of the eastern variation, the two extremes are confined to 326 years.

I remain, Sir,
Your obedient servant,
MARK BEAUFOY.

Bushey Heath, near Stanmore,
September 16, 1826.

N. B. Latitude of the place of observation 51° 37′ 44·3″ north; longitude west in time, 1′ 20·93″.

IMPROVEMENT IN WHISKEY.

Distillers formerly paid according to the time their stills were in operation; and the duty was calculated on the supposition that a still of 80 gallons could be run off in eight minutes. It was soon found, however, that by making the still very broad, and increasing the briskness of the fire under it, the process could be completed in as short a space as three minutes; so that an active distiller could make double the quantity of spirit that he paid duty for. In carrying on distillation in this rapid way, it was necessary to put a piece of soap into the still, the oily matter of which rose, and spreading over the surface of the wash, broke the large bubbles, and prevented the spirits from coming over, or what was called *running foul*; and hence the disagreeable soapy taste that whiskey used to have. Owing to the rapidity of the process, the spirit also contained more of a peculiar essential oil derived from the malt, than was at all conducive to the goodness of its quality. Now, however, distillers pay according to the *strength* of their wash and the *quantity* of spirit; hence it is that whiskey is now far superior to what it formerly was, the spirit being distilled more gradually, and carrying with it less of the substances that are calculated to give it a disagreeable flavour.

BUILDING AND TUNING OF ORGANS.

Sir,—Can any of your musical correspondents inform me how many beats in 10 seconds the various 5ths in tuning a chamber or other finger organ should have, supposing the stop commenced on, should be the open diapason, and the note middle C; or the stop first tuned to be the principal, and the note C an octave below middle C; and supposing also, that the 3rds in the most common major keys should be kept perfect?

What system of tuning is generally adopted in the Church organs in London?

The method of tuning by a stated number of beats in a given time (say 10 seconds) is definite and satisfactory; but I have tried the system of Dr. Robert Smith (see Encyclopedia Britannica), and I think I found it did not give perfect 3rds, as it professed. I have not, however, that work at hand for immediate reference to. I should be also glad to know how the pins and staples are bent for organ barrels, and how the tunes are marked off on the barrels—I mean the best *practical* methods.

I am, Sir,
Your obedient servant,
K.

Madras, Feb. 4, 1826.

SAFE CONSTRUCTION OF CARRIAGES:—MACHINE FOR MOWING GRASS AND CORN.

Sir,—Your correspondent, Senex, like myself, is, perhaps, not a practical mechanic, or, I think, he would not have objected to the mounting of a carriage body on the iron span, which I proposed to be attached to the axle of the vehicle, for the purpose of balancing the *pull*, for I am aware that a pull from the middle of the axle would be attended not only with an irregularity, but also with a force of *leverage*, that would be likely to break the pole at the neck. This however is counteracted by passing through the iron span, and a collar on the pole behind it, communicates the draught or pull to the span, whose two ends are at the extremities of the axle, and, therefore, the effect of *jibing* or twisting, is prevented. For an illustration of this remark, let Senex refer again to your former description, and, with respect to the breaking, I think any coach smith will assure him that iron will admit of being made safer than wood, and this remark I make without the idea of any allusion to the well-known fable of, the Town in danger of a Siege. I should like, at all events, to try the experiment, for I know well, that without practical experience, there is little certainty in any theory whatever, and, in the operation, many improvements become apparent, which, in theory, are not easily foreseen to be requisite.

I take this opportunity to say that I have an idea in my mind of the possibility of forming a machine for mowing grass or corn, and thereby, if not to facilitate the operation, at least to diminish the labour, which every body, acquainted with the effect of that labour, must know, is not only very slavish, but injurious to health, because it requires that twisting of the body which, by pressure on the left side, always affects the ribs, and the interior of that part of the person next to the heart. I have known instances of men being so hurt, after the first day's labour, as to be unable to follow it up the next day, and not only have I seen this, but likewise have experienced it, and can therefore say, *probatum est*. If any of your ingenious correspondents, through this hint, should anticipate me, it is well; if not, expect my future remarks and suggestions on the subject.

Your's,
R. JACKSON.

USEFUL HINT TO BUYERS OF SPIRITS.

When spirits are in any considerable degree diluted, it is very seldom that the dilution cannot be detected, however much it may be disguised by colouring or flavouring expedients. A perfect combination between the spirits and the water, takes place with difficulty; and, in nine cases out of ten, the lightest part of the spirits, consisting of a semi-ethereal liquor, or dulcified spirit, flies to the top, leaving the grosser and least spirituous portion at the bottom. Of course, wherever this kind of depreciation is suspected, the surest way of detecting it is to compare, by the hydrometer, the strength of two samples, one taken from the top of the cask, and the other from the bottom. If they prove unequal in strength, it will shew that the cask of spirits has been watered, and the degree of difference may be taken as a measure of the extent to which the dilution has been carried. But if a buyer merely wishes to protect himself from imposition, he may rest content with taking his sample for proof from the lowest part of the cask, to which, more than to any other part, no dealer, *professing* to sell fairly, can object. If the spirits have been watered, the lowest portion will, for certain, be the weakest; and, by buying at the weakest point of strength, as a medium of the whole strength, you will turn on the dealer himself, the cheat which he wished to play off upon you. Should the spirits not have been watered, then the sample will be a fair average sample, and the buyer will get no more than the seller has promised to give him.

INSTRUMENT FOR ASCERTAINING THE STRENGTH OF MILK.

The value of milk, as an article of lucrative produce on a farm, depends on the quantity of cream which it is capable of producing; and it is a pity, therefore, that it is not more generally known, that there is a simple instrument by which the relative proportion of cream produced by different animals, or by the same animal with different sorts of food, may be clearly ascertained. It was constructed under the direction of the late Sir Joseph Banks, and used to be made for sale by most mathematical instrument makers. It consists of any number of glass tubes, each of about three quarters of an inch in diameter, and eleven inches long; they are closed at one end; open and a little flanched at the other; being precisely similar to the test tubes used in experimental chemistry, and mounted on stands in the same manner. At ten inches from the bottom of each tube a mark is made upon the glass, having a zero (0) placed against it, and from this point the tube is graduated into tenths of inches, and numbered downwards for three inches, so that each division is one hundredth of the tube. Now if several of these are filled with new milk at the same time, and placed in the same temperature, the thickness of the cake of cream formed at the top, will be indicated by the divisions, and thus experiments may be made upon quantities of cream produced by different systems of feeding, or by different animals under all circumstances, with great accuracy; and, by the continual division, the per centage of cream will be evident upon inspection.

CASE FOR OPINION.

The following case of difficulty having occurred, three different solutions have been given of it by different individuals.

Case.

There is a large cistern or reservoir full of water, 40 feet wide at top, eight feet wide at bottom, 20 feet deep, and 200 feet long, sloping equally on each side from top to bottom, and each end perpendicular. Some labourers are employed to pump it out; but a dispute arising among them concerning their proportions of the work, they have divided themselves into two parties, each agreeing to pump out the one half. A new question, however, has arisen, namely: what depth of water should be left when the first half is pumped out? The parties also desire to know what they should receive for their work, supposing they are allowed six-pence per ton weight?

Opinions.

R. J. calculates that the depth of water which will be left when the first half is pumped out, is 13 feet 7¼ inches; W. Mc F. that it will be only 13 feet, one inch four-tenths.

R. J. computes that the total sum, which the men will have to receive, is 62l. 6s. 10½d.; W. Mc F. that it will amount to 81l. 6s. 5¼d. A third friend, T. H—t. (whose answer to the preceding branch of the question, we have passed over as *too deep* for ordinary comprehension) states the sum to be 66l. 19s. 3¼d.

Query.—What is the correct answer?

TEST FOR THE DETECTION OF WHITING OR GYPSUM IN FLOUR.

Dip the fore-finger and thumb in a little sweet oil, and take up a small quantity of the flour between them; if it be pure, it may be rubbed for any length of time, and will not become adhesive; but if whiting be present, it very speedily becomes putty, and adheres strongly; the pure flour also takes on a very dark colour from the oil, but adulterated flour is but little altered in colour.

Another Test.

Pour a drop of lemon juice or vinegar into a small quantity of the suspected flour; if whiting is present, an effervescence will be immediately produced; but if the flour is pure, no particular effect will be exhibited.

HOW TO DISCOVER FLAWS IN PRECIOUS STONES.

It is of great importance to lapidaries and purchasers of precious stones, to possess some means of ascertaining their soundness or freedom from flaws when in the rough state. The following method is recommended by Dr. Brewster:—Immerse the rough unwrought stone in Canada balsam, oil of sassafras, or oil of anniseed, and turn it round with the hand so that the rays of light may pass through it in every direction. By this means the slightest flaws or cracks may be instantly perceived, in consequence of the changes which they produce on the transmitted light.

SYMPATHETIC INK.

(From a Correspondent.)

The following application of a modern chemical discovery has never before been communicated to the public, and affords a sympathetic ink very far superior to any as yet in use. Dissolve a small quantity of starch in a saucer, with soft water, and use the liquid like common ink; when dry, no trace of the writing will appear upon the paper, and the letters can be developed only by a weak solution of iodine in alcohol, when they will appear of a deep purple colour, which will not be effaced until after a long exposure to the atmosphere. So permament are the traces left by the starch, that they cannot (when dry) be effaced by Indian rubber; and in one case, a letter which had been carried in the pocket for a fortnight, had the secret characters displayed at once, by being very slightly moistened with the above-mentioned preparation.

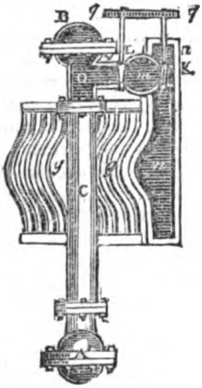
NARCOTIC EFFECTS OF SPANISH WINES.

When the French were in occupation of Madrid, it happened that several of their soldiers, after drinking wine in the public houses, died, some almost immediately, others after a short illness, under unequivocal symptoms of poison. Baron Larrey, who was at the head of the medical staff, sent for wines from different *ventas*, analized them, and detected narcotic ingredients in all; and he ascertained, upon full enquiry, that these substances, of which laurel-water was one, were as commonly used to flavour and strengthen the Spanish wines, as litharge is to correct acidity in the lighter wines of France.—The natives were accustomed to it from their youth; they frequently mixed their wine with water; and, moreover, the practice of smoking over their liquor tended to counteract its narcotic effects, by stimulating the stomach and intestines; it was, therefore, not surprising that they could drink it with safety, though it proved fatal to a few strangers.—M. Larrey, therefore, justly concluded that there had been no intention of *poisoning* the French, and that they had only themselves to blame, *for drinking their wine so far from home.*

EVE'S PATENT STEAM ENGINES.

(Concluded from page 323.)

III. *The Revolving Cocks or substitute for the Forcing Pump.*



The revolving cocks, by which the generator is supplied with water, are explained by the above. *n* is a vessel filled with water, of any convenient shape, one side of which vessel is near the furnace, so as to keep the water warm. A tube at O connects this vessel with the generator, and this tube has two revolving cocks, K and L, with a chamber, *m*, between them. The cocks are made to revolve equally by cog wheels gearing into each other; so that, if cock K is open towards the water reservoir, cock, L, will be closed towards the tube leading to the generator. The chamber between the cocks, will, therefore, be filled with water through the cock, L. By that time cock K, closes, and L opens towards the generator; the water in the chamber will then descend through O, into the generator, by its own gravity, and its place be occupied, in the chamber, by steam from the generator. Cock K, opens again towards the chamber, and L is closed towards the generator; the steam in the chamber will be condensed by the water now entering, or escape into the water reservoir, *n*. This revolution will go on continually. If water be presented by cock L, to the generator, and the said generator should be sufficiently full, the water being up to the dotted lines, in such a case the water will not be received, but remains in the chamber until part or the whole is wanted, the cocks constantly revolving. By this arrangement the water can be kept constantly at the desired height.

IV. *The Safety Apparatus.*

Figs. 5, 6, 7, and 8, elucidate Mr. Eve's improvements in the safety apparatus, as applicable to his tubular circulatory steam generator, or to any other boiler where high or low pressure steam is generated. Fig. 5 shows a longitudinal section of the compound tube: *a*, is the piston rod, screwed into the piston, *b*, which piston fits into the cylindrical tube, *e*, screwed or otherwise fixed at its base into the pipe that connects it with the steam receiver or boiler. O is a hole perforated through *b*, to allow the steam to ascend into the hollow space, *n*, above the piston, so that the pressure is equal on both sides with the exception of the piston rod, the diameter of which alone, is unbalanced. The piece, *h*, screwed into the upper part of tube *e*, prevents the steam from ascending higher; another piece, *g g*, having a hollow space on the top, is screwed into *h*. Both these pieces have a hole bored in their centre, lengthways, of a diameter equal to the piston rod, *a*, and to allow it to work up and down. The hollow space, *i i*, in the middle of the two pieces, *g* and *h*, is filled with packing so as to prevent any escape of steam along the piston. The hollow space, *p*, at top, is filled with oil; K K is a bason, with

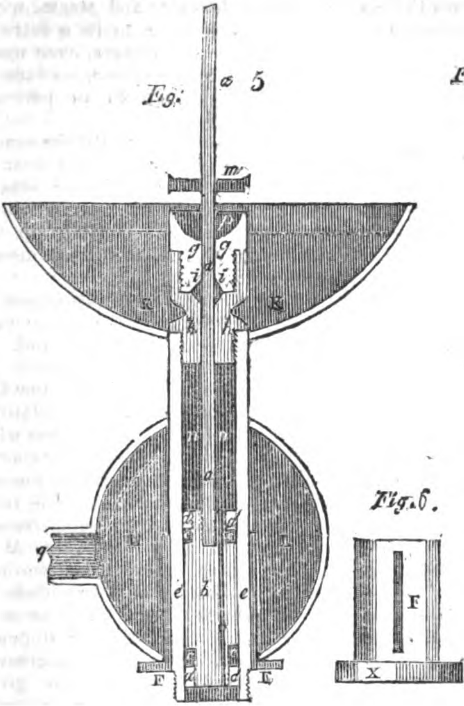


Fig. 5

Fig. 6.

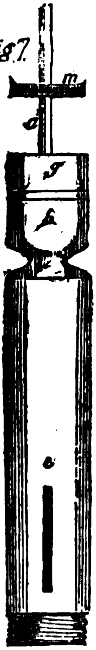


Fig. 7


Fig. 8

water up to the dotted line, to keep the upper part cool, the weights, with which the safety apparatus are intended to be loaded, are placed on the collar, *m*. The hollow tube, *e*, has longitudinal openings, as will be perceived by fig. 7, which presents an outside front view of the apparatus, and through these openings the steam escapes whenever the piston, *b*, rises. These holes may be of an indefinite length and breadth ; a jacket, F, represented by fig. 6, which fits over the tube, *e*, and has likewise the same number of longitudinal holes cut through it, slides over the said tube, and by adjusting this jacket at X, the channel for the escape steam can be made narrower accordingly, as it may be desirable to have the piston rod raised more or less. The hollow vessel, L L, or a vessel of any other form, slides or is otherwise fixed over the lower part of the apparatus, so as to intercept the steam from incommoding the upper part of it where the rod is loaded. The pipe, *q*, leads from this hollow vessel, L, to the steam condenser, or serves for the escape of steam. Fig. 8, represents an outside view of the piston : *a*, is the rod already described ; *c c*, are packing rings, two on the upper side and two on the lower side. These rings press against the tube, *e*, in order to keep it steam-tight, so that no steam can escape through the longitudinal openings ; *d d*, are two pieces of metal, screwed on at the top and base of the piston, to confine the packing rings.

V. *The high and low pressure combination.*

A, fig. 1, (see our last number) is the furnace containing the steam generator or boiler : B is the dome on the top of the steam receiver, with the steam pipe, C, and safety apparatus, M.. D is a cock upon pipe C, through which steam is admitted to the high-pressure engine, E. After having acted upon it, the said steam passes into the low pressure engine, F, constructed on Mr. Eve's principle on a larger scale, so as to allow the steam to expand, and then act upon it as low pressure: E and F have pinion wheels of an equal pitch, gearing into a spur wheel, G; these wheels determine the power given to each engine by regulating their motion with reference to the power required from each. The steam finds its escape at Z into the condenser, H; the condensed steam or water runs through pipe, I, by its own gravity, towards the two revolving cocks, K, whence it is conveyed back to the feeding pipe in the steam generator. V is an engine, constructed upon the plan explained under Head I, having two induction and two eduction pipes, which engine serves as a pump in this particular situation. Pipe, W, sucks the water from the well or river, and carries it into the refrigerator: X receives the water in the refrigerator, and carries it downwards; P is the bellows, fanning the fire by means of a band round the axle, Q, connected with two pulleys, R and S, or by any other contrivance; O is the valve and lever of the bellows, connected, by rod N, with the safety apparatus; T and U, are pulleys, connected by a band to give rotary motion to pump V; but many other contrivances may be used; L is a cock, which is only opened before the engine is set to work, in order that the air may be driven out of the pipes and condenser by the steam; the cock may then be shut, and the engine set to work; Y is a pipe leading from the safety apparatus to the condenser. If an engine, therefore, be so contrived, and the boiler once filled with water, the same water will answer for working the engine, as long as all the pipes through which the steam and water circulate, are tight; or, at any rate, the loss of water will be very inconsiderable.

The advantages supposed to attend these engines are thus summed up by the patentee.

"It is presumed, in the first place, that from a steam generator so small as the above-described, containing little water and steam, with the provision made in its construction against any danger, even were a rupture to take place, no danger could possibly happen to persons near the engine.

"It is also obvious, that the quantity of fuel consumed, will bear a proportion to the boiler or steam generator, and that, comparatively, very little can be consumed in so small a furnace as my steam generator requires.

"There are no reciprocating parts, levers, fly-wheels, or valves, but simply two revolving parts; and, if I may so speak, the whole power of the steam is appropriated by the direct or first intention. The relative weight and bulk of this engine will require a few more words for elucidation. A more concentrated power in steam-engines is attainable in two ways:—the first is by using steam of great elasticity; thus, on Mr. Perkins's plan, a cylinder, two inches in diameter, would be sufficient for a ten-horse power. The second method of diminishing the dimensions of steam-engines is, to increase their mobility; that is, to give greater velocity to the part or parts on which the steam acts. This, in all engines having reciprocating motions, is limited; for motion, alternately in opposite directions, requires a certain time, otherwise the whole power of the engine may be consumed by simply overcoming the inertia. Now it is certain, abstractedly considered, that as we increase the velocity of the piston, we may decrease the size of the engine; it follows, therefore, from the above premises, that if we could conveniently make use of steam of 150 pounds to the inch, instead of mere atmospheric pressure, and have 150 strokes to the same engine instead of 15, we should require 100 times the power; or, what is the object at issue, have the same power with an engine and generator in that proportion smaller.

"The first object, as regards high pressure, it will not be too much to concede, as it has been long ago practically attained by Evans, and others. And, as to the velocity which this engine is calculated to admit of from its construction, though not unlimited, it is certainly very great, much more than ten times that of reciprocating engines, and much greater even than that of rotary engines, that have reciprocating parts. Thus, if these premises be correct, it cannot be too much to say that this engine ought to have the same power as the engines in common use, though of smaller dimensions; and that the weight will be reduced, not in proportion to the reduction of its superficial, but its cubic dimensions.

"The simplicity of the engine (the next desideratum), I conceive, cannot be well increased, as the engine itself consists of but two revolving parts. And lastly, as a result, the expense of erecting an engine of a given power, on the construction of the above, ought to bear a proportion to the diminution of its bulk and weight, and greater simplicity.

"The difficulty of availing ourselves of the advantage of using steam twice, that is, first as high pressure, and then in a condensing engine to any extent, is sufficiently apparent from the following considerations. It appears from Mr. Woolf's experiments, that steam, heated to balance six pounds to the inch, will expand into six times the volume under atmospheric pressure; at 20 pounds to 20 times; at 40 pounds, to 40 times, and so on. Working with comparatively so low a pressure as 40 pounds to the inch, it would be found extremely inconvenient to use two engines whose capacities were as one to forty; and if not impossible, would appear ridiculous, if steam of 200 pounds elasticity, which is quite common in the United States, be used, as the second engine would have to be 200 times the capacity of the first, which, in this extreme case, would, at least, have a disproportionate appearance. All reciprocating engines, or those having reciprocating parts, will have to contend with this inconvenience; or, rather, can only avail themselves of a partial advantage from using high and low steam, as they have to work stroke for stroke. With my rotary steam-engine the full benefit of this principle may be appropriated, as the engine that acts by high pressure may be made to revolve as much faster than the first as to allow of the full expansion of the steam before it is acted on, for the velocity may be carried to any extent required, without inconvenience.

"It is presumed that it will not be too much to say, from what has been known to be done by using steam twice, on Mr. Woolf's principle, even with the reciprocating engines, that a saving of half the fuel may be achieved when applied to my rotary engine, which is so much better adapted to give it full effect; nor ought it to be considered extravagant to anticipate that a moiety of the balance will ultimately be saved by some of the new modes of generating steam, which the ingenuity of so many competitors has elicited, among whom I have ventured to enter the lists."

HISTORY AND PROSPECTS OF BRITISH INDUSTRY.

Sir,—I perceive from different public journals, that a considerable impression has been produced by an article, stated to have appeared in the last Quarterly Review, entitled the History and Prospects of British industry.

Now, Sir, the data from which conclusions are drawn, intended to demonstrate the efficacy of the great resources of this country, to produce the remote effects of universal civilization; to improve and enlarge the moral and physical powers of man;—or, in the phraseology of the day, to promote the march of intellect, are, in themselves, so removed from ordinary apprehension, that they seem rather the objects of faith than of reason—if Mr. Locke's definition of these principles be correct. A poet's imagination might indeed conceive, but his "fine phrenzy" would find it difficult to embody or furnish them with any "local habitation."

To prove the great capacity of steam in this general redemption from ignorance and error, a calculation is made of the time it would require to erect, by its aid, such a mass of matter as one of the pyramids of Egypt. This effort it appears might be completed in 18 hours, so that we have now the ability of doing in that time that which occupied the feeble powers of antiquity nearly 20 years. But I believe, it will be admitted, that an effect is always adequate to its cause. If, therefore, the united power of the steam engines of this country be capable of producing, as it is stated, the above work in 18 hours, it is clear that if the power be increased, and the argument does not require that we should give it a definite limitation, the same work will be produced in less time; and again, if this power be conceived to be still further increased, we shall at last bestow upon our machinery the creative energy of a moment; and engines, pyramids, and mummies, arise at once in perfect completion.

Nor does it appear to me that the calculation which regards the application of machinery to the manufacture of cotton, is less visionary. It is observed, that "the machinery employed in cotton manufactories save 700 millions sterling (per annum) to the British nation; or in other words, that without machinery and steam, the prodigy of British industry and civilization, would still have been wanting to honour mankind." I will not suppose, this assertion is intended to prove that 700 millions sterling are saved out of the expenditure of the country—it would be absurd; but that it is meant merely to affirm, that the present produce of machinery would require 700 millions sterling more in its manufacture, if the same quantity of work were produced by human labour. Now what does this prove, not that this vast power is the cause of civilization and prosperity, but that we have substituted machinery for the labour of human hands, and have rendered useless and unproductive a large portion of the community. Such great results of mechanism (and they are truly wonderful) are not the causes but the effects of previous civilization. I here speak of those gigantic mechanical powers, which, according to the language of the review, must render the stupendous remains of antiquity, objects below the dignity of the present age, and by withdrawing all magnitude and magnificence from its structures, leave us to consider them only as the pigmy efforts of past ages, whose monuments have, nevertheless, opposed the revolutions of forty centuries, and outlived the records of their history. The limited introduction of machinery into the operations of life, stands upon different ground.

They "whose withers are unwrung" may calmly contemplate this progress of steam, and its adaptation to the superfluous wants of mankind; but the present moment offers too serious a commentary upon the system, to invest it with all that glory and happiness, the visionary spreads around it. He may exult in this inordinate and progressive power, but the man whose small comforts are to be supplied, whose real wants are to be removed by labour, will reject its application with indignation and contempt.

To implant one virtuous principle, to fix one immutable truth in the inconstant breast of man, by which his actions in society may be regulated, is to do more to promote order and happiness, than the daily invention of new machines, continually suggested by the endless modifications of mechanic power, can ever effect.

That there are elements of intellect at work, whose remote influence will materially alter the moral surface of the world, is, I think, unquestionable. But the philosopher, who in his reasonings on mankind, would wish to be comprehensive, without confusion, and profound without mystery, must begin with principles far different from those of steam and machinery. In following the history of the human mind, in tracing the effects of art, science, and literature, on the past and present systems of society, and their probable influence on the future, he must at every step deduce his conclusions from the silent and unerring operations of an eternal intelligence, whose ends, though not at once revealed, appear the result of visible means. He will then learn to distinguish between the effects of a first cause produced by material agency, and the gross conceptions of our nature, too ready to bestow the attributes of omnipotence, upon that which is only an instrument in his hands.

I am, Sir,
Your obedient Servant,
ANTIFUMUS.
Neath, Glamorganshire, Sept. 6, 1826.

HIGH AND LOW DRIVING.

Sir,—I have seen the following case stated in support of the opinion, that a low seat in driving is more advantageous than a high one. Suppose the driver to sit *perched* aloft, so that a *right* line drawn from his hand to the horse's mouth, passes above, and not through the saddle-rings, does he not *lose* power? Now, Sir, to this question, I should answer decidedly No; and I will endeavour to show that my opinion is correct, by a very simple yet practical example:—

Whenever the progress of a body in motion, as a barge going with the tide on a river, or a weight down an inclined plane, is required to be stopped, whether suddenly, or by degrees, it is invariably the practice for the person stopping it, instead of pulling against it in a right line to the point of resistance, to look out for some projection round which he may pass the rope, whereby the operation is very considerably facilitated; and for this reason, that such post or projection then becomes a *fixed* and *steady* point of resistance, against which he opposes his strength to much greater advantage, and is also enabled much more easily to maintain the ground that he has gained. I conceive then, that I may fairly compare the efforts which a horse makes to get his head free, to the impetus that has been received by a body in motion, and thus reduce the two cases to an exact similarity. I contend, therefore, that instead of a *loss*, there is a *gain* in the power and facility of reining in a horse, when the reins come in contact with the upper part of the saddle-rings.

I do not mean to deny that in case an accident *should* happen, the lower the seat, the less the danger; but it is equally certain, that the higher and more commanding (to a certain extent) the seat of the driver is, the less likelihood there is that an accident should occur, on account of the additional facility thus obtained in managing the horses, and also the much better view which the driver is enabled to take of the surrounding objects.

I am, Sir,

Your obedient servant,

PAUL PRY.

London, August 21, 1826.

THEORY OF THE SALTNESS OF THE SEA.

Sir,—Having seen a notice of the process of purifying coal gas, for which Messrs. Ledsam and Cook, of Birmingham, have recently taken out a patent, it gives me an opportunity to make a few remarks on the similarity of this process to one of a more gigantic kind, that is continually proceeding in nature.

The quality of saltness belonging to the sea, it is well known, is a purifier of nature; but the extent to which it operates in this way, is, perhaps, underrated even by philosophers; and by the world in general it seems to be not at all appreciated.

In that which here follows, I shall endeavour to illustrate what I conceive to be its principal function, by an appeal to the process of art, employed by Messrs. Ledsam and Cook, of Birmingham.*

Whether the patentees of this ingenious process were plagiarists from nature, in making their discovery, or not, it is impossible for me to say; though I think it highly improbable that they were, as the knowledge of nature, and philosophical subjects, is not of the right kind to assist persons to take out patents.

To proceed to a more immediate consideration of the subject, it appears, that coal gas may be purified by common salt, either dry, or in solution, and mingled indiscriminately, or placed in alternate strata with the coals in the retort.

By a cross-examination, if I may express myself, of these several processes, or modes of operating, an identity may easily be established between some one or other of them, (if not between two or more) and that process of purification which, it is here assumed, takes place in the waters of the ocean.

There are three principal things to be regarded in this view of the sub-

* The process is simply this—Common salt is placed in alternate strata with the coal in the retort; or mixed with the coal previous to subjecting it to distillation. By either of these means, the gas as it is generated, or emitted from the coals, is immediately purified.—EDIT.

ject.—First, the medium, which (in the ocean) is water; secondly, the purifier, which is salt; and thirdly, the thing or things to be purified, including all the heterogeneous matters, other than salt and water, that find their way into the ocean.

Now, in any illustrative process of art, the conditions necessary to constitute a sufficient identity with the known positions in nature, of the three things above-mentioned, are chiefly two—the salt must be efficient in solution; and also when mingled with the coals or whatever is to be distilled and purified.

It is scarcely necessary to trace the resemblance further, as it is obvious that both these conditions are obtained, either jointly or separately, by the process adopted by the patentees. Therefore the distinct or alternate use that is obliged to be made of them, by no means destroys the resemblance that the entire of the processes have to their grand prototype in the ocean.

It would be easy to extend the imitation much further by considering the effect of heat upon the two operations. There is not, I believe, a more surprising phenomenon in nature, than that of the absorption of heat by the waters of the ocean.

It is evident that the same quantity of heat (admitting the sun to be its source) must descend upon any given portion of land that does upon an equal quantity of water, (and vice versa) and yet the surface of the latter always indicates nearly the same temperature; whilst that of the former, it is too well known, is excessively variable at different times of the day and year.

It would be the height of folly, in my opinion, to assume that even a thousandth part of this difference is generated by evaporation, on the surface of the water;—No! The heat must inevitably sink down into the main body of the ocean, and there, aided by the numerous submarine volcanoes, which we know exist, it, no doubt, assists in the reduction, distillation, or sublimation of the animal, vegetable, and mineral debris of the growing world, which all of them, ultimately find their way into the ocean.

From these processes, the more rectified spirits or vapours ascend to form new air, and consequently, fresh materials for subsequent life and vegetation. The remainder is quietly deposited in mineral strata, or serves to augment or replenish that very saltness by which it has been acted upon; but which is principally, according to the view here taken, for the rectification of the distilled liquids, in their ascent to the surface of the water; in which position, we in common parlance call them vapours, from the idea or acknowledged impression, that they arise from simple evaporation, caused by the adustion of the sun-beams on the surface of the water.

But the reason why we never think of calling this, which I have just described, a distillatory process, is simply because the *retort* (including the whole atmosphere) is so magnificent a one, that we puny mortals are lost in it. Nevertheless, how much would it contribute to the advancement of science, if this were to be considered a purely distillatory process? I could almost venture to assert, that meteorologists in particular, would begin their studies again with new ardour. The whole theory of clouds, and the agency of electricity in supporting and changing them, is hereby so much simplified and explained. But to follow this part of the subject would drag me too far away from the consideration of heat, and the saltness of the sea.

It is a well established fact, that the sea is warmer at a considerable depth than at the surface; but it is probable that no gauge has been taken of its temperature, at so much as one fifth part of that which is, sometimes, regarded to be its average depth, namely, some number of miles between five and ten. Therefore, it is impossible to say what is the full effect of this increase of heat in the lowest beds of the ocean.

But the simple fact, of a physical quality prevailing in a mass of matter, that covers at least three-fourths of the globe, affords presumptive evidence that it was not so ordained without design. And further, the constant tendency of all the particles of matter (heavier than salt and water) to gravitate downwards, is somewhat a corroborative proof of the truth of these views, as the said particles are thus enabled to meet and participate in a due abundance of heat, for the purposes already pointed out.

I am, Sir, &c,

ÆQUIS.

RELATIVE VALUE OF FUEL.

From the Operative Chemist.

Charcoal.

Mr. Dalton, by heating water, obtained a result equivalent to melting forty pounds of ice with one of charcoal. But Dr. Crawford's experiments give sixty-nine pounds of ice melted by one pound of charcoal. Lavoisier's give ninety-five pounds and a half; Clément and Desormes ninety-five pounds, and Hassenfratz's trials, on various kinds, give a mean of ninety-two pounds of ice melted by one pound of charcoal; his highest result being ninety-six pounds, and lowest one seventy-four pounds. Mr. Tredgold considers forty-seven pounds of ice melted by one pound of charcoal as the real average effect of that fuel. A cubic foot of charcoal weighs about fifteen pounds.

Coke.

Lavoisier makes the quantity of coal to be to that of coke as 605 is to 552 when the same effect is produced; and in addition to this increased power of giving out heat, it must also be considered that coke gives out no smoke in burning, whence it should always be used in furnaces seated in towns, in order to prevent any annoyance to the neighbours.

The present prevalent use of gas, for lighting towns and even houses, has brought a considerable quantity of *gas coke* into the market, which does well enough for heating rooms, but is far inferior to the stifled coke in its heating power, so that smiths and iron-founders invariably use the latter kind, and when a great heat is required, the chemist should follow their example.

Coke has been tried against wood in Paris for warming the Opera-house. Fifty-eight pounds of coke, costing there about 1s. 3d., produced the same effect as 160 pounds of wood, costing there about 2s. 6d.

Charred Peat.

According to Messrs. Blavier and Miché it requires 1666 pounds of charred peat to produce the same effect as 740 pounds of common charcoal.

The charred peat, made by stifling, is superior, in its power of producing heat, to that made by distillation. Unfortunately the stifled charred peat is a kind of pyrophorus, which takes fire if it becomes accidentally wetted, or even in moist weather. In consequence of this property several accidents have happened by the rain finding its way into places where it is kept; it is on this account forbidden, by the laws of some countries, to be kept in towns.

Therefore the Dutch, who burn this fuel not only in their houses, but even in pans under their feet, while they are at church in winter, are in the habit of charring it at home as it is wanted. It is first burnt in the kitchen, and when they find it is red hot quite through, they then take it off the fire, put it in a close earthen or copper pot, and cover it down with a wet woollen or linen cloth, and by the air being excluded the fire is soon extinguished, and when it is cold it will resemble charcoal, except being covered with white ashes, and will, if properly charred, burn with scarce any smoke, and very little of the suffocating quality which charcoal has. This it is that makes the charred peat so proper for green houses, for charcoal burnt in them is very prejudicial to the plants, and often fatal to the person who attends them.

The usual method of burning this peat in Holland, especially by the poor, is in cast-iron kettles, and for boiling any thing over it this way saves half the fire it would otherwise take if burnt on a hearth, or in a grate, by the side of the pot reflecting the heat.

A collected view of the data from these experiments and comparisons is given by Mr. Tredgold. It is as follows:

Kind of Fuel.	Fraction of a pound that will heat one cubic foot of water one degree of Fahrenheit's scale.	Pounds of fuel that will convert one cubic foot of water into steam.
Newcastle, or caking Coal	0·0075	8·40
Splint Coal	0·0075	8·40
Staffordshire cherry Coal	0·0100	11·20
Wood, dry pine	0·0172	19·25
—— dry beech	0·0242	27·00
—— dry oak	0·0265	30·00
Peat, of good quality	0·0475	53·60
Charcoal	0·0095	10·60
Coke	0·0069	7·70
Charred Peat	0·0205	23·00

It will appear, as Mr. Tredgold justly observes in his very excellent "Principles of Warming and Ventilating Public Buildings," that the utmost effect we can hope to gain in applying fuel must be less than double the measure of effect here given; and even to attain that effect all the caution of conducting a philosophical experiment must be continually employed, which will be found impracticable on a large scale, and altogether incompatible with the simple apparatus and small share of attention which can be devoted to this end in real business, although there are not wanting persons who promise four, six, and even ten times these effects.

Improvement of Fuel by mixture.

It is surprising that so few attempts should be made to improve the fires which are made in the open chimneys of elegant apartments by preparing the fuel; for, as Count Rumford observes, nothing surely was ever more dirty, inelegant, and disgusting than a common coal fire.

Fire balls, of the size of goose eggs, composed of coal and charcoal in powder, mixed up with a due proportion of wet clay, and well dried, would made a much more cleanly, and, in all respects, a pleasanter fire than can be made with crude coals; and it is believed would not be more expensive fuel. In Flanders, and in several parts of Germany, and particularly in the duchies of Juliers and Bergens, where coals are used as fuel, the coals are always prepared before they are used, by pounding them to a powder, and mixing them up with an equal weight of clay, and a sufficient quantity of water to form the whole into a mass, which is kneaded together and formed into cakes; which cakes are afterwards well dried, and kept in a dry place for use. And it has been found, by long experience, that the expense attending this preparation is amply repaid by the improvement of the fuel. The coals thus mixed with clay not only burn longer but give much more heat than when they are burnt in their crude state.

Notices to Correspondents.

If H. H. will favour us with a specimen of his proposed investigation, we shall then be better able to decide as to its admissibility.—We agree with him that it is wanted.

We have written to M. H. S. according to the address given in his last, but to prevent mistakes, have directed the letter to remain at the post office till called for.

We are obliged to N. H. for his friendly hints and admonitions; but must, in justice to ourselves, observe, that owing to an accidental circumstance, the article containing the numerous errata, of which he chiefly complains, was not revised by us in its printed state before publication.

L. J. F. chuckles at what after all was but a sorry imposture; neither has he hit the right nail on the head with his wonderful hammer, when he supposes that *we* were the parties imposed upon on the occasion.

Communications received from F. M.—H. O.—H. C——l. — Aurum.— J. M. N.—R. M.—E. F. G.—Thomas Tayspill—John Barleycorn—I. M. B. An Enquirer after knowledge—N. M. M.—Paul Pry (Secundus)—T. D.— Senex—Olinthus—Mr. Harrison.

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Mechanics' Magazine,

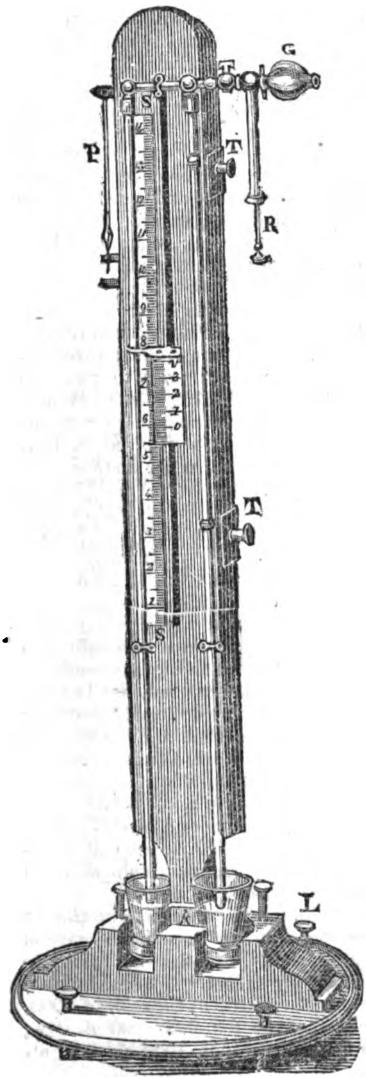
MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

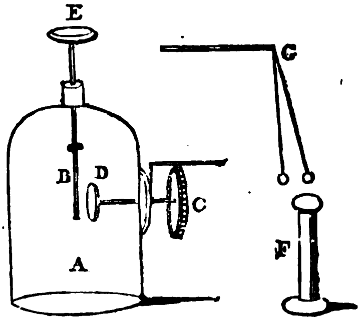
No. 163.] SATURDAY, OCTOBER 7, 1826. [Price 3d.

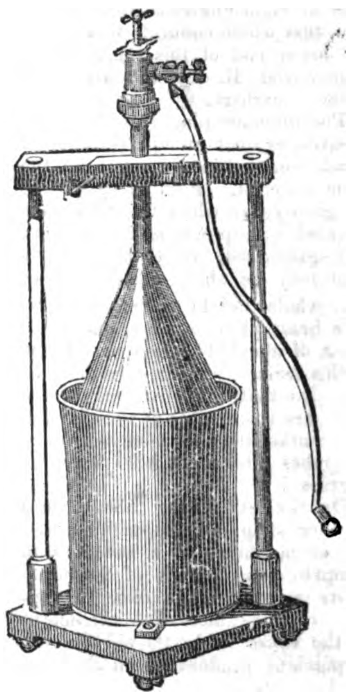
" Philosophy that does not dream or stray,
Walks arm in arm with nature all the way.
* * * * * * * * * * * * * *
And brings at his return, a bosom charg'd
With rich instruction and a soul enlarg'd."

COWPER'S CHARITY.

THE LITRAMETER, &c.







DESCRIPTION OF THE LITRAMETER INVENTED BY PROFESSOR HARE, OF THE UNIVERSITY OF PENNSYLVANIA.

The name *Litrameter*, is derived from the Greek *litra*, weight, and *meter*, measure; and is given to an instrument which professor Hare has contrived for ascertaining specific gravities. The litrameter owes its efficiency to the principle, that when columns of different liquids are elevated by the same pressure, their heights must be inversely as their gravities.

The first of the figures on the preceding page is a representation of this instrument.

Two glass tubes, of the size and bore usually employed in barometers, are made to communicate internally, with each other, and with a gum elastic bag, G, by means of a brass tube, and two sockets of the same metal, into which they are severally inserted; the brass tube terminates in a cock, to which the neck of the bag is tied. Between the cock and the glass tubes, there is a tube at right angles to and opening into, that which connects them. At the lower end of this tube, a small copper rod, R, enters through a collar of leathers.

The tubes are placed vertically, in grooves, against an upright strip of wood, tenanted into a pedestal of the same material. Parallel to one of the grooves, in which the tubes are situated, a strip of brass is fastened; and graduated, so that each degree may be about equal to $\frac{1}{220}$ of the whole height of the tubes. The brass plate is long enoug to admit of about 140 degrees. Close to this scale, a vernier, *v*, is made to slide, so that the divisions of the scale are susceptible of sub-division into tenths, and the whole height of the tubes into about 2220 parts, or degrees.

On the left of the tube there is another strip of brass, with another set of numbers, so situated as to comprise two degrees of the scale above mentioned, in one. Agreeably to this enumeration, the height of the tubes is, by the aid of a correspondent graduation on the vernier, divided into 1100 parts or degrees.

A small strip of sheet tin, *k*, is let into a kerf in the wood, supporting the tubes, in order to indicate the commencement of the scale, and the depth to which the orifices of the tubes must extend. At distances from this, of 1000 and 2000 parts, (commensurate with those of the scale) there are two other indices, (T, T,) to the right hand tube. Let a small vessel containing water, be made to receive the lower end of the tube, by the side of which the scale is situated; and a similar vessel of any other fluid, whose gravity is sought, be made to receive the lower end of the other tube; so that the end of the one tube, may be covered by the liquid in question, and the end of the other tube by the water.

The bag being compressed, a great part of the contained air is expelled through the tubes, and rises through the liquids in the tumblers. When the bag is allowed to resume its shape, the consequent rarefraction allows the liquids to rise into the tubes, in obedience to the greater pressure of the atmosphere without. If the liquid to be essayed, be heavier than water, as for instance, let it be concentrated sulphuric acid, it should be raised a little above the first index, at the distance of 1000 degrees from the common level of the orifices of the tubes. The vessels holding the liquids, being then removed, so that the result may be uninfluenced by any inequality in the height of the liquids, the column of acid must be lowered, until its upper surface coincide exactly with the index of one thousand. Opposite the surface of the column of water, the two first numbers of specific of the acid, will then be found; and, by duly adjusting and inspecting the vernier, the third figure will be ascertained. The liquids should be at the temperature of sixty.

If the liquid under examination be lighter than water, as in the case of pure alcohol, it must be raised to the upper index. The column of water, measured by the scale of 1000, will then be found at 800 nearly; which shows that 1000 parts of alcohol, are in weight, equivalent to 800 parts of water—or, in other words, 800 is ascertained to be the specific gravity of the alcohol.

The sliding rod and tube at R, between the cock and the glass tubes, facilitates the adjustment to the index of the column of liquid in the right hand glass tube. When the rod is pushed in as far as possible, it causes a small leak, by which the air enters; and the columns of the liquids, previously raised too high by the bag, may be allowed to fall, till the liquid which is to be assayed, is near the index. Then, by pushing the rod in, they may be gradually lowered, and adjusted to the proper height with great accuracy.

A rod of this kind, graduated, might answer the purpose of a vernier.

The bag of caoutchouc, may be advantageously furnished with two valves; one opening from the tubes into the bag, the other, from the bag into the air.

But, upon the whole, Professor Hare finds a syringe preferable; the adjusting rod being included in the rod of the piston, which is perforated for its reception, and furnished with a stuffing box, to render it air tight.

The plummet P, and the screws at L, enable the operator to detect, and rectify any deviation, in the instrument, from perpendicularity.

ELECTRICAL EXPERIMENTS.

The following experiments were begun several years ago, when Deluc's column came first into notice, and were performed on one of them, formed of zinc, of the size of half an inch square, alternated with gilt paper; this was connected with an electrometer, such as is represented by the second figure on our front page. A, is the bottle with a side neck, C, a divided screw head, passing through a mettle plate fixed to the side neck; D, plate on the inner end of the screw; E, head of the screw passing through a plate fixed in the upper neck, from which a gold leaf pendulum hangs; F, a piece of amber fixed on a short stick of hard sealing wax, with a wooden foot, and which, when excited by rubbing is brought under G—two pith balls hanging by a fine silk thread, or, what is better, small disks of platinum. The rest of the apparatus may be easily conceived.

The pendulum was connected with the zinc, or positive end of the pile, and the plate with the negative or gilt paper end. The zinc end was occasionally connected with a thunder rod, insulated on the outside of an upper window, but the difference in the action of the column, was not then much, except during a thunder storm. This instrument is a real electrometer, or measurer of the intensity of the electricity, and capable of the greatest nicety, by dividing the head of the plate screw into 100 parts, which will, of course, give the 100th part of the turn of the screw; it is, however, not so sensible as the electroscope after mentioned. In using it, I brought the plate within the striking distance of the pendulum, and then numbered the strokes with a stop watch; I found my observations to agree entirely with those of Deluc, as to the increased quantity in winter, beyond summer, from which he draws this conclusion, that in the latter period, electricity goes into the earth, to stimulate vegetable growth. The beats were, under the same circumstances, 50, in winter, per minute, and 5, in summer, as a maximum; the minimum in each season being 5 and 0, except when in summer, the connexion was formed with the external air,; in that case, on a thunder cloud passing, it rose to 50; then generally sunk to nothing on its being discharged; but at any other time at that season it never exceeded 5. But the chief singularity, which has escaped M. Deluc, and other observers, is the influence that the direction of the wind has on electricity; by innumerable observations, I found that when the west wind blew, though accompanied with rain, the beats were often ten times greater than with an east wind, though accompanied with snow and frost; I had not, at that time, my hygrometer in use, but I find the above confirmed by later experiments, on a different plan. The faster the W. wind blows, the more the electrometer is affected. I also observed the clearest proof of the current of electricity, from the positive wire, and satisfied my mind with regard to a point, of which I had, till then, entertained considerable doubts; on applying the flame of a candle to the negative wire, no effect followed, (you will observe that the electrometer, from its structure, was insulated) but, applied to the positive, the beats immediately ceased. However, the electricity was not destroyed, or carried off, but, on the flame being taken away, increased with fresh vigour, and then returned to its former action. I had an opportunity of seeing this experiment performed on a great scale. I was examining the electrometer during a thunder storm, the beats were 50, and, on the thunder discharging on a house, not many hundred feet from the place where I was, the electricity fell to 0, and it was a considerable time before the action re-commenced. The house where the lightning broke, was comparatively low, but rather insulated; the cloud came from the south west, and, what is singular, there were several very high vents of a distillery, to the windward of the house, coming from furnaces, and continually throwing out smoke and flame from their tops; this saved the distillery, but made the condensed electricity more apt to discharge on the next prominent object; this happened to be the house in question, where a poor young woman fell a sacrifice on the occasion; but the danger would have been incalculable had it struck the distillery.

Having laid aside my column, which had lost most of its power, I had no farther opportunity of renewing my experiments for some time. I now conclude this part, by answering some objections to the conclusions, that I consider may be drawn from them. It has been said that the difference between the effects of the east and west winds, may be owing to the moisture imbibed in passing over the German ocean; but I have since seen, from experiment, that electricity will change from positive to negative, and vice versa, by the change of the wind only, though there may be no change in the hygrometer; and when it shews only $\frac{1}{2}$ grain of moisture in the cubic foot of air. The S. W. wind, though noted for its moisture, is negative; and the N. W. and N. though exceeding dry, positive. This seems to shew that the electrical current, is from E. to W. and that the west wind heaps up the electrified clouds, and is the source of the increased electricity, and that the current originates with the sun. When I come to that part which treats on the electricity of coloured bodies, I expect to prove this. I shall only add, that I have observed that spasmodic contractions, both external and internal, are much increased during the west wind; and sudden deaths during the east, which seems to shew that electricity is the real source of muscular motion, as has been conjectured; and accounts partly for the effect that the state of the air has on diseases of different kinds.

(To be continued.)

LARGE SELF REGULATING RESERVOIR FOR HYDROGEN USED IN THE LABORATORY OF THE UNIVERSITY OF PENNSYLVANIA.

The third figure on our front page represents a self-regulating reservoir, of large dimensions, which is used as a repository for hydrogen gas, at the Pennsylvania university. It is not made of glass, as the smaller reservoirs are, but of lead. The outer tank or vessel contains diluted sulphuric acid; and the inverted bell, within it, some zinc, supported on a tray of copper, suspended by wires, of the same metal, from the neck of the bell. The cock being open, when the bell is lowered into the position in which it is represented, the atmospheric air escapes, and the acid, entering the cavity of the bell, by its reaction with the zinc, causes hydrogen gas to be evolved rapidly. As soon as the cork is closed, the hydrogen expels the acid from the cavity of the bell, and, consequently, its reaction with the zinc is prevented, until there be reason for drawing off another portion of the gas. As soon as this is done, the acid re-enters the cavity of the bell, and the evolution of hydrogen is renewed, and continued until again arrested, as in the first instance, by preventing its escape, and consequently causing it to displace the acid from the interior of the bell, within which the zinc is suspended.

This reservoir is attached to the compound blowpipe, in order to furnish hydrogen; and may, of course, be used in all experiments, requiring a copious supply of that gas.

SENEX'S IMPROVEMENT IN CARRIAGES.

Sir,—The obliging notice taken of my communications to you upon the subject of the best mode of connecting the sway bar with the pole of a four-wheeled carriage, has induced me to call upon an artist to make a drawing to explain my meaning more distinctly and accurately, (which I shall have pleasure in forwarding to you as soon as it is prepared;) and the encouragement you have given to the suggestion, leads me at present to detail some experiments, I have myself made, as to such mode of draft, which may not be unworthy of consideration.

I was induced, for the security and comfort of a blessed relative, now no more, to try the use of four horses driven in the manner called a short set, that is, with a coachman and a postillion upon the foremost pair. I found much difficulty, however, in enabling each to work his horses to advantage, which led to the mode of harnessing already described; namely, by passing a pin through the pole, which received a loose ring attached to the sway bar, which admitted the ring to work up and down freely within the space of four inches. This certainly attached the sway bar to the pole much more conveniently than the usual hook, for the reasons already described, and others I could offer. But having lost one of my horses, I was induced to drive a third horse tandem in the same way, and I found it to answer extremely well. The point of draft was not only much less affected by the twists and jirks of the pole, but with reference to its position, was much more motionless than when depending from a hook, upon which it swayed to either side incessantly, when not stiffened by the pull of the leaders. The hook and ring affords no support to resist the alternate elevation and depression of the sway bar sideways, but a ring operating upon a pin, thickened at its inner side to the depth of one inch (say), or made into two parts with an intervening space of an inch, resists this lateral movement, and keeps the sway bar, although loose and unconfined, yet *steady*. The same effect is further attained upon the principles of gravity, in consequence of the weight being suspended *underneath the substance from which it hangs*, and not supported in a line with it, as each increment of descent is calculated to produce such effect. But the mode I made use of to preserve the sway bar in its station, having been a short brace attached to the pole in the rear, perforated in front with a hole to receive the pin, it was kept in its position by a French nut, which took the pin, which was further retained in its position by a linch pin. The sway bar rested upon a substance, in breadth three inches, which maintained it in nearly an horizontal position, or at least, greatly diminished *the giddiness of motion* derived from the hook.

The benevolence with which my views have been considered, induces me to mention a further experiment I made, which was to have a light shaft suspended to the pole, as I have described, and resting in a saddle upon the back of the leader, with the usual gig harness, comprehending a breaching, and in this *little crib as it were*, my coachman worked a leader with long reins, and although his position was perfectly flexible to either side, as if he was in the usual way unconfined, yet the use of the breaching enabled the coachman to use the bridle, and to back the carriage with perfect safety and facility, and gave an appearance of *compactness to the team*, very different from the straggling mode of draft, which the usual harness for three horses presents.—Nor did I ever experience the smallest interruption or derangement from this mode of draft whilst I had occasion to continue it in use, although I should still hope a more prolonged use may *greatly improve* the experiment I made.

Although your candour is so much disposed to give the best construction to my imperfect statements, yet I am almost afraid to suggest to their honours, the coachmen of England, what may seem to derogate from their acknowledged skill and ability. I beg leave, however, to submit to them *with great deference*, that, if the mode of draft I have described were adopted *by them*, they would find it particularly advantageous on dark and dreary nights, with storms of rain, hail, or snow, blowing in their teeth. The leaders, with postillions upon them, would face the elements more readily, and the draft being from the underneath part of the pole, would effectually prevent the overset of the carriage.

A word, before concluding, to post-masters. There is now no difference of price between four post-horses, and two chaises, (although I remember when the first was 1s. 8d. and the last 2s.) and the consequence is, that gentlemen travel in their carriages often loaded before and behind with luggage beyond the proper exertions of a pair of horses to draw. Now, this risk might be avoided, if any well regulated power of *an intermediate kind* were introduced into use, which might be done, if a third horse were to be attached to the pole of the carriage by a *moveable piece of iron work*, comprehending the pin, &c. which could be made to fasten to the pole behind the common hook, which could be fastened to the pole in a strong manner by a few coils of flexible iron chain and a hook or buckle. One postillion might drive the foremost single horse with reins which *he could hold in his hands upon his saddle*. I have been driven in this way with four horses in Germany, and I think it would be a disgrace to the trade and the nation, if our English postillions (the best in the whole world) could not do what *is in customary use in other countries*. This I take upon myself to say, for reasons too long to trouble you with, that three horses worked in this way would exert their powers with less risk or fatigue, *than four horses* worked as at present with two postillions, and long traces.

I am, Sir,
Your obliged Servant,
SENEX.

P.S. I am utterly unacquainted with mechanics, and in particular, with the strength of iron, and having myself constructed the mode of application of the perpendicular pin under the pole, *to make the trial with*, I have no doubt that an experienced and intelligent coachmaker would construct iron work for *such mode of suspension*, either *fixed* or *moveable*, *better* than I have done.

THE LIGHT OF THE MOON.

Sir,—In No. 160, of your valuable Magazine, a correspondent gives us a new theory to account for the light of the moon, to which I think the objections are many and great. Your correspondent's argument against the old theory, appears to me to rest upon the supposition, that if the moon reflected the light of the sun, she must of necessity be a *convex mirror*. That this is by no means necessary, may be proved by analogy. If a stone ball (one of those, for instance, which are frequently placed upon the top of the pillars of a gate,) be exposed to the rays of the sun, one half of it will be illuminated with a brilliancy sometimes even dazzling, whilst the other half will be in comparative darkness. Now, this is precisely the case with the moon. The stone cannot be compared with a convex mirror, therefore, why should the moon, which is almost infinitely diversified with mountains and valleys over the whole of her visible surface, (as may be perceived with the assistance of a telescope of moderate magnifying power,) be compared with one?

Hence it is manifest that, in the same manner as the stone, the moon may reflect the *light* (not the *image*) of the sun, and yet by no means be subject to the laws of convex mirrors.

Thus far with respect to your correspondent's argument against the commonly received opinion. Let us now proceed to his own theory.

He begins by *supposing* the moon to have an atmosphere. Now, this is a point upon which there has been much dispute among modern philosophers, but, nevertheless, most of them agree that if she has any it must be rarer than the most perfect vacuum which we on earth can form by means of an air-pump.

Thus, to support his theory, he must begin by proving that she possesses an atmosphere; next that the intense light of the sun will excite his "*two elastic fluids*;" and, lastly, that his theory is more rational and simple than that which has been commonly received by the greatest philosophers of all nations.

I remain, Sir,

Your obliged Servant,

H. C—LL.

Chigwell, Sept. 25th, 1826.

FRENCH IMPROVEMENT IN THE MANUFACTURE OF GLASS.

We learn from the *Annales d' Industrie* that a patent has been granted in France to a M. Segnay, for a new method of manufacturing glass, without the use of free alkali. The following is the process:—Take 100 parts of dried sulphate of soda, 656 parts of silica, and 340 parts of lime, which has been exposed to the air; these ingredients must be mixed with much exactness. The mixture, in small balls, is to be cast into a pot, and the pot being covered up, introduced into the furnace. As soon as it is perceived that the materials have sunk in the pot, more of the same mixture must be put in, until the pot is at last filled with a melted vitreous substance. A strong fire must be continued in order to obtain a complete fusion in as little time as possible. When the fumes diminish, small portions must be taken out at different times to ascertain whether the glass be sufficiently refined, which generally happens in about 22 hours. Another mode proposed, is to take 100 parts of well-dried muriate of soda, 123 parts of silica, 92 parts of lime, which has been exposed to the air, well mixed together, and fused in the way above described. In 16 hours a good glass will be obtained, which will be fit for use for any purpose that may be required. Other proportions are likewise assigned: 100 dried muriate of soda, 100 slaked lime, 140 sand, from 50 to 200 chippings of glass of the same quality; or, 100 dried sulphate of soda, 12 slaked lime, 19 powdered charcoal, 225 sand, from 50 to 200 broken glass; or 100 dried sulphate of soda, 235 slaked lime, 500 sand, 50 to 200 broken glass.

PASTING MAPS UPON CLOTH.

September 21, 1826.

Sir,—In your very useful magazine for August, I find a *Subscriber* wishes to know the best method "of pasting large maps upon cloth, so as to adhere to every part thereof and be free from air-cockles." The following one which I have pursued with uniform success, is much at his service, (viz.) Strain the cloth or canvas by tin tacks upon a drawing board or floor, taking care that it draws tight from the centre in every direction. For this purpose, begin with one tack in the middle of each side, giving it a moderate strain from the centre, then with an interval of about three inches and a half, add another tack to each side, and proceed alternately till you reach the corners, increasing the strain as may be required. If it is coarse canvas, *one* more tack between every two will be enough; but, if Irish cloth, *two* may be necessary. When this is done, paste the map till it lays dead flat without a cockle, then damp the cloth lightly with a half squeezed sponge and water, give the map another pasting, and lay it down upon the cloth, rub it hard with a cloth folded thick, in one hand, and a sheet of clean paper held in the other, on the face of the map, to prevents its being injured. When it is gone all over in this way, beginning from the centre and working off to the outside, let it remain three or more days to dry, according to the state of the air. If the map is in sheets, and, as sometimes happens, the corresponding parts of the roads, rivers, &c. are not printed to answer each other in joining, it will be necessary to stretch some more than others by damping with a sponge and water, and letting it nearly dry before pasting. Hoping I have been sufficiently explicit without taking up too much of your valuable room,

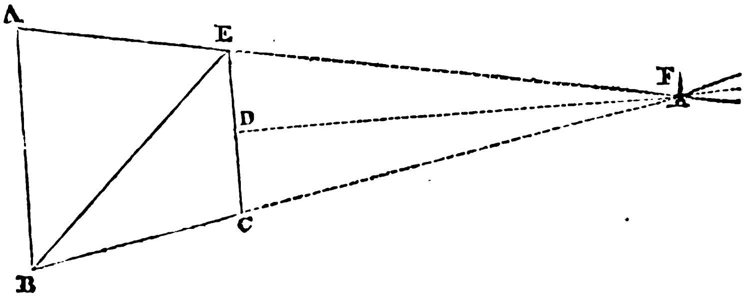
I remain, Sir,
Your obedient servant,
E. F. G.

MEASURING OF DISTANCES.

Sir,—In No. 121, page 144 of your useful magazine, I observe, that W. H. B. has sent you (in answer to an inquiry) 'a method laid down by Vauban as tolerably accurate, for the purpose of measuring short inaccessible distances, when proper instruments cannot be had.' As this method is formed on a system of right-angled triangles, and as a difficulty may arise, to some, in forming sufficiently correct squares or right-angles in the practical part of the work, I beg to lay before you another method of obtaining the same, by the forming of a trapezoid or an irregular figure, as A, B, C, E. Suppose the distance is required from the object F to D, then, *set out* and afterwards measure correctly the four sides of the figure, and the diagonal, B E, and let the two sides, A E, and B C, be laid out in such a direction as to concentre at the object F; having *laid down* the same accurately, according to the dimensions you have taken,—then the *point of intersection*, made by the extension of the two lines, A E, and B C, will be F, the object whose distance is required, and which can then be ascertained by the use of the scale, and will also be found tolerably correct;—care should be taken, however, that the base line, A B, be of such a length as to give out a pretty definite intersection.

I am, Sir,
Your obedient Servant,
H. W.

St. John's Place, Wakefield.



CONTINUOUS WORKING ENGINE FOR RAISING COALS, ORES, &c.

Sir,—I see in your interesting Magazine, No. 133, a machine for raising coals, ores, &c. A similar subject engaged my attention, some time ago, in consequence of seeing the inconvenience experienced in some parts of Devon and Cornwall, (where water wheels are used instead of steam engines,) by employing the double bucket wheel; as, also, when a single bucket wheel is used, in which case they apply a friction gripe, and lever, in order to facilitate the descent of the empty bucket.—To remove this inconvenience, I adopted the following method:

Fig 1

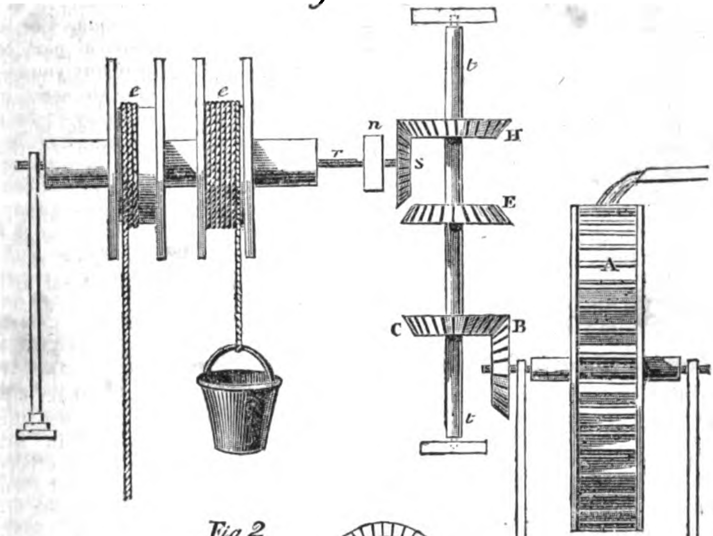
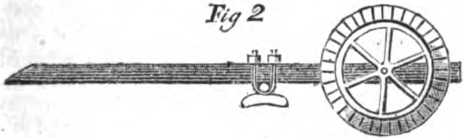


Fig 2



A is a water wheel, which moves in one direction. H, E, and C, three bevelled wheels, stationary on the perpendicular shaft, *t t*.—B is a bevelled wheel, fixed on the axle of the water-wheel, A. S is a bevelled pinion, fixed on the axle of the rope barrel, *e e*.—*n*, is the end of a lever, in which the axle, *r*, of the rope barrel, *e e*, revolves, as shown in fig. 2.

The rope barrel, *e e*, moves with its axis parallel to the horizon, and can be easily reversed by the lever, *n*, by raising or depressing the pinion, *s*, (which is stationary on the axle, *r*,) in contact with one of the bevelled wheels, H or E.

Your's, &c.

WM. TONKIN,
Mine agent, Fowey,
Cornwall.

August 26th, 1826.

MISCELLANEOUS HINTS.

I have often thought how much it would contribute to the benefit of society, if any proportion of men of sense and observation, were to publish the various ideas of improvement which must frequently suggest themselves to minds of the least experience, or proneness to examination. The Mechanics' Magazine has proved itself an excellent vehicle for conveying such stray ideas to the public; so I flatter myself, that should any of the following series of hints which I intend to publish, be deemed worthy the notice of any of your numerous readers, they will be honoured with their investigation and support.

It certainly is not usual for men to give themselves much trouble, without some commensurate inducement of profit or reputation, neither of which can be anticipated, from attending to trivial subjects. We cannot expect many men to imitate Messrs. Day and Martin, who write long advertisements in the papers, merely because they are "ever anxious to prevent deception."

The comforts and conveniences of life are made up of many things, which, taken singly, may appear of an unimportant and trivial nature; but as the Scotch say, "many littles make a mickle;" and he that adds but one pebble to the tumulus, does homage to the spirit to which it is raised. But I must not occupy your valuable pages with any further introduction to the trifles I venture to lay before you.

Increase of day-light in London.

In a city built of red brick, where the immense consumption of coal overloads the atmosphere with smoke and showers of soot, which speedily convert the ugly red into still worse hues of deeper gloom and black; where, in many parts devoted to important business, the streets being narrow, are still more smoky, black, and gloomy, just where light is most required; and in a climate too where, except in very extraordinary seasons, we have but little familiarity with the rays of the sun;—that in such a city, in such a climate, and in the present age, the inhabitants should go on with their black light-absorbing walls; groping their way in the dark at mid-day, when a little lime and size is to be had for love or money, must surely be very surprising to any person who gives himself the trouble to think at all on the matter!

In every town in Spain, where a white wall would not be so much soiled in a thousand years, as in London in one month, every house is unnecessarily white-washed once a year. In Italy, many of the handsomest buildings are stuccoed and white-washed; and so are the entire cities of Naples, Faenza, Imola, Forli, &c.—But whether of stone or brick, every house is white outside; a red house seeming as fitting and picturesque to an Italian, as the stems of trees painted blue and red, in a cockney Dutch garden. In Spain and Italy they have plenty of light, without encouraging the reflection of it from the walls; but here, in London at least, there certainly is none to spare. Were every house white-washed once a year, or every two years, what a very great and beneficial increase of light would be produced!—And that the effect might be greatest when most required, the operation might be performed in October.

I have heard it objected, that it is not classical or regular to white-wash brick walls. Is there, then, something so very architectural and classical in our lines of common brick houses, hideously black and filthy to boot? Let these objectors look at some new building constructed of white bricks,—let them observe most of the new churches, the Duke of Norfolk's house in St. James's Square, and several others of the same description, and then decide whether they do not look infinitely better, though not stuccoed, than if they were of the most flaming red, or even of the much admired British black! Talk of taste indeed! Who can witness with any patience, the stupid, tasteless, and expensive operation, called "pointing!" A huge apparatus of scaffolding erected for the purpose of painting a house red, and drawing delicate white lines around each brick! very like the "taste" of our ancestors, who painted their bodies blue; and that of modern citizens, who so admire the sooty features of our public buildings, that they say "it makes them look quite venerable." But I should think that, even in a ruin, there is no occasion for soot. A venerable old man or woman, clean and silvery, would not surely be improved by blackening them into a chimney sweep or cinder sifter! Look at that huge lump of coal, St. Paul's, see how all its beautiful architectural lines and proportions are confused, lost, or reversed, by the false shades of the "venerable" soot, laid on in regular irregularity, by the capricious pencil of the wind! Where there would have been a shade, is a white streak—where, on a prominent part, there would have been a light—it is completely black. The apparent size also of the building is very much diminished by being so black, which is well known to make all objects appear less. I would really recommend the gentlemen who so much admire black walls and columns, to convert to their doctrine the owners of the new buildings in the Regent's Park, but above all, to gain over the pope and the Italians to their taste; by so doing, they may obtain an order for a sufficient quantity of the best Day and Martin's, to beautify St. Peter's, the Pantheon, the Cathedral of Milan, and all the other poor white edifices of Italy. Any how, if our houses and churches at home are to be black, it were better that they should be so uniformly and regularly, to effect which, what could be better than the said "Day and Martin's real japan!" But to conclude; seriously, I earnestly submit to the public the advantages which would result from giving to the whole of London, a clean, bright, and reflecting surface. Without white-washing, Regent Street will soon become as black as the Strand or Cornhill, and with its whiteness, its most exhilarating feature will disappear. Imagine for a moment, that beautiful street to be constructed of sooty brick,—what a sad difference would it not produce! Nevertheless, there would still be some architecture, and good architecture in it, of which we have not a tittle to console us, in the sooty brick walls with holes in them for "windows," throughout the rest of London.

In order to perform that tasteful and microscopic operation, called "pointing," we see that a complete set up of scaffolding is required; but I opine that, to white-wash any house or edifice, no such trouble and expense would be required, as it might be done from boxes, moved up and down by pullies from the top.

White-wash, if properly made, with a due proportion of animal gelatine, (size,) is impervious to water, and a great preservative to bricks, as well as to the soft lime-stones and sand-stones, of which most of the London edifices are constructed. The recently renovated parts of Westminster Abbey, are executed with soft Bath-stone, which decomposes, and crumbles away, as soon as pure chalk. But the pretty lace-work carvings, will last out the present generation, which is, I suppose, all the renovators have in view—except, perhaps, the legacy of another good job to their near descendants. As, however, it would be an outrage to certain tastes, merely to hint at white-washing Westminster Abbey, I think I can shew, in the succeeding article, that the cheese-like limestone of which it is constructed, may be rendered as durable as marble, by saturating it with whale, or any other oil.

A building might receive fifteen or twenty white-washings, before it would be necessary to scrape off the accumulated coats; so that a house white-washed every two years, would not require scraping for at least twenty or thirty years. With regard to the lines of a different shade, to represent or indicate the joinings of the stones or bricks, they may be drawn according to fancy, as we now see them in houses covered with Roman cement. The "pointing" fanciers also, might still indulge in their miminy piminy performance around each brick, only in a white ground instead of a red. But should pure white be quite intolerable, any tinge of yellow may be obtained with a little ocre, to anticipate the darling smoke.

There is an act of Parliament, which was brought forward by Mr. M. A. Taylor, to compel the owners of steam-engines, forges, breweries, &c. to construct their chimneys so as to consume the smoke. It was fully proved, that this can be effected with very little cost and trouble, yet not one of the thousands of huge volcano-like chimneys, which day and night vomit forth torrents of smoke, or rather soot, has been reformed "as the act directs." According to our precious system, having no public prosecutor, "what is every body's business, is nobody's business;" and it is no agreeable business for an individual to bring an action against one of the soot-makers, which might cost him 500l.! Except it be in the cause of bigotry, stultification, and persecution, we seldom find our worthy countrymen associate and expend their money to enforce the enactments of the honourable house, or to give effect to the Dodonian dicta of our venerable judges, called common law. To form any idea of the advantages which would result from the proper enforcement of Mr. M. A. Taylor's act, it would be well to cast our eyes upwards in the neighbourhood of any great brewery, or take a boat at Battersea Bridge, and descend the river to Greenwich, in which trip we may behold some hundred monstrous chimneys, each pouring forth enough soot to blacken seven hundred cities.

Hint the Second.

Roman cement when exposed to the action of the air and rain, absorbs water in such quantity, as to be penetrated quite through. Decomposition is assisted in the shade, by green mouldy vegetations, and still more mischief is done by the absorbed water expanding with the frost. Let any person observe the side of a cement-covered house, after it has been exposed to the rain, they will find that it will take some days of fine weather to extract the water, and restore it to the same colour with the sheltered part.

We have numerous examples in nature, of animal gelatinous matter, forming in combination with aluminous, calcareous earths, and even siliceous sands, substances so hard and compact, as to strike fire with steel. In some lumacular limestones it is very easy to distinguish the parts which have received the *animal* matter of the shell-fish, from their superior hardness, and an agatized translucid appearance. I do not pretend that, by any artificial means, we can make agate or flint, but I have observed such a tendency in all earths to aglomerate and harden, in all earths that have been saturated with animal gelatine, or with oils, as I think might, in many cases, be turned to good account.

I would recommend all plastered walls, to be washed over with linseed or whale oil, when at their greatest point of dryness, in fine weather. If size were to be added to the water in laying on the cement, its hardness and durability would be very much increased. Roman cement, mixed up with oil, without water, becomes as hard and compact as marble. But to lay it on in the usual way, and when *perfectly dry* to saturate it with oil or size, will be quite sufficient.

I have reason to believe, that in default of stone or bricks, artificial stones of sufficient solidity, might be substituted by applying animal gelatine, or oil, to earths submitted to strong pressure in cast-iron moulds. Chalk, also, cut into regular shapes, and saturated with these substances, or with coal-tar, will become sufficiently hard to answer every purpose of building. If the latter fluid be used, it will moreover ensure that "venerable" sable hue treated of in the preceding hint. Any kind of mortar may be rendered very hard and durable, by these means, and furnish an excellent arched coping for a wall.

It would be superfluous for me to do more than to hint at the various processes, by which what we call animal and vegetable matter, assumes other modes of gaseous, mineral, or fluid existence. With reference to the present subject, let any one contemplate the exposed side of a chalk-hill, with the regular strata of flints between those of chalk; evidently the result of an accumulation upon a consolidated bed of chalk of gelatinous moluscæ, and other animals with which the ocean abounds, which were suddenly covered over by a new layer of cretaceous matter. Every body has seen agatized trees, some beautiful specimens of which are in the British Museum.

There is reason to believe from analogy, that their silicification was promoted by their having been suddenly placed in certain circumstances, while their vegetable juices were entire and undecomposed, by which a particular kind of transmutation was produced, varying from the more general one which so amply provides us with fuel. The bones of animals, as well as shells, reduced to a fossil state, from the *phosphate*, are converted into *carbonate* of lime. Fowls fed entirely on oats, which contain much silicia, nevertheless produce plenty of lime to form their bones, egg-shells, and other calcareous secretions. Eggs have been found under the ruins of the palace of the Cæsars on mount Palatine, completely converted into agate; and a similar transmutation was found to have taken place in the interior of certain earthen pipes conducting from that palace to the Cloaca maxima, of which beautiful agate rings or bracelets have been constructed. In that curious specimen, a Guadaloupe negress imbedded in solidified sand, that portion of the mass nearest the bones, is considerably harder and more compact than the rest, which is evidently occasioned by the greater quantity of animal matter it contains. Of an analogous but far more interesting description, is the beautiful cast from the bust of a young woman, preserved in the museum at Naples. In the eruption of mount Vesuvius, when Pliny the elder lost his life, the towns of Herculanium and Pompeii were overwhelmed by a flood of water from the volcano, mixed with a prodigious quantity of pumice stone, and other volcanic matter, for the greater part as fine as sand, which found its way into the cellars, and unluckily even into the amphoræ of wine,* which, according to the present custom in Italy, was protected from the air by a little oil on the top. As might be expected from the nature of the materials, the minutest portions of the alluvia found their way to the bottom, and in this mass of pumice sand, if I may so call it, and detritus of scoriæ, a young woman, apparently flying from the danger, was overwhelmed, and her skeleton was found, in 1792, laying on its face, with a bunch of keys in the right hand. The mass of aluminous and silicious particles immediately under her becoming saturated with the humours of her decomposing body, became as hard as limestone, and had the discovery been made by any other, than the ignorant peasants at that time employed, and who broke every thing to pieces in search of gold and trinkets, there is little doubt but a complete mould of her entire body might have been obtained. As it was, nothing but the bust from the chin to the waist, was preserved—and a most beautiful bust it is—not quite so much developed, but every bit as perfect as that of the Venus di Medici. The impression of a thin shift, or tunic, I suppose I must call it, with the hem across the lower part of the breasts, is perfectly impressed, and, if I remember right, part of the tissue itself adheres to the mould, from which a plaster cast has been taken and placed beside it.

In a public walk at Naples, the ground of which is principally composed of broken tuffa, containing alumine and silex, a few drops of oil have occasionally fallen from the lamps, or been spilt by the lamplighters. This small quantity of oil occasioned so great an induration, and the garden being regularly swept, in process of time, little hemispherical hillocks were formed under each lamp, of such consistency as to resist the spade and pickaxe. Some of them, quite hard enough for building, I saw taken out, like corns as it were, by digging around and under them.

About a year ago I poured a quantity of coal tar upon a heap of road scrapings, which, when removed six months after, was much harder than a mass of solid chalk. A walk made of gravel and road scrapings, to which I also applied coal tar, became as hard as a rock.

In No.161 of the Mechanics' Magazine, I have presumed to offer some observations on the excellent lectures of Mr. William Allan, at Guy's hospital, in which he so well and philosophically alludes to the incessant

* Large stone bottles, containing about five gallons.

and universal transmutations of matter. I will venture to hope that the foregoing little remarks of mine may, by your indulgent readers, be taken for humble and familiar illustrations of some of the facts Mr. Allan adverts to.

What treasures of useful knowledge would rapidly be brought forth to improve the moral and physical condition of mankind, were not those on whose education most time and money are expended, chained down for years, almost exclusively to the parrot-like acquirement of mere words and sounds, in which any "learned doctor" would be beaten hollow by a resuscitated Roman or Greek infant of seven years old! The polish and the ornaments are mistaken for the foundation of the structure itself. Your collegian will for years bewilder his poor head with abstract qualities, without any substance to support them,—as whiteness without a white body—motion without matter, which is its essence!

Happily for mankind, although the present generation still behold the bewigged and belawned buffoons of universities and colleges enacting discussions on the nature of the light of mount Tabor, on the accent of a Greek word, and stupifying themselves and hearers with insane *metaphysical* jargon, — thanks to Mechanics' Magazines, Mechanics' institutions and lectures, the more worthy and useful members of the community are beginning to study things of real existence and utility, and are learning the best possible means of benefiting themselves by contributing to the felicity of their fellow-creatures. Thus will they soon discover the fundamental principles upon which the improvement and happiness of society depend. For instead of reasoning on phantoms, reality is beginning to be the basis of their inquiry; and the mind, resting on that solid foundation, may accumulate an extent of science, of which at present we can form no idea. Sentiments of the noblest delight must accompany every addition to such knowledge—knowledge of realities and facts, which can only be obtained by the free unrestrained operations of thought, with no other guides than sagacity and experience.

I fear I shall be accused of extending this article to an unreasonable length, of travelling far "out of the record," as the lawyers have it, and of giving "great cry but little wool." I began by recomending houses to be white-washed and daubed with oil or size, and I now find myself talking about mounts Vesuvius and Palatine, the Venus di Medici, ladies' *tunics*, feeding hens, gravel walks, and mount Tabor!—However, it may be my luck, for some kind people to find a matter or so of consequence in these hasty ideas, although so clumsily put together. Should such be the case with any of your readers, I flatter myself that, having the necessary leisure, they will condescend to examine into their correctness and utility, and finding them worthy of it, give them notice and support.

I am, Sir,
Your obedient, humble Servant,
F. M.

25th Sept. 1826.

(To be continued.)

VULGAR FRACTIONS.

Selections from Answers by Correspondents to the questions proposed in Vulgar Fractions.

By J. S.—M. L. M. Institution.

Question III.—Reduce $\frac{825}{960}$ to its lowest terms by a commoneasure.

```
1st.— 825)960(1
          825
          ---
          135)825(6
              810
              ---
               15)135(9
                  135
                  ---

2nd.  15)825(55 new numerator.
         75
         --
         75
         75
         --
```

```
3rd.   15)960(64 new denom.
          90
          —
          60
          60
          —
```

then $\frac{825}{960} = \frac{55}{64}$ Ans. $\frac{55}{64}$

Question VI.—Reduce $\frac{5184}{6012}$ to its lowest terms by a common measure.

```
1st. 5184)6012(1
          5184
          ————
          828)5184(6
              4968
              ————
              216)828(3
                  648
                  ———
                  180)216(1
                      180
                      ———
                      36)180(5
                         180
                         ———
```

```
2nd.  36)5184(144 new num.
         36
         —
         158
         144
         —
          144
          144
          —
```

```
3rd, 36)6012(167 new denom.
        36
        —
        241
        216
        —
         252
         252
         —
```

then $\frac{5184}{6012} = \frac{144}{167}$ Ans. $\frac{144}{167}$

N.B. J. S.'s answers to the other questions are also perfectly correct, and carefully worked.

By Mr. W. G. Pearson, 2, Essex Street, Gravel Lane.

Question II.—Reduce $\frac{192}{576}$ to its lowest terms.

```
1st.   192)576(3
           576
           ——
```

Thus we find 192 to be the lowest common measure required.

```
192)192(1
    576 3
```

thus $\frac{1}{3} = \frac{192}{576}$ Ans. req.

Question V.—Reduce $\frac{176}{547}$ to its lowest terms.

```
First 176)547(3
          528
          —
          19)176(9
             171
             —
             5)19(3
               15
               —
               4)5(1
                 —
                 4
                 —
                 1
                 —
```

Thus we find 1 to be the common measure required; the fraction $\frac{176}{547}$ is already in its lowest terms

N. B. All Mr. Pearson's solutions are correct, except the 6th, where, by a slight inadvertency in the commencement of the operation for finding the common measure, he puts 5182 instead of 5184; on which account, the answer given is $\frac{2591}{3006}$ instead of $\frac{144}{167}$.

Question III.

By Mr. W. Stert, 18, Old Burlington Street.

```
825)960(1
    825
    —
    135)825(6
        810
        —
        15)135(9
           135
           —
15)825(55
   960 64
```

thus $\frac{55}{64}$ $\frac{825}{960}$ Ansr.

Question V.

```
176)547(3
    528
    —
    19)176(9
       171
       —
       5)19(3
         15
```

4)5(1
4
—
1)4(4
4

thus $\frac{176}{547}$ is the answer required.

N. B. In Mr. Stert's answer to the 6th question, and in the 3rd line of the division for the common measure, he has 116 instead of 216, wherefore the common measure is 4 instead of 36; and he therefore had to reduce the fractions at more than "one work." All his other answers are perfectly correct.

By Mr. Robert Jones, 1, Woburn Buildings, Tavistock Square.

Question I.—Reduce $\frac{144}{240}$ to its lowest terms by a common measure.

144)240)1
144
—
96)144)1
96
—
48)96(2
96
—

Com. mea. 48)$\frac{144}{240}$($\frac{3}{5}$ — $\frac{3}{5}$ = $\frac{144}{240}$

Question IV.—Reduce $\frac{1344}{1536}$ to its lowest terms by a common measure.

1344)1536(1
1344
—
192)1344(7
1344
—

Com. measure. 192)$\frac{1344}{1536}$($\frac{7}{8}$ — $\frac{7}{8}$ = $\frac{1344}{1536}$

Question V.—Reduce $\frac{176}{547}$ to its lowest terms by a common measure.

176)547(3
528
—
19)176(9
171
—
5)19(3
15
—
4)5(1
4
—
1)4(4
4

Common measure. 1—1)$\frac{176}{547}$($\frac{176}{547}$

Consequently it is in its lowest terms.

N. B. Mr. Jones's answer to the 1st question is not correct, on account of his having taken 567 for the denominator, instead of 576; wherefore, instead of having the numerator (192) go exactly three times at the first division, he has made a long sum of it. He, however, by good luck, has got the same common measure, but then he has divided 567 again by it, instead of 576; wherefore his answer is $\frac{64}{189}$ instead of $\frac{1}{3}$.

His answer to the third question is correct, but not very neat; in the latter end of the division, he has

15)135(8 120 — 15)15(1 15	instead of	15)135(9 135 —

(See Mr. Stert's ans.)

His answer to the sixth question is incorrect from the same reason as that of Mr. Pearson.

H. O.
(Formerly, 1 and 2 make 3.)

NOTICES TO CORRESPONDENTS.

Opinions on the Case submitted in our last, have been received from W. C.—N. H.—A.—Mr. Meynard (whose former communication never reached us)—Zelid—and Q. Q.

In our next, we shall give the commencement of, what we believe is much wanted, a Treatise on Perspective, as applicable to the correct delineation of machinery.

Samaht Keah guesses rightly: his Enquiry in our next.

Communications received from Mr. Loudon—E. W.—B. West—B.—J. M. N.—H. H.—Mr. Burns—P. K.—Delos—J. Bromarch—and Mr. Allen.

Communications (post paid) to be addressed to the Editor, at the Publishers', KNIGHT and LACEY, 55, Paternoster Row, London.

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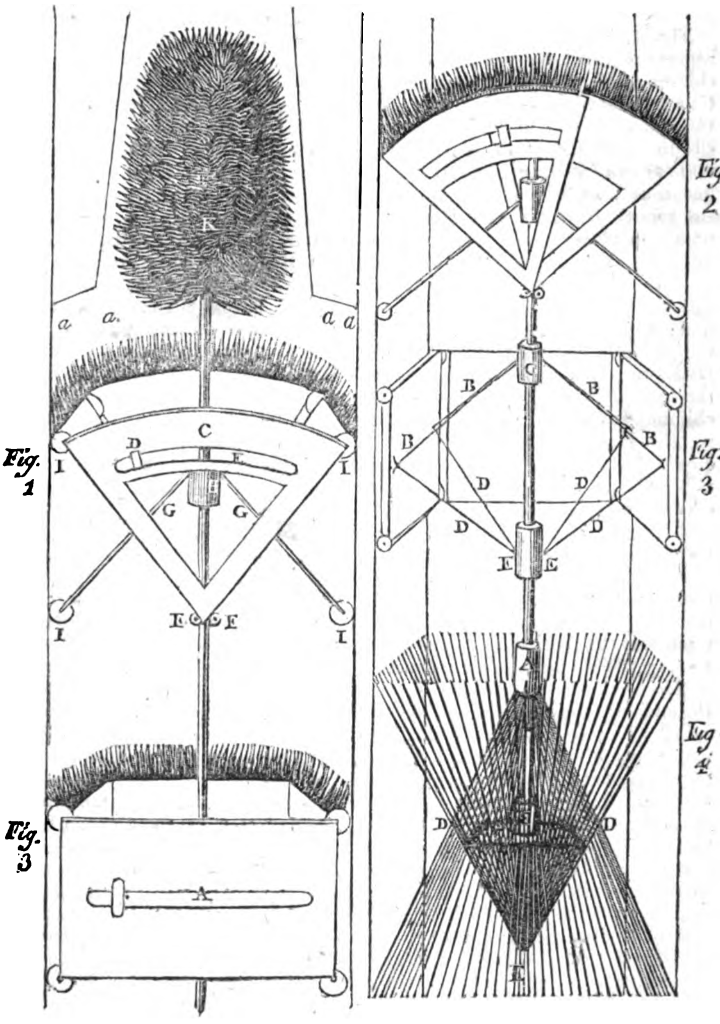
"A man's genius is always, in the beginning of life, as much unknown to himself as to others; and it is only after frequent trials, attended with success, that he dares think himself equal to those undertakings in which those who have succeeded have fixed the admiration of mankind."

HUME.

CHIMNEY-SWEEPING MACHINES.



CHIMNEY SWEEPING MACHINES.

Sir,—The inclosed attempt at machines to supersede the necessity of employing boys to sweep chimneys are at your service, if you think they are likely to succeed; at all events, they may, amongst your numerous readers, suggest some plan of more practical utility.

T. B.

Sun Tavern Fields, St. George's, East.

Description.

Fig. 1. The four lines, *a, a, a, a,* represent the four corners of the chimney; B, is a perpendicular rod; C, a fan or wing, of which there are two on each side of a chimney, one sliding over the other in the same manner as a fan opens. The inner fan has a nut, D, which passes through the groove, E, in the outside fan, and which connects them together, and allows them to expand in proportion to the width of the chimney, as in figure 2nd, where the fans are expanded; these fans are fastened to the upright rod by a hinge at F; G G, are small rods extending from the upright rod to the corners of the chimney; they are hinged on the weight, H, which slides freely up and down the rod, B, and these small rods. G, G, are so fastened to the corners of the fans they pass through, that they allow the fans to expand, but to slide in and out.

Now, if the chimney should increase in width, the weight, H, immediately descends, the rods G G, extend, and the fans extend in proportion, by which means every inequality of the chimney is provided for. Again, the ends of the rods being always parallel with the corners of the fans above, preserve the machine always perpendicular to the direction of the chimney. I, I, I, I, are small wheels attached to the ends of the rods and the corners of the fans, to facilitate the passage up and down; K, is a brush fixed to the top of the upright rod, to clear the chimney-pot

Fig. 3, is a square machine, consisting of two flat boards or frames on each square, which extend themselves by means of a groove and rim, in the same manner as that described before.

The corners are extended by the rods, B, B, B, B, which are hinged on the sliding weight, C; the rods, D, D, D, D, below, are the same length as those above, and are fastened to the upright rod by hinges, E, E; this, of course, acts on the same principle as the former one, and has wheels at each corner, as shewn in the figure.

The second, figure 3, exhibits a view of the interior of fig. 3.

Fig. 4, is a machine similar to the frames of two umbrellas, one inverted over the other on the same rod; the lower frame is fixed to the rod as at E, the upper one is fixed to a sliding tube as at A, which is connected by two wires to the lower weight and tube, B; this tube has the square, C, round it, having pins projecting from the sides of the square, to keep the rods equidistant, and likewise to keep them in a square position to the chimney.

The rods are connected together at the parts they cross, as at D, by rings or pins forming a loose joint. If a line were passed through a pulley above the sliding tube, A, the operator might, by pulling the line, relieve the machine in descending, and this line applies to all the machines.

COMPARATIVE PROPORTIONS OF STEAM ENGINES.

Sir,—Your correspondent who has stated, at p. 293, the diameters of the cylinders, and lengths of stroke of three steam engines of 70 horse power, lately made for steam vessels by Messrs. Boulton and Watt, Mr. Maudsley, and Mr. Fawcet, has omitted to mention the number of strokes which the different engines are intended to make per minute; this is an essential particular for any computation on the power which an engine can exert; for other circumstances being similar, the powers of steam-engines will be proportionate to the quantity of steam expended by them in a given time; so that a smaller cylinder, whose piston moves quicker than that of a larger one, may exert a greater power.

The proportions originally established by Mr. Watt, for the cylinders of his engines of different powers, are such as to allow 33·1 cubic feet of steam per minute, to produce each horse power.

For instance, his 40 horse engine had a cylinder 31½ inches diameter, and the piston made 17½ double strokes per minute, of 7 feet each, so that it passed through 245 feet per minute. The area of a circle, 31½ inches in diameter, is 779 square inches, or 5·41 square feet, which, multiplied by 245, gives 1325 cubic feet of steam expended per minute, by the motion of the piston, without making any allowance for the extra quantity expended by waste of condensation, or leakage. This is at the rate of 33·1 cubic feet per minute for each horse power.

Again, his 20 horse engine had a cylinder 23¾ inches diameter, its piston made 21½ strokes per minute, of 5 feet long; or it moved 215 feet per minute; the expenditure of steam was 662 cubic feet per minute, or equal to 33·1 cubic feet per minute for each horse power.

This allowance has been followed ever since by Messrs. Boulton and Watt in their large engines for manufactories, though they have, in many cases, reduced the lengths of the strokes, and enlarged the diameter of the cylinders; for instance, their modern 40 horse engine has a cylinder of 32¼ inches diameter, and the piston makes 19 double strokes per minute, of six feet each, or it moves 228 feet per minute, which is an expenditure of 1304 cubic feet of steam per minute, or a little less than Mr. Watt's old engine, though the cylinder of the latter is smallest.

If 33 cubic feet per minute is allowed for each horse power, then the effective pressure upon each square inch of the piston, will be 6·944 pounds per square inch, without any deduction for friction or imperfect exhaustion. The following rule is adapted to this proportion.

*To find the power of a steam engine on Mr. Watt's principle in horse power.**

RULE.—Multiply the square of the diameter of the cylinder in inches, by the motion of the piston in feet per minute, and divide the product by 6050; the quotient is the power of the engine in horse power.†

Example.—Cylinder 23¾ inches diameter, squared = 564 circular inches area, × 215 feet motion per minute, = 121,260 cylindrical inch feet of steam expended per minute, ÷ 6050 = 20 horse power.

The calculation may be conveniently performed by the two lines marked C and D upon a sliding rule, when the slider is set in the following manner:—

Sliding Rule.		
C	feet per min.	Horse power of Eng.
D	246‡	Diam. of cylin. inch

The above may be depended upon as an authentic rule for Mr. Watt's engines on shore. It should be observed, that a properly constructed engine, with a sufficient boiler, is capable of exerting full half as much more as its nominal power; so that a 40 horse engine, with a suitable increase of fuel, is able to do the work of 60 horse power, or a 20 horse engine can exert 30 horse power. In this respect, the old engines, such as were constructed by Mr. Watt himself, are greatly preferable to their decendants of the present day, which in performing their evolutions with a more quiet motion, have lost much of the activity of their noisy progenitors.

In steam-vessels, it would be useless to load the vessel with any more weight of engines than are actually employed, and hence it is the universal practice to urge the engines on board

* A horse power is that exertion of moving force which, besides overcoming all friction, will raise 33,000 pounds weight one foot high per minute; or any smaller weight a proportionably greater height in the same time.

† The divisor, 6050, is the number of cylindrical inch feet (i. e. small cylinders one inch diameter, and one foot long) that are contained in 33 cubic feet; for a square foot contains 183·346 circular inches × 33 = 6050·42.

‡ The number 246, which is used as a gauge point on the line D, of the sliding rule, is the square root of nearly ten times 6050 or 60,516; or the number 77·78 which is the square root of 6050, may used for the gauge points, and will give the same result as 246.

vessels to their very utmost power, the throttle valve being always kept fully open, when the vessel is under weigh; and as such engines have an unlimited command of cold water for condensation, they may be considered as always exerting half as much more power as they are rated at, or that two forty horse engines always exert 120 horse power; two fifties 150 horse power; two sixties 180 horse power; and two seventies 210 horse power. The best steamboat engines even exceed this proportion considerably.

If your correspondent can state with certainty, the number of strokes each of the seventy horse engines is intended to make, the diameters of their paddle-wheels, the length and breadth of those paddles, their number, how much they dip into the water, and the dimensions and draft of water of the vessels, their names, the services they are employed in, the speed with which they move through still water, and any other particulars, it would be very useful and interesting to many of your readers.

I am, sir,
Your's, &c.
X.

P. S. I have been told that Mr. Maudsley's cylinders are 46½ inches, but your correspondent says 47.

ECONOMICAL METHOD OF KEEPING HORSES,

By Henry Sully, M. D.

Sir,—If the following description is considered as of use to any of your numerous Readers, I beg it may be inserted in, your Mechanics' Magazine, as the best mode I can devise of diffusing, most extensively, a plan I am daily requested to describe, and which, for above 17 years, I have invariably followed with a success that most of my neighbours have witnessed, and, as a thorough good chaffcutter and corn bruiser are matters of high importance, we may be favoured with improvements which some of your correspondents have instituted.

I am, Sir,
Your obedient Servant,
HENRY SULLY, M. D.

When the scarcity of horse provender renders it so expensive, as it is likely to prove the ensuing winter, one cannot do a greater service to his countrymen than by pointing out to them, a plan by which their expenses may not only be lessened, but their cattle kept in better condition.

Having received innumerable letters from gentlemen who keep horses, requesting a description of my plan of feeding, I shall save much future trouble, both to others as well as myself, by laying my system before the public. Having pursued the plan above 17 years, I am enabled to appreciate its full value, and, being perfectly satisfied of its superior excellence, I hope to continue the same as long as I keep horses. Most people who know me will allow, that horses in my employ enjoy no sinecure places, and few people can boast of their cattle being in better working condition, or more capable of laborious undertakings, than mine.

The loft above my stable contains the machinery for cutting chaff, and grinding corn. From this loft each horse has a tunnel of communication with the manger below, and a tub annexed to each tunnel in the loft for mixing the ingredients composing the provender. There should be no rack in the stable, because this may tempt the groom to fill it with hay, and thus, by overloading the horse's stomach, endanger his wind, to say little of its expense and waste, for it is a well known fact, that if a horse has his rack constantly replenished with hay, he consumes and spoils upwards of 30 lb. per day; whereas in chaff, his utmost allowance is 10 lb. in 24 hours. The manger with which the tunnel communicates, should have cross bars of firm oak placed at the distance of 10 or 12 inches from each other, to prevent the horse from wasting his provender in search of the grain it contains, and this space between the cross bars allows the horse plenty of room to take his food.

The chaff cutter I make use of, is manufactured by Mr. Wilmott, a very ingenious mechanic, who resides about five miles from Taunton, on the road to Wiveliscombe. He also provides corn bruisers upon the best construction, and any person keeping three or four horses, will save the prime cost of his machinery the first year of its trial, and the horses themselves, thus fed, to use the language of horse keepers, will always be above their work.

When the provender is thoroughly mixed in the tub, previously weighing out each ingredient, the mixture should be given in small quantities at a time, many times in a day, and, at night, enough is thrown into the tunnel, to last till the morning. This process will be found of very little trouble to the groom, who will only have to go into the loft six or eight times a day. As the component parts of the provender are weighed out separately for each horse, we are certain he has his just proportion, and I have hereunto annexed my scale of feeding, in four classes, for it sometimes so happens, that some of the ingredients cannot be procured, and, at other times, that it may be better to substitute others; but, whatever grain is given, it should always be bruised or coarsely ground, and carefully weighed out, for by weight alone is it possible to judge of the quantity of farinaceous substances the horse consumes, it being well-known that a peck of oats varies from seven to twelve pounds, consequently, if the provender were mixed by measure, there would be frequently an uncertainty as to quantity. Wheat varies from 16 to 12. Barley, from 13 to 10. Pease from 17 to 15. Beans 17 to 15 per peck. And, as wheat, beans, pease, barley, and oats, are equally good, and a very trifling difference in price, when their specific gravity is taken into consideration, I am equally indifferent which grain I use, but I should always select boiled or steamed potatoes, for hard working horses, to be a component ingredient, whenever they can be procured.

As I call all ground or bruised grain, of whatever description, farina, so it will be distinguished in the following

Scale.

	Class 1.	Class 2.	Class 3.	Class 4.
Farina consisting of bruised or ground beans, pease, wheat, barley, or oats	5 lb.	5 lb.	10 lb.	5 lb.
Bran, fine or coarse pollard - -	—	—	—	7 lb.
Boiled or steamed potatoes, mashed in a tub, with a wooden bruiser -	5 lb.	5 lb.	—	—
Fresh grains - - - - -	6 lb.	—	—	—
Hay, cut into chaff - - -	7 lb.	8 lb.	10 lb.	8 lb.
Straw or reed in chaff - - -	7 lb.	10 lb.	10 lb.	8 lb.
Malt dust, or ground oil cake -	—	2 lb.	—	2 lb.
Salt - - - - - -	2 oz.	2 oz.	2 oz.	2 oz.

By the above scale it will be seen, that each horse has his 30 lb. of Provender in 24 hours, which, I maintain, is full as much as any horse ought to eat, and is more than some can eat. The two ounces of salt will be found an excellent stimulus to the horse's stomach, and should, on no account, be omitted. When a horse returns from labour, perhaps the groom will see the propriety of feeding him from his tub more largely, in order that he may be the sooner satisfied, and lie down to take his rest.

Whenever oat straw can be procured, it is generally preferred, and some like to have it cut into chaff without threshing out the oats, but this is a bad plan, for, in preparing a quantity of this chaff, unequal proportions of oats will be found in each lot, so that one horse will have too large a portion whilst others have less than they ought, although the portions are accurately weighed.

The only certain method, then, is to let the grain, of whatsoever description, be weighed separately from its straw, and the keeper of horses will soon satisfy himself that his cattle are in want of nothing in the feeding line. Many people object to potatoes, and think them unfit for working horses, but from many years' experience I am enabled to recommend them as a constituent part of the 30 lbs. and am convinced that it is as wholesome and nutritious a food as can be procured for labouring horses, which are called upon sudden emergencies to perform great tasks, as has been abundantly proved by Mr. Curwen, M. P. who kept above 100 horses on potatoes and straw, and always found that their labours were conducted better on this than any other food.--*See Curwen's Agricultural Hints, published in* 1809.

HENRY SULLY.

Wiveliscombe, Somerset, Sept. 12, 1826.

ANSWER TO THE QUERY FROM ST. PETERSBURG ON THE ROMAN CEMENT CISTERN.

Let the water out, and stop up the cracks, if any, with fresh cement. Let the cistern remain empty, exposed to the *sun* and air at least a week; then saturate its sides with any kind of oil, or coal tar, a strong animal extract. Suffer the cistern to be well exposed to the sun for another week or two, then scour it with sand and wood ashes, and let in the water.

F. M.

MACHINE WANTED FOR COMPRESSING EARTH INTO BLOCKS.

Sir,—I have been a constant reader of your excellent Magazine from its commencement, and I hope not without having derived considerable improvement from it. That it has done extensive service to the cause in which it is engaged, is universally allowed, and I hope it will long continue to be equally useful and popular.

The object of this communication is, to direct the attention of some of your readers, to the construction of a small portable machine of cast iron, for compressing earth into blocks of different sizes and shapes, for the purpose of building field-walls, and for other agricultural and horticultural purposes. In my Encyclopædia of Agriculture, and also in the [illegible]'s Magazine, (No. 3, page 353,) I have given some account of Cointereaux's method of compressing earth by a stamping-machine, not unlike a pile driver, and I have referred to a cottage in Mr. Gibbs's nursery, Brompton, which is built of blocks of compressed loam, about three times the size of common bricks, and laid in thin clay as mortar. This building was erected under the direction of M. Cointereaux, a French architect, the patentee of the invention in France, and brought over at the expense of the Board of Agriculture. Independently of cottage field-walls, there are some particular purposes in horticulture for which blocks of compressed earth would be highly useful, and therefore a machine that would go in little bulk, and cost little, would be of great value to the gardener. None could be more powerful than Bramah's press; but, perhaps one sufficiently powerful, and less expensive, could be constructed by means of a system of compound levers, after the manner of Ruthven's printing-press. If some of your numerous readers would turn their attention to the subject, and communicate the results to you, a proper machine would soon be produced; and if at a moderate price, I have no doubt it would soon be as common in gentlemen's gardens, as cast-iron rollers. I shall be much gratified to see such a machine described and figured in your pages, and shall then request your permission to communicate it to the readers of the Gardener's Magazine; a work which, it is the object of my highest ambition to render as useful to gardening and gardeners, as your's is to mechanical science and mechanics.

I am, Sir,
Your obedient servant,
J. C. LOUDON.

[We trust it will appear, that our esteemed contemporary has not addressed himself in vain to the inventive faculties of the readers of the Mechanics' Magazine, but that they will shew themselves as deserving as proud of the hand of fellowship, so courteonsly held out to them. Few things can promote the general cause of knowledge more, than such occasional references from the cultivators of one branch to the cultivators of another; they tend not only to the saving of much valuable time, but bring at once the excellence which each class has attained, in its particular pursuit, to the aid of all the rest; and thus accelerate greatly, their common progress to perfection.—EDITOR.]

DRYING BY STEAM.

Sir,—Being about to erect a malt-house, to wet 100 quarters of barley weekly, I wish to ask your scientific correspondents, if any of them are aware that the drying process has been attempted by steam? If it has, how it answered? What would be the probable cost of an apparatus suitable for the above quantity, and what may be calculated on as the comparative difference of expense, or quality of the malt when perfected?

SAMAHT KEAH.

EAST LONDON MECHANICS' INSTITUTION.

We have been requested to insert the following particulars concerning the above institution:

It was first formed in June, 1826, and its progress, hitherto, has been unusually successful. Its success has been owing entirely to the exertions of its members, for it has not received any external pecuniary assistance. Notwithstanding this disadvantage, classes have been formed for French, mathematics, geography, and the globes, arithmetic, and drawing. Lectures have been delivered on astronomy, geography, chemistry, mechanics, &c. &c. by J. Mitchell, LL. D. Messrs. Partington, Fowler, Peche, and Children. Mr. Lewthwaite is now delivering a course of lectures on pneumatics, and on Monday, Oct. 30, W. Stone, Esq. of Deptford, will commence a course of lectures on ship building. At the first quarterly meeting, which is to be held on the 25th inst. a highly interesting report is expected from the committee of management.

SPOTS ON THE SUN.

Sir,—I believe it is not generally known that the spots on the sun's surface may be distinctly seen through any common telescope, during the dull mornings at this season of the year, when it appears of a red colour, and can be gazed at with a tearless eye.

The spots now traversing the sun, extend through a space of not less than 350,000 miles, or one-eighth of the whole circumference. Every part of this vast range exhibits proofs of violent action; but, whether produced by internal commotion or external affection, it is difficult to solve. It is remarkable that similar appearances have been exhibited for several years, with scarcely any intermission, though about a century ago, one spot only was observed during the space of seven years.

I am, Sir, &c.

B.

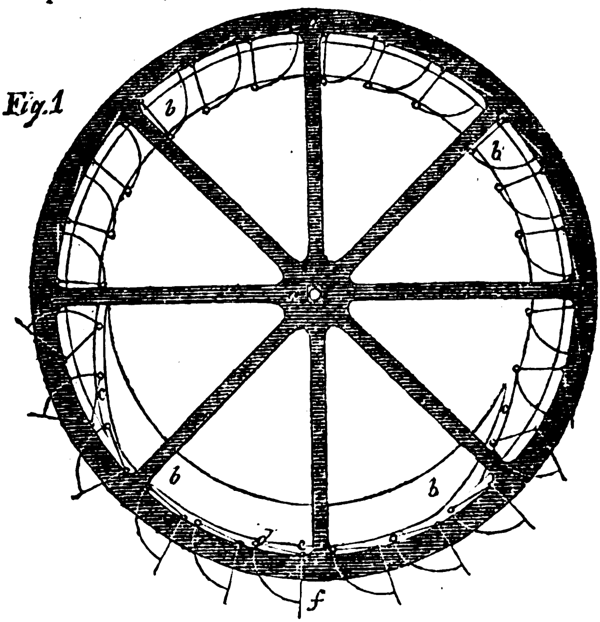
THE SUMMIT OF EUROPE.

For a long time, it has been a point much in dispute among geographers, whether Mont Blanc or Mont Rosa, is the highest eminence in Europe; but it may now be considered as finally determined in favour of the former. Baron de Zach, in his "Correspondence Astronomique, Geographique," &c. a work but little known in this country, gives the results of seven trigonometrical measurements, made with great care, and by very competent individuals, in 1796 and 1821, taking the mean of which, it appears that Mont Blanc, is 2462 toises (14,772 feet,) and Mont Rosa 2366 toises, (14,196 feet) above the level of the sea.—Difference, in favour of the former, 96 toises, (576 feet.) "Thus," concludes Baron Zach, "it is definitively established, that Mont Blanc is the King of European mountains, but that, immediately after him, comes Mont Rosa."

IMPROVEMENT IN PADDLE WHEELS.

Sir,—I beg an early insertion of the following improvement in paddle wheels, in your very useful publication, and hope some of your ingenious correspondents will favour me with their opinions upon the subject.

Fig.1

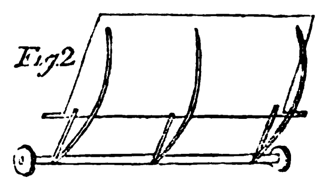


Description of the Drawing.

Fig. 1. *a a a a*, the wheel which may be constructed of cast iron, or of wood; *b b b b*, a circular ring or curb attached to the side of the vessel, and innerside of the caseing, which covers the wheel, and projecting about three inches; *c c*, two grooves cut in the above curb; *e f*, the paddle, which is of sheet iron; *d e*, and *d f*, small rods or bars of iron, attached at *e* and *f*, to the paddle, and at *d*, to a longitudinal rod. There are three sets of these quadrantal traces to each paddle. The longitudinal rod to which the paddle braces are attached, projects three inches on each side of the wheel, upon which projecting part, a small wheel or friction roller is fitted. When the paddles are propelling, the friction rollers are running upon the outer side of the curb, the action of the water pressing them in that direction. When the rollers arrive at the groove, they pass through it to the inner side of the curb; and the paddle will then be perpendicular to the radii of the wheel. The pivot of the paddle at *e*, is attached to the curb of the wheel, by an eye-bolt passing through it, and secured by a nut or key at the outer edge of the curb.

Fig. 2, exhibits a large view of the paddle.

Fig.2



It is evident, upon the bare inspection of these figures, that the paddles may be made to stand in any direction, by altering the shape of the curb; and also to fall and rise at any required point, by giving the grooves, through which the friction rollers pass, any given direction. The most advantageous position of the paddles, in every point of their rotary motion, can only be determined by actual experiment.

Chatham, Sept. 16, 1826. A. D.

PRACTICAL PERSPECTIVE.

Sir,—Presuming to suggest that a brief treatise on perspective, as applicable to the correct delineation of machinery, might be useful as well as entertaining to many of your readers, I venture to offer you the following commencement of such a work, which, should it meet with your approbation, I propose to continue and conclude in as summary a manner, and in as small a space as the subject will admit of; and as most explanatory of my ideas, I shall call it Practical Perspective.

Fig. 2. Plan.

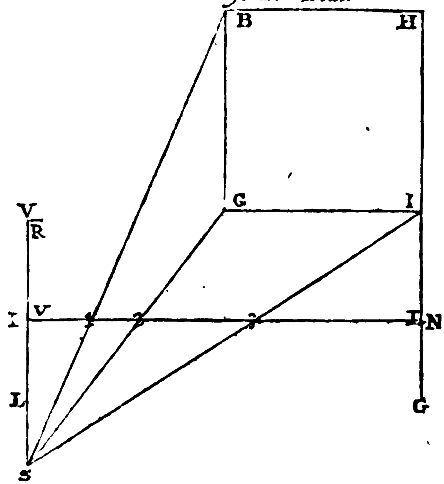


Fig. 1 Elevation

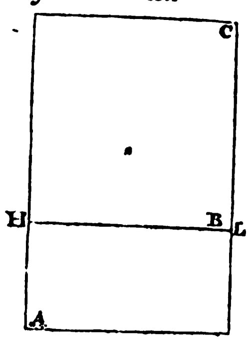
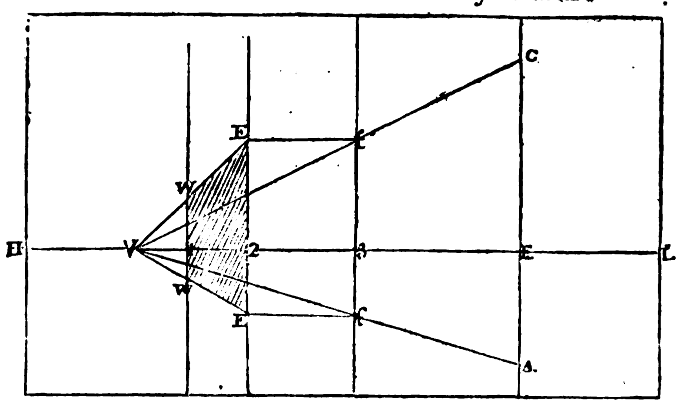


Fig. 3. Picture



Introduction.

Perspective is the art of delineating an object, as it would appear to the eye at a given distance; to effect this purpose, the mathematician possesses unerring rules capable of demonstration, and supported by theory. The limits of your Magazine will, I am aware, exclude the latter, but I will endeavour to give the former in as compact and intelligible a form as possible, and with this design, I shall at first follow the usual divisions of writers on this science, into parallel and oblique, but shall afterwards annex a third, under the title of Mechanical Perspective, which will comprise rules for representing mill-work in all points of view, which, united with the preceding, will enable the student to delineate accurately every species of machinery.

Definitions.

Parallel and Oblique Perspective. In the former, one side of the object is viewed parallel, and in the latter, the sides are seen oblique to the picture.

Picture. The plane on which the object is to be depicted.

Station. A point fixed at pleasure, determining the spot from which the object is supposed to be viewed.

Visual Rays. Lines drawn from the station, to the several angles of the object.

Horizontal Line. A line in the plane of the picture, whose height is regulated by the eye of the spectator.

Intersecting Line. The horizontal line in the picture, is the intersecting line on the plane.

Vanishing Points. Points on the horizontal line, in which all parallel lines vanish.

PARALLEL PERSPECTIVE.

Problem 1.

To put a quadrangular prism into perspective.

Having laid down the geometrical elevation, fig. 1, on which the horizontal line, H L, must be drawn, as also the plan, fig. 2, fix the station, S, at the point and distance from which the object is to be viewed, and draw the visual rays, S B, S G, and S I, to the several angles of the plan.

To find the situation of the intersecting line, first determine the width the object is wished to occupy in the picture, say from 1 to 3, then draw the line, I N, at such a distance from S, parallel to the opposite side, G I, of the plan, that the line, 1 3, will be the space required, which continued indefinitely, will form the intersecting line.

Next, from S draw the line, V L, cutting the line, I N, at right angles, and the intersection, V, will give the vanishing point. Lastly, continue the line, I H, to G, and its intersection with the line, I N, will give the elevation point, E.

The plan thus prepared, the horizontal line, H L, must be drawn on the picture, fig. 3, generally placed about one-third of the height, and transfer to it, from the line, I N, the points V, 1, 2, 3, (formed by the intersection of the rays, with line I N,) and E, through which raise the perpendicular lines, 1, 2, 3, and E; then set off (from the line, H L, elevation, fig. 1,) on the line of elevation E, the distances, A B, and B C. Draw to the vanishing point, V, the lines V C, V A, cutting the perpendicular, 3, at *f f*, and when they intersect, draw parallel to H L, the lines E *f*, E *f*, and from E E, draw the lines E W, E W, to their vanishing point, V, which will give W E, *f f*, E W, the representation required.

If the preceding problem be strictly examined, it will be found to contain the most material principles of the science, but as their application of them is various, I shall add a few more examples, which I shall scruple the less to do, as the second division of my subject will require but few; and to avoid recapitulation, I shall only refer as I proceed, to those lines not hitherto noticed. I have not, perhaps, so fully described the method of obtaining the different elevations as may be necessary, but as I have already considerably intruded upon your pages, I shall take an opportunity of more accurately elucidating this part of the subject, in my next communication.

M. H. S.

ROTATION OF BODIES.

Theory of the Deluge.

The surface of the earth at the equator, revolves at the rate of more than 1000 miles per hour, or nearly 1500 feet per second; a rapidity of motion of which it is not easy to form a precise idea, even though we compare it with other velocities which are familiar to us. Sound is estimated to travel at the rate of 1100 feet per second; and a ball, impelled by gunpowder, to traverse about 1700 feet per second, which is about 200 feet more than the rate at which the earth revolves. But in these cases, the motion is straight forwards, or nearly so, and is exempt from that centrifugal tendency, which is so great an obstacle to *circular* motion.

The surface of a spindle, of three inches diameter, revolving 4000 times a minute, passes through only 50 feet per second; and a wheel of wrought-iron, of three feet diameter, will fly in pieces before it reaches a velocity of 400 feet per second. An instance occurred very recently, of a man being killed by an accident of this last description.

But this destructive velocity, of 400 feet per second, is little more than a fourth of the rate of the earth's revolution at the equator. The greater bulk of the earth is of course the cause why the centrifugal influence acts with such comparatively small power upon it. A late writer in Professor Silliman's Journal, conjectures that it must have been some sudden stoppage of the earth in this, its amazingly rapid revolution, that caused the universal deluge. "Supposing," he says, "the solid earth suddenly stayed, or even slightly checked in her diurnal motion, the Pacific Ocean would, as it were in a moment, rush over the Andes and Alleghanies, into the Atlantic, which, in the meantime, would be sweeping over Europe, Asia, and Africa. A few hours would cover the entire surface of the earth, except, perhaps, the vicinity of the poles, with one rushing torrent, in which the fragments of disentegrated rock, earth, and sand, would be carried along with the wreck of animal and vegetable life, in one all but liquid mass." "It is obvious," he continues, "that such is precisely the effect to be expected, should the earth come in contact with a comet, although ever so slightly. Dr. Halley, in an essay on the causes of the flood, written in 1694, suggests that a change has been effected in the axis of the earth, by the shock of a comet; but he evidently mistakes the effect to be produced by such an event. He thinks it would have produced such a commotion in the waters, as would have caused them to overflow the highest land, in consequence of their tendency to rush from all parts of the globe towards the spot which received the shock. He probably calculated, that this would result from the attractive power of the comet; but this power being so exceedingly small, compared to the rotary impulse possessed by the waters, it is obvious that the effect I have described must be the result of such an occurrence."

CURE FOR HYDROPHOBIA.

The Editor of the New Monthly Magazine, informs his readers that a medical friend, who has lately returned to England, from a long residence in South America, states, that while in that country it occurred to him, that a plant, called the *guaco*, celebrated for curing the bite or sting of all venomous snakes, and so called after a bird which preys on snakes, and had been observed to apply to this plant as a remedy when bitten, might prove equally efficacious in hydrophobic cases. He accordingly exhibited it in numerous cases of hydrophobia, which came before him, "*with complete success*." The informant adds that, "should the attention of the faculty be excited to investigate the virtues of this plant in hydrophobia, and deem it worthy of a trial, I have it in my power to procure *any quantity*, and shall be happy to give any information on the subject."

We think the author of this highly valuable piece of information had better import a quantity of the plant at once—before the next dog days, at the latest,—and make it *a business of his own*, to introduce it into every laboratory in the kingdom. If it be really the specific which he represents, and if he will only exert himself with suitable zeal to make its virtues known and appreciated, he may sure of both fame and profit, by the adventure. A place, second only to that of Jenner, among the benefactors of humanity, must await him. But he will require to do as Jenner would have done in such a case. He must enter on the propagation of his discovery with the enthusiasm of an apostle, and never rest till he has succeeded in erasing hydrophobia from the list of incurable maladies. To stay till "the Faculty" wait upon him for "information on the subject," will, we fear, be as hopeless a speculation, as that of the dolt who laid himself down on the bank, to wait till the river passed bye. "Faculties," dont go after any one, or do any thing of themselves. It is by individual exertion alone, and by not a little of that, that all great improvements in this country are accomplished.

DURABLE COMPOUND METAL.

Brass being peculiarly liable to decomposition in the atmosphere of London, Captain Kater directed Mr. Bate, of the Poultry, the artist employed to conduct the new standard of linear measure, to make some experiments, in order to ascertain the proportions of tin and copper, which might produce a metal equal in hardness, and which might be worked with the same facility as hammered brass; and after some trials, it was found that a mixture of 576 parts of copper, 59 of tin, and 48 of brass, afforded a beautiful metal, which possessed all the qualities desired.

STEAM BOATS.

H. H. in estimating the probability of the success of an apparatus for propelling vessels, will feel obliged by some of your correspondents giving him the following information:—

It is reported, that the Margate steam-boats have completed their distance in 5¼ hours. Allowing a boat to be of 100 horse power, and its paddle wheels 9 feet diameter, how many revolutions per minute will its wheels make, to affect the above motion?

What force applied to the circumference of these wheels would stop them; that is, what weight applied to the rising extremity of the transverse axis would prevent motion?

Suppose the paddles of the wheel to be five feet in length, and one foot deep, (if these dimensions are correct) and that one paddle enters the water as the other leaves it, what force of water has the paddle wheel to overcome, the boat going with the tide, and at the rate given above?

It is presumed, that the force of the water is more to overcome as the wheel revolves with greater rapidity; but how is this increasing force of water to be estimated?

What influences the decrease of motion against tide? The paddle wheels in that case move through the water in the same direction as the tide, consequently must be more easily revolved; is it correct, therefore, to consider the stream acting against the boat as the cause, or the power lost at the paddles?

What length would the crank be of such a boat as above described, to turn the axis of a wheel of the given diameter of 9 feet.

When the power of a steam boat is spoken of as being that of 100 horses, to what part of the machinery is this power to be understood as applied?

If the dimensions above given, are not sufficiently correct for the boat described, the correspondent obliging H. H. with the required answers, will perhaps alter them.

ELECTRICAL EXPERIMENTS.

(*Concluded from p. 356.*)

The next series of experiments, was performed in consequence of the accidental discovery, that combination with water made sealing wax positive; I was attempting to clean some wax by melting it in boiling water, and, to my astonishment, I found that it retained permanently a positive electricity: I have some formed several years ago, and it still retains its moisture; when fastened to a stick of hard sealing wax, and brought into the vicinity of an electroscope, excited in the manner mentioned below, it shews positive electricity, and seems to prove that quality to belong to a conducting substance, dispersed through an electric; probably the maxim is not quite so general, though true in this instance. If the negative end, composed of hard wax, is held to the electroscope, when W. and S. W. winds blow, and also partly from the N. of W. it shews negative electricity, and the hydroresinous end, (as I may call it,) positive. But if the winds blow from the S. of S.W. S.E. E. N.E. N. or N.W. both ends shew positive electricity, whatever may be the state of the hygrometer. If a fine magnetic needle be suspended from a fibre of untwisted silk thread, covered with bees' wax, on presenting the negative wax, during a W. wind, both poles are attracted, shewing the needle to be positive; but during an E. wind, the south end is attracted, and the north end repelled. These magnetical experiments I mean to repeat and vary. What is singular, there seems no way of increasing, (by enlarging or alternating,) the power of this compound—a double stick, of an ounce and a quarter, having nearly as much power, as one of above two pounds weight; could that increase have been possible, it would have been invaluable as an electromotive machine, not being liable to any change of its properties. Several other positive bodies, such as cannell coal, caoutchouc, &c. held to the electroscope, by the same insulator, have the same effects; and all the metallic bodies shew their electric properties, when held to the excited electroscope, without the use of any doubler, provided the wind is in the W. When in the same point, the gold leaf electrometer will shew the electricity of the negative end, particularly if the positive is held for some time over it, the plate being connected with the ground. I now come to that part of my experiments which was performed on coloured bodies; I wished to discover, what coloured silks were the best insulators; on insulating them on the end of a stick of hard sealing wax, I found they held the following order, taken down after repeated trials. Wind West.

Negative.

Yellow silk.	Royal purple silk.
Apple green do.	Orange do.
Rose red do.	

Weakly Positive.

Pink silk.	Blue purple silk.
Coquelicot do.	

Strongly Positive.

White silk.	Mazareene blue silk.
Light blue do.	Black do.
Glass green do.	Lilac do.

It having been objected, that the dyes might influence the results; I determined to try glass.

Negative.

Dark and light red glass.	Clear and light twisted yellow do.
Do. do. purple do.	Opake yellow do.
Blue twisted do.	Clear white twisted do.
Blue and white twisted do.	Clear twisted do.
Light green do.	Rough do.

Positive.

White glass.	Dark green glass.
Light blue opake do.	Brown do.
Dark blue plain do.	Black do.

These last were held to the excited electroscope, by a pair of botanical forceps, fastened to the end of a stick of hard sealing wax, and on the inside of the points, pieces of cloth are glued, to prevent the glass slipping; this instrument is useful for holding many other substances, to the electroscope, but they should be of some length, else they will shew the electricity of the forceps which is positive.

I have not yet tried other coloured substances, such as linen, cotton, woollen, leather, &c.; but I apprehend that their conducting properties will modify their results considerably.

I think I have now evidently shewn, that the course of electricity, is contrary to the motion of the earth, or comes from the sun; that the red, orange, and yellow rays, are negative, or having a tendency to give out electricity; and that the blue, green, and purple, have positive electricity, or a tendency to absorb it; and though there are some anomalies, such as the scarlet in silk, and the twisting of the clear and blue glass, which vary the results: yet upon the whole, they agree with the other facts. It may also be remarked, that black and white are both positive in glass as well as silk: black seems to approach to a dark purple, and, therefore, follows its law; white being the undivided ray, and possessing a surplus of light, is still inclined to take in a farther portion of heat and magnetism to form the compound electricity: thus the red ray has a surplus of heat greater than its light and magnetism can absorb. The white ray has a surplus of light, and the violet a surplus of magnetism uncombined, which its small quantity of heat is not able to unite with the light.

I now come to my conclusion; what follows is a matter of mere theory; but theory is one of the landing places on the great staircase of the temple of wisdom, where the ardent enquirer may take a rest, and look back to the steps he has passed, and forward to those to which he is proceeding; therefore, even a false theory is not altogether unprofitable.

I think I have proved that there is a current of electricity, from east to west, round the earth; and it seems highly probable, and, indeed, nearly demonstated, that there are two currents of magnetism, one from the North, and the other from the South, Pole. If electricity is magnetism combined with light, by means of heat, as water is combined with oil by means of alkali, it may lose its heat in the rigorous cold of the Poles, when the light will fly off in the form of auroræ boreales and australes, and the magnetism go to the equator, in search of new portions of both; the constant current of a condensed fluid continually, but gradually changing its point of origin, may be explained by its condensation, till it arrives at a certain point, and then its expansion afterwards, till it is carried off, by some provision in nature, similar to that by which light and heat are prevented from accumulating, in too great quantities, which will account for the variation. The dip of the needle may also be accounted for, on the supposition that the fluid current is strongest near the Poles, and counterbalances the contrary current weakened by its greatest distance.

It has also been observed, that the south pole is most magnetic, which agrees with this theory, as the cold extends farther from the south pole than from the north. The primitive rays of light, those seeming exceptions to the simplicity of nature, may owe their properties to greater and less combinations of heat and magnetism with the original matter of light, therefore may be resolved into the effect of electricity passing into the humours of the eye, (from coloured bodies) which we know to be formed of conducting substances. In addition to all these considerations, we must reflect, that we are able to procure heat, light, and magnetism, independent and distinct from each other, and in considerable quantities; whereas electricity is never sensible, but in very small quantities indeed, without the presence of some of the others. If yourself and your readers should not be tired with this subject, I may probably renew it when I have collected more materials.

I am, Sir,

J. R. I.

Edinburgh.

THE LOST COMET.

A comet appeared in the year 1770, and was carefully observed for nearly four months by M. Messier. When Prosperin and Pingre applied themselves to calculate the elements of its orbit, they found that a parabolic path would not represent the observations of Messier, and hence they suspected that its orbit might be sensibly elliptical. M. Lexell of St. Petersburg computed its elements in an elliptical orbit, and he found that its period was five years and a half, and that its greatest distance from the sun did not much exceed that of Jupiter. This curious subject was investigated rather unsuccesfully by MM. Sejour and Lambert; and a few years ago it attracted the particular notice of the National Institute of France. At the request of that learned body, Dr. Burckhardt, repeated all the calculations with the utmost care, and the result of his investigations was a complete confirmation of Lexell's conclusions. Here then was a most singular anomaly in the motion of this comet. While all the other comets which had been observed, moved in orbits stretching far beyond the limits of the solar system, and revolved in periods of long duration, the comet of 1770 never wandered beyond the orbit of Saturn, and completed its revolution in the short period of five years and a half. The return of this body, therefore, was confidently expected by astronomers; but though it must now (on the theory of M. Lexell,) have completed nearly 8 revolutions round the sun, and though more observations have been made in the heavens during the last forty years than perhaps during the two preceding centuries, yet the comet of 1770 has never reappeared.

Dr. Brewster has endeavoured to account for the disappearance of this comet in the following manner. (Art. COMETS, Edin. Encycl.) "If the comet of 1770 is lost, this could happen only from its uniting with one of those planets whose orbits it crossed. Now, if such an union took place, two consequences would obviously flow from it. The planet would suffer a sensible derangement in its motions, and its atmosphere would receive a vast accession of that nebulous matter, of which the comets are often wholly composed. Here then, we have two distinct criteria to enable us to ascertain the individual planet by which the comet was attracted. The path of the comet intersects the orbits only of Venus, the Earth, Mars, the four new planets, and Jupiter, and therefore it must have united with one of these bodies, or their satellites. Now, since the year 1770, neither Venus, the Earth, Mars, nor Jupiter, have suffered the smallest derangement of this kind, nor have they received any visible addition to their atmospheres. We must, therefore, look to the four new planets for some indication of the presence of a comet, and if they exhibit any phenomena that are unequivocally of this description, we must consider such a coincidence as a strong proof of the theory, or as one of the most wonderful facts in the history of science.

"Two of the new planets, Ceres and Pallas, exhibit, in the form and position of their orbits, evident marks of some great derangement; but as this may have arisen from that explosive force, by which they seem to have been separated from a larger planet, we are not entitled to regard it as a proof of the present theory. But though we cannot employ our first criterion for or against the theory, the second replies with irresistible force, and we would entreat the particular attention of our readers to this single point. The two planets, Ceres and Pallas, are actually surrounded with atmospheres of an immense size. The atmosphere of Ceres is 675 English miles high, while that of Pallas rises to the height of 468 miles. Now the height of any of these atmospheres is greater than the united heights of the atmospheres of all the other planets, and is above a thousand times higher than it ought to have been, according to the ratio which exists between the globes and the atmospheres of all the other bodies of the system. Astronomers were so forcibly struck with the magnitude of these atmospheres, that a dispute arose whether Ceres and Pallas should be called planets or comets, and the discussion terminated, by giving them the name of asteroids, a class of bodies which were supposed to partake of the nature both of planets and comets. But to draw this argument still closer upon the subject, let us enquire from what other source these atmospheres could be derived, if they were not imparted by the comet of 1770. If the four new planets are the fragments of a larger body, endowed with an extensive atmosphere, each fragment would obviously carry off a portion of atmosphere proportioned to its magnitude; but two of the fragments, Juno and Vesta, have no atmospheres at all, consequently the atmospheres of Ceres and Pallas could not have been derived from the original planet, but must have been communicated to them at a period posterior to the divergency of the fragments.

"It would have been a satisfactory addition to the preceding arguments if we had been able to shew, by direct calculation, that Ceres and Pallas were at the same instant with this comet in that part of their orbits which was crossed by its path, and that the position of the planes of the orbits was such as to permit a near approximation. But as we have no data sufficiently correct for such a calculation, we must leave this part of the subject to some future opportunity. There is one fact, however, which in some measure supplies its place, and which is therefore worthy of particular notice. The nodes of the comet of 1770, lie exactly between the nodes of Ceres and Pallas, an arrangement which is absolutely indispensable to the truth of the preceding theory."

HAIL RODS.

Paragreles (hail rods) are of as sovereign efficacy in the estimation of the vulgar of France, (where the produce of large districts is often destroyed by hail storms,) as lightning conductors are in the opinion of the people of this country; but it would seem that both are alike fated to lose the countenance of the learned. Professor Leslie (as our readers are aware) has proclaimed the inutility of the former; and now we find the French Academy of Sciences declared against the latter. In reply to a question submitted by the Minister of the Interior, regarding the use of hail rods, M. Fresnel has reported in the name of a committee of the French Sçavans, "that the electric theory of hail does not rest on a sufficiently solid basis, and the affinity of hail-rods appears too uncertain to justify them in recommending the employment of them." No attempt, he adds, hitherto made, has given any positive result, and to decide the question by suitable experiments would require much time and expense, disproportionate to the probability of success.

SOUTHWARK MECHANICS' INSTITUTION.

Last week Mr. Kirby concluded a course of lectures at this institution on Pneumatics, and he is succeeded by Mr. Wallace, who is to deliver lectures on Astronomy on the Monday of each week. We are glad to learn that many new subscribers have joined the Institution.

NOTICES TO CORRESPONDENTS.

In the hands of the Printer, but postponed for want of room—Memoir of Sir Isaac Newton—and Simple Method of Constructing Horizontal Vanes.

A notice in our next of Baron Dupin's Geometry of the Arts, adapted to England by Dr. Birkbeck.

We have received four more opinions on the Reservoir Case, from M. W.—W. Crosbie—James Anderson—and S. H. P.—and shall endeavour to give a summary of the whole in our next.

Mr. T. G. B.'s recommendation shall have every attention.

Communications received from R. D.—Mr. J. Cock—A Constant Subscriber—Delos—Quereris—A Real Well-wisher—H. H. S.—Clyde—F. M.—Mr. Burns—An Original Subscriber—Az.—Trebor Valentine—M. K.

Communications (post paid) to be addressed to the Editor, at the Publishers', KNIGHT and LACEY, 55, Paternoster Row, London.

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Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 165.] SATURDAY, OCTOBER 21, 1826. [Price 3d.

IMPROVEMENT IN CARRIAGES.

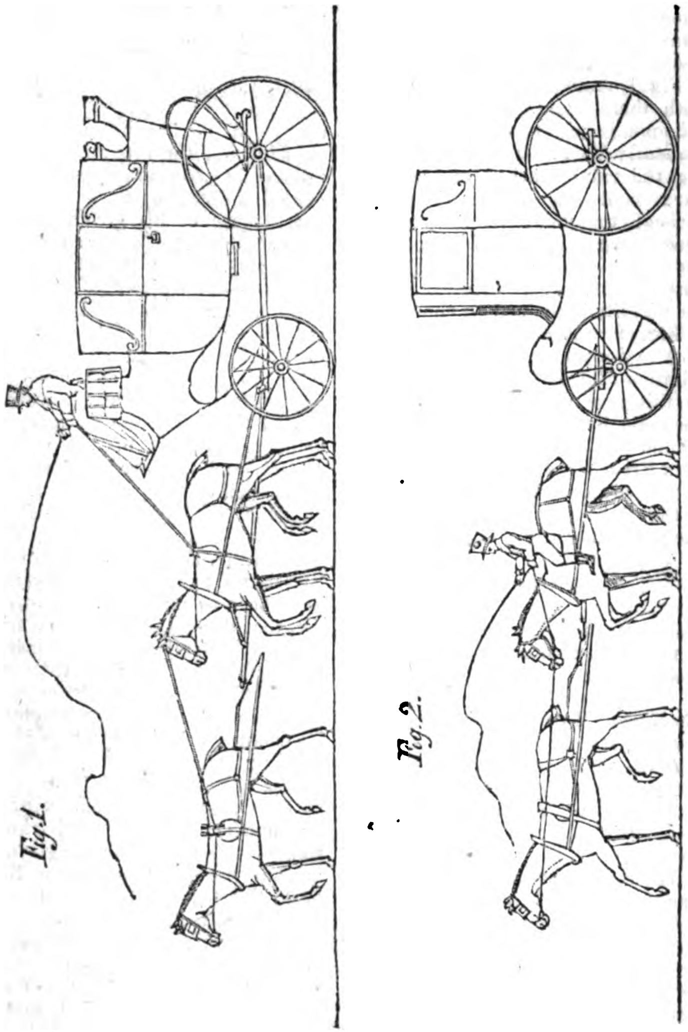
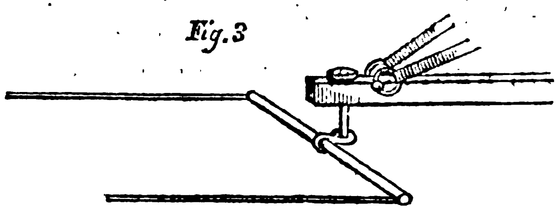


Fig. 3



We have been favoured, by our correspondent Senex, with the drawings which we have transferred to this and the preceding page, explanatory of his improved mode of connecting the sway bar with the pole of a carriage, and driving tandem with three horses.

Fig. 1, represents a family carriage with three horses and one driver. The pin is here supposed to be permanently fixed to the pole for receiving the ring attached to the sway bar; and is, therefore, passed through the pole, and secured by a head piece at top. The saddle on the back of the leader, the light shaft suspended from it, the breaching, &c. are all fully explained by the sketch.

Fig. 2, represents a chariot or post chaise adapted to the occasional addition of a third horse. The pin in this case does not pass through the pole, but is received in a hole behind the hook, and secured there by a French nut, &c. as more fully explained in our 163rd number.

Fig. 3, is an an enlarged view of the pin, &c.

MATHEMATICS PRACTICALLY APPLIED TO THE USEFUL AND FINE ARTS.

By Baron Charles Dupin. Adapted to the state of the arts in England, by George Birkbeck, Esq. M. D., President of the London Mechanics' Institution. No. 1, pp. 32.

Baron Dupin has the merit of having introduced mechanics' institutions into France, on the model of those established in Great Britain; and has, perhaps, done more by this single act, than by all the rest of his scientific labours, highly and deservedly esteemed though they be, to establish for himself an imperishable name. It was when travelling in Scotland, in 1817, and on visiting Glasgow, the favourite seat of Scottish industry, and the first British city which could boast of a mechanics' institution, (the Andersonian,) that the baron was first struck with the great advantages attending courses of popular instruction in the principles of the arts and sciences; and before two years elapsed he succeeded in obtaining the sanction and concurrence of his government, to the employment of similar means for promoting the industry of his native country.—On the 2nd of December, 1820, he commenced at the *Conservatoire Royal des Arts et Metiers* of Paris, an annual course of lectures on geometry and mechanics applied to the arts, which were attended till their close by numerous audiences, chiefly of the working classes, and produced a favourable impression on the public mind. The example of the metropolis was speedily followed at Lyons, Clermont, Lille, Bar-le-Duc, Sedan, and Strasburgh; and more recently, there have been so many additions to the list, that Baron Dupin can now number nearly forty mechanics' institutions, which he has been the means of founding throughout France.

Desirous of still farther benefitting his country and society at large, the Baron has proceeded to publish the course of lectures which he delivered at the Conservatoire; and with the first number of a proposed translation of this work into English, we are now presented by Doctor Birkbeck, the President of the London Mechanics' Institution.

"The very perspicuous and instructive manner," says Dr. Birkbeck, "in which the truths of geometry are (here) unfolded, and the continually attractive application of these truths to the proceedings of the workshop, an application never before to an equal extent ever attempted, must place this treatise in the hands of every inquiring workman, and, on account of the amusing character of its contents, in the hands of the least scientific or practical.—It is likewise so completely adapted to the purposes of mechanics' institutions, that I trust it will soon become not only the text book for the elementary schools, but be introduced as the basis of courses of lectures to be regularly delivered by suitable professors upon this fundamental branch of mathematical science."—*Address to the Reader.*

The claims with which this translation comes before the public are, it will be seen, considerable. It is a translation of the prelections of the man who has done so much for the mechanics of France, recommended in the warmest terms by one who has deserved almost equally well of those of Great Britain. It is to supply our inquiring workmen and scientific amateurs with a sort of work which they want greatly, but which no countryman of their own (for such is the assertion,) has yet offered to provide for them; it is to become the common text book in geometry, of our mechanics' schools and institutions; and as the appropriate consequence of such services, to make the name of Dupin an object of as grateful veneration among the English, as it is already among his own countrymen.

We are not of opinion that claims like these are such as should be either hastily or easily admitted. We think on the contrary, that they demand the most rigid examination. It is due to the interests of our working classes, and to those of the nation as involved in them, that we should investigate carefully whether the work, which it is proposed shall be their universal text book in so important a branch of knowledge as the application of geometry to the arts, is deserving of that distinction. It is due, also, to the honour and feelings of our men of science, that they should not be condemned as so unmindful of the wants of their fellow countrymen, or so incapable of supplying them, except on the most undeniable evidence. It is due, lastly, to truth, that we should not be carried away by mere authorities, but that the more the names of Dupin and Birkbeck are celebrated and esteemed, the less hesitation we should have to scrutinize the services they have rendered or propose to render us.

We trust it will not be supposed that we approach this subject with any of the *prejudice* and *illiberality* which are so commonly mixed up with national feeling. Although it must, doubtless, be a great reproach to our men of science, to have left to a foreigner the task of supplying a necessary text book to our schools and institutions; we should count it a far greater reproach to reject a good text book, when offered to us, merely because it happens to be the production of another country. We would say, with Watts,

> "Seize upon truth where'er 'tis found
> Amongst your friends, amongst your foes,
> On Christian or on Heathen ground,
> The flower's DIVINE where'er it grows."

Would our history have been what it is without the aid of a Rapin? Our political constitution without the developement of a Delolme? Even our grammar, without the help of Murray (an American)? Why then, should we deny to another foreigner, the honour and pleasure of familiarizing us with the principles and practice of geometry? Not, certainly, because he is a foreigner merely; nor for any other cause whatever, but that his services are either uncalled for, or inadequate to the supply of our wants.

In referring to what has been done by countrymen of our own, to furnish that which, Dr. Birkbeck says, has "*never* been placed in the hands of the public," nor "*even attempted;*" namely, "a treatise exhibiting clearly and comprehensively the connexion of science with the arts;" we shall not seek to drag to the light books either forgotten or neglected. Neither shall we set any store on numerous detached treatises illustrative of particular branches of art, (such as weaving, watch-making, mill-wright work, carpentry, &c.) which might be mentioned to shew that science has not been so backward in lending its assistance to the labours of British industry as Dr. Birkbeck supposes. Nor shall we even presume to offer "Ferguson's Lectures," tolerably comprehensive though they be, comprehending mechanics, hydrostatics, hydraulics, pneumatics, optics, geography, astronomy, dialling, &c.) and admirably improved and enlarged by Dr. Brewster, as a proof that science has already done what Baron Dupin, through the help of Dr. Birkbeck, proposes to do, for the mechanics of this country. We would speak merely of such works as are of our own day and generation, and have had professedly for their object to supply all that the Baron and his translator and adapter propose to supply. We would respectfully remind Dr. Birkbeck that there is such an English work as "*Mathematics for Practical Men*, being a Common Place Book of Principles, Theorems, Rules, and Tables, in various Departments of Pure and Mixed Mathematics, *with their most Useful Applications, especially to the pursuits of Surveyors, Architects, Mechanics, and Civil Engineers*," and written by a friend of Dr. Birkbeck's own, the enlightened, and in the cause of scientific instruction, indefatigable, Dr. Olinthus Gregory. We would presume also to bring to Dr. B.'s recollection, that his successor at Glasgow, Dr. Ure, announced several months back that he was preparing for the press the whole of his excellent courses of lectures at that institution,—lectures which embrace nearly the entire circle of the sciences—which have been delivered to and specially adapted to, the understandings of working men,—and which have served to keep up a degree of information, among the mechanics of the west of Scotland, that attracted the wonder of Baron Dupin himself, and which we verily believe is not to be matched in any part of the civilized globe. With the former work before us, and the latter announced, we know not how it can be fairly said that our own men of science have so utterly neglected the interests of their fellow countrymen, as Dr. Birkbeck would represent. Dr. Gregory has said of his work, very modestly, "I do not attempt to persuade myself that the present volume will be thought adequately to supply the desiderata to which these passages advert," (passages in Mr Brougham's "*Practical Observations upon the Education of the People*," in which he recommends the compilation of popular treatises on geometry, mechanics, &c.) But when we find on looking into the work that it contains perspicuous treatises on arithmetic and algebra, and synoptical compendiums of geometry, trigonometry, conic sections, curves, perspective, mensuration, statics, dynamics, hydrostatics, hydrodynamics and pneumatics, that the illustrations are generally of the most popular description, and *practical applications incessantly borne in mind*; and that it includes numerous tables excellently calculated to save the labour of architects, mechanics, and civil engineers, we feel it (for our parts,) impossible to refuse to the ingenious author the praise of having left to others but little beyond mere investigations and demonstrations to furnish. It comprehends in fact all that a good Text Book for Mechanics' Institutions ought to comprehend, and wants only that sort of illustration which it is the business of lecturing to supply, and which there is little doubt will be supplied by the forthcoming work of Dr. Ure, in a style of excellence that can leave the British mechanic little or nothing to desire at the hands of foreign benefactors.

Great, therefore, as is our respect, both for Baron Dupin, and for Doctor Birkbeck, we can by no means assent to the high pretensions with which they make their present appearance before us. The lectures of the Baron must doubtlessly contain much valuable matter, of which British writers will do well to avail themselves; but that a translation of the whole is wanted to supply a text book, or any desideratum whatever, in the British language, is what we cannot for a moment allow.

It seems to us, on the contrary, extremely probable on a first view of the subject, that there must be much in these lectures which, though applicable enough to the state of knowledge among the French mechanics, will be found of rather indifferent use to British artizans; and not a little omitted also, which a better acquaintance with the intellectual wants of our working classes, than any foreigner can be supposed to possess, would have induced the writer to supply.

The work in its present form, is not, to be sure, a translation merely, but is stated to be "*adapted* to the state of the arts in England," by Dr. Birkbeck. Judging, however, from the specimen before us, we should say that this adaptation consists more in amplification, not always of the most judicious kind, than in proper and necessary curtailment.

The present number, which is the first of ten that are to comprehend the Geometry of the Arts, contains a first lesson on "Right Lines, Angles, Perpendicular and Oblique Lines;" and the greater part of a second, on "Parallel Lines, and their combination with Perpendicular and Oblique Lines."

Of the manner in which the mode of producing these different sorts of lines is explained, and their various properties are illustrated, we shall take a few specimens at random.

"As there are not between any two points, two directions of which each may be shorter than the other, so there cannot be drawn two distinct lines between any two points. *When two right lines terminate in the same two points, they form consequently, only one right line.*" p. 4.

To trace a right line. "When we have to draw a line through two given points, the ruler must be placed equally distant from both, and as near as is required by the thickness of the instrument which is to draw the line; the ruler must then be held firm and immoveable, till the line is drawn, taking care that the pencil or pen always remains in contact with the ruler." p. 5.

"When two figures placed one over the other, are adjusted to each other—when all the parts of both appear in the same lines—*they have the same form and size, they are perfectly equal to one another, and one figure is made of the same form and size as another, when it is drawn on this principle.*"—p. 13.

To draw a number of right lines at once. "The five parallel lines (in music) are very often traced at the same time, by means of a ruling pen with five points at equal distances from each other; *the pen is held so that the five distances are in a line perpendicular to the ruler, and in this manner the five lines are drawn equally distant at every point, and consequently parallel.*"—p. 20.

Application of right lines to rail roads. "Rail roads are constructed of two *rails*, or wheel racks, which may be either grooves below, or rods above, the surface of the road, but fixed perfectly straight, and being perfectly united; the wheeler on which the wheels of carts or waggons ought to move with precision, *the two wheels on the right side moving on the right hand rail, and the wheels on the left side moving on the left hand rail.*" p. 21.

We believe there is nothing in these different pieces of information, but what is extremely correct; but our readers will at once perceive, from these examples, and particularly from the parts of them marked in italics, what the sort of curtailment is, which we think the labours of M. Dupin ought to have received, but have not received, in order to adapt them to the state of intelligence in this country. We are bound to presume, that a writer of M. Dupin's superior judgment and tact, would not have taken the pains, and used so many words as he has done, to explain such self-evident truths, and simple practices as we see here unfolded, but from an idea that all this was necessary to bring them within the comprehension of the working classes of France. And it is a possible case, (though we confess not a very probable one,) that M. Dupin may have done his countrymen no injustice by this supposition. As regards our artizans, however, we are convinced, that there is not a man or boy among them, (of those at least who can read and write,) but must smile at the notion of lessons like these being imported for *their* edification.

(To be concluded in our next.)

THE RESERVOIR CASE.

Conditions of the Case.

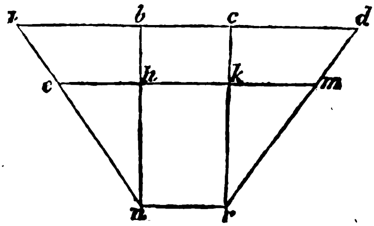
Cistern 200 feet in length.
Ends perpendicular.
Width at top, 40 feet.
Width at the bottom 8 ditto.
Depth 20 ditto.
Length 200 ditto.

Question 1.

What should be the depth of water when the reservoir is half emptied?

R. J. has given for answer, 13 feet, 7½ inches.
G. H. P. 13 feet 4 inches.
Zelid. 13 feet 3½ inches.
W. M. F. 13 feet 1 inch 4-10ths.

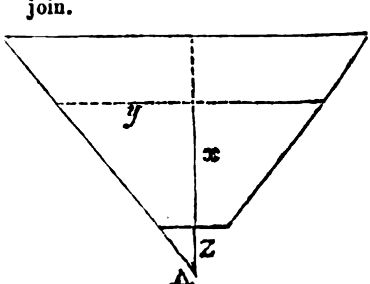
The whole of these answers are erroneous, and the mode of demonstrating this is well shewn, by our old arithmetical correspondent, M. W. He supposes the following figure to represent the reservoir in question.



He then proceeds thus: "$\overline{ad+nr} \times \frac{bn}{2}$ = the area of adnr, the end of the reservoir; that is $\overline{40+8} \times \frac{20}{2} = 480$ square feet in adnr, which, multiplied by 200, the length, gives 96,000 cubic feet, for the contents of the reservoir. And it also appears that 240 square feet are contained in *half the area of the end*, adnr. It is well known that in right-angled triangles, bn : : eh : hn ; therefore, first let us see whether, by assuming with one of your correspondents, that there will be 13 feet 7½ inches in depth left, when half the water has been pumped out? bn and cr, are perpendicular to the bottom, nr; therefore, hk, is equal to eight feet.

"Now, in order to find the length of eh, which is equal to km, we must say, as 20 : 16 : : $\overline{13{\cdot}625}$: $\overline{10{\cdot}9}$.; so we find that (by adopting the depth given by your correspondent,) eh and km are each equal to 10 feet and 9-10ths of a foot, consequently, the line em, must be 29 feet and 4-5ths of a foot. Having now got the length of the line em, at the depth, (13 feet 7½ inches,) we shall soon find that there is an error. $\overline{em+nr} \times \frac{hn}{2}$, or $\overline{29{\cdot}8+8} \times \frac{13{\cdot}625}{2}$, should, according to your correspondent, produce 240 square feet, half the area of the end of the reservoir; but the product of $\overline{29{\cdot}8+8} \times \frac{13{\cdot}625}{2}$ is $\overline{257{\cdot}5125}$, and this sum, multiplied by the length, (200 feet,) gives 51,502·5, which is 3,502 *feet and a half more* than half the contents of the reservoir. By the same mode of computation, it will be found that your other correspondent, who states the depth to be 13 feet 1 inch and 4-10ths, when the reservoir is half empty, is also in error; and that such depth will contain about 514 cubic feet more than ought to be left."

The exact depth, according to M. W. and to our other correspondents, J. Anderson, Q.Q. A.—W. Crosbie, S. Maynard, and N. H. is, 13 feet and 1-3rd of an inch nearly. The demonstration of N. H. which is very, neat and satisfactory, we subjoin.



"Let the annexed figure represent a section of the reservoir, with a perpendicularly bisecting line, produced to meet the continuation of one of its sides in A; let y represent half of the horizontal line, dividing the section into equal parts; and x, the depth, when exactly one half has been pumped off. Then, as the difference between the width of the top and bottom, $40-8=32$; is to the depth 20; so is the width at bottom 8; to a fourth number 5, which is the distance of the point, A, from the bottom of the reservoir: call it z. Then, by similarity of triangles, as $z : \frac{1}{2}$ bottom width $:: x+z : y$

$$5 : 4 :: x+5 : \frac{\overline{x+5}\times 4}{5}$$

$=\frac{4x+20}{5}$; and the area of the section remaining, when half is pumped off, must necessarily be $\frac{480}{2}=240$ square feet.

$$\text{Wherefore } \overline{y+\tfrac{1}{2}\text{ bottom width}}\times x.$$

$$=\frac{4x+20}{5}+4x=\frac{4x+40}{5}\times x$$

$$=\frac{4x^2+40x}{5}=240$$

$$x^2+10x=\frac{240\times 5}{4}=300;$$

And completing the square

$$x^2+10x+25=325;$$

and $x=\sqrt{325}-5=13\cdot028$ nearly, or 13 feet and 1-3rd of an inch."

Question 2.

What is the total cost of pumping out the cistern, at sixpence per ton weight?

Answers.

	£	s.	d.
W. Mc F.	81	6	5¼
G. H. P.	66	19	9
T. H——t	66	19	3¼
W. Crosbie	66	19	3¼ 1-5th.
S. Maynard	66	19	3¼·71428568
Q. Q.	66	19	3
A.	66	19	3¼
J. Anderson	66	19	3 1 5-7ths.
Zelid	66	19	3¼
M. W.	66	19	3¼
N. H.	66	13	4
R. J.	62	6	10¼

According to the majority of these answers, the total cost is not exactly so much as 66l. 19s. 3¼d. but somewhat more than 66l. 19s. 3¼d. The solid contents of the reservoir are reckoned at 96,000 feet; thus 40 at top, and eight at bottom, make the cistern equal to a triangle whose base is 48 feet, and perpendicular height 20 feet; then 48 multiplied by 10, the half of the perpendicular, gives 480 square feet for the area of the section, and 480 multiplied by 200 feet, the length, = 96,000 cubic feet. The specific gravity of the water is set down at 1000 ounces per cubic foot, "Then, as 1 cubic foot : 96,000 cubic ft. :: 1000 oz. : 2678·57142857 tons, the weight of water the reservoir contains; hence, $\frac{2678\cdot 57142857}{40}$ = £66 19 3¼·71428568."—*Answer of Mr. Maynard.*

N. H. remarks, however, very justly, that "the party who pumped out the lower part, would have the most labour, having *farther* to draw the water."

BREWING.

Mr. Editor,—I think it right to bear testimony to the worth of a communication "On Brewing," contained in No. 115 of your valuable miscellany, and furnished by your correspondent of Stratford on Avon, "Experimentum Crucis."

Although totally unskilled in the art, I was induced, from the simplicity of the directions, to make the experiment, and I did so with a full determination to adhere strictly to the prescribed rules. Through the different stages of the process, I was greatly encouraged by finding the results exactly as foretold, and having completed the business, I confess I was a little impatient *for the expiration* of *the month*, which even now has not quite elapsed. I have, however, the satisfaction to say, that my expectations have been fully realized, and for the encouragement of others, I shall only add, that I have, indeed, "a beverage, rich in flavour, pleasant, good tasted, and as fine as wine."

I am, Sir,
Your obedient servant,
R. D.

Nottingham, 7th October, 1826.

EXERCISES IN VULGAR FRACTIONS.

London, October 9th, 1826.

Sir,—Will you permit me the liberty of inquiring whether the exercises in vulgar fractions are intended for *young mechanics*? if so, I give them credit for their attention to the questions proposed. As I am a friend to rising genius, if you have no objection, I will offer a few hints to my young friends. Almost all fractions that occur in common calculation can be reduced to their least terms by *inspection only*:—Thus question III. which is $\frac{825}{960}$ can be reduced by two easy steps, for $8+2+5=15$; and $9+6=15$; now 15 is divisible by 3, and also by 5 ∴

$$\overset{3}{\frac{825}{960}} = \overset{5}{\frac{275}{320}} = \frac{55}{64} \text{ Answer.}$$

Question VI. $\frac{5184}{6012}$, $5+1+8+4=18$; and $6+1+2=9$; now 9 and 18 are both divisible by 9, and the units and tens of both numbers (84 and 12) are divisible by 4 ∴

$$\overset{9}{\frac{5184}{6012}} = \overset{4}{\frac{576}{668}} = \frac{144}{167} \text{ Answer.}$$

And for the same reason question II.

$$\overset{4}{\frac{192}{576}} = \overset{4}{\frac{48}{144}} = \overset{12}{\frac{12}{36}} = \frac{1}{3} \text{ Answer.}$$

$$\text{Question I. } \overset{4}{\frac{144}{240}} = \overset{12}{\frac{36}{60}} = \frac{3}{5} \text{ Answer.}$$

$$\text{and ques. IV. } \overset{4}{\frac{1344}{1536}} = \overset{4}{\frac{336}{384}} = \overset{12}{\frac{84}{96}} = \frac{7}{8} \text{ Ans.}$$

Now, to prove that a fraction *reduced to its least terms*, is precisely of the same value as before such reduction, the *numerator* is always a *multiplier*, and the *denominator* a *divisor*, and the increasing and decreasing qualities of the fraction being equally abridged, the value of it is not altered thereby; for suppose 12 men dig 24 feet in 2 days, which may not unaptly be represented by $\frac{24}{12}=2$; let $\frac{24}{12}=\frac{2}{1}=2$; it is therefore evident, that one-twelfth of the work can be done by one-twelfth of the men in precisely the same time; that is, one man can dig two feet in the same time that 12 men can dig 24 feet, that is, in two days; therefore the truth of the operation is evident. These observations I have made merely with a view to assist the young mechanic.

I am, Sir,
Your's truly,
CLYDE.

GRATUITOUS LECTURING.

Derby, October 4th, 1826.

Sir,—I hope you will think this communication worthy a place in your magazine, as it is a subject of vital importance to us, and I make no doubt highly interesting to you.

About a year and a half since, a mechanics' institution was established here, under most auspicious circumstances; in the course of six months after, a tolerable good library was opened for the use of the members; about the same time, a scientific gentleman (an honorary member) volunteered his services to give a gratuitous course of lectures on chemistry and anatomy: they were gratefully accepted, and highly approved of, redounding much to his credit, as well as the amusement and edification of all parties present.

Now, Mr. Editor, mark what follows; and as I know you are a great advocate for the working classes paying for whatever benefit they receive, I should be glad to know whether you can approve of their paying in the manner we of Derby have done in the present instance? In the first place, the committee tendered a check for twenty pounds, as a just remuneration for the expenses incurred in getting up the necessary experiments, with which the gentleman illustrated his lectures; he only accepted of ten pounds. The committee then pased a vote of thanks, and also voted him an honorary member for life; which, according to the rules of the institution, may be considered as ten pounds more: well, then, at the conclusion of a lecture on vision, light, and colour, delivered the other evening, judge, if you can, what the members could be thinking of, (if they thought at all) who could allow themselves to be led on, to bestow the most unbounded applause on the farce of presenting a silver snuff-box to the honorary lecturer, valued, I believe, at fifteen pounds, making altogether the sum of thirty-five pounds, paid by the members of the Derby mechanics' institution for a gratuitous course of lectures!!!

I remain, Sir,
Your obedient servant,
TREBOR VALENTINE,
Ordinary member of the D. M. I.

NEW HORIZONTAL VANES.

Fig 1

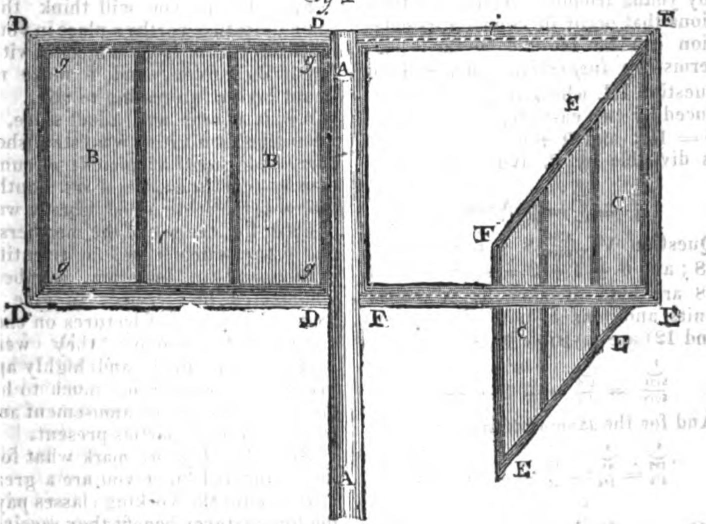
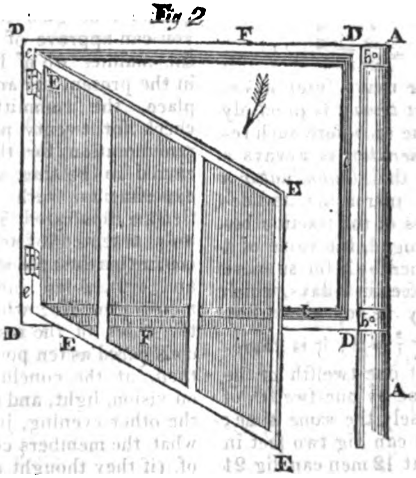
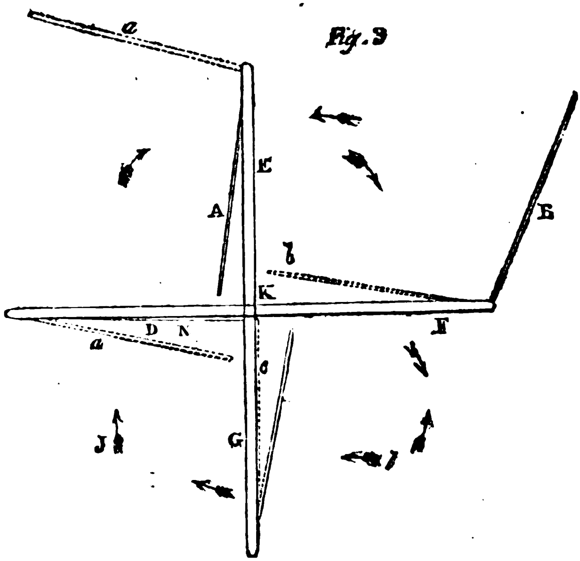


Fig 2



Sir,—I beg leave to offer you for insertion, the description of a new kind of horizontal vanes, to work mills, &c. of my own invention,



They are very simple, and will answer, I have no doubt, exceedingly well. The following is the

Description.

A A, fig. 1, is a perpendicular shaft, having fixed to it four frames (two of which only are here represented) D D D D, and F F F F, to the exterior ridges of which are fastened, on a hinge, other frames, E E E E, and *g g g g*, which open like doors, only in one direction, being prevented, by the groove shewn by the dotted lines, from turning the other way (see fig. 3); this frame, E E E E, is to be covered with tarpauling, such as is used for the sails of wind-mills. Fig. 2, is a more minute delineation of the frame.—E E E E, is the interior frame of wood, moving on the hinge *e e*, as before said, and is supposed to be open towards the spectator; it is prevented from opening the other way by the projecting groove, *i i i*.

A slight inspection of fig. 3, will sufficiently shew how the wind acts on these vanes. When it blows in the direction shewn by the dart, I, the moveable wing, B, of the frame, F, is wide open, being blown so by the wind, and the wing, D, of the vane, H, is perfectly shut, while A, of the vane, E, is open in a slight degree, as is also that of the vane, C, when it is evident the whole must go round, as shewn by the darts, together with the shaft, *k*.

Supposing, however, the wind should change, as shewn by the dotted dart, *l*, the wing, C, would immediately shut, as shewn by *c*,—D would open in a slight degree, as shewn by *a*, and A, would be wide open, as shewn by the dotted lines, *a*, &c. and the machine would continue to go round in the same direction. It would be the same, let the wind come from any quarter.

The two bars, F F, (fig. 2,) are to pass through the shaft, A A, and be further secured by pins, *h h*.

I am, &c.

Henry O****y,

Late 1 and 2 make 3.

September 18th, 1826.

"SALTNESS OF THE SEA."

Sir,—In your 162nd number, a correspondent has favoured us with a "Theory of the Saltness of the Sea," which appears to me to rest on some assumptions, in point of fact, which are entirely groundless.

"The heat," he says, "must inevitably sink down into the main body of the ocean."

And again, "It is a well established fact, that the sea is warmer at a considerable depth than at the surface."

Now, Sir, I believe the case to be precisely the reverse. Professor Leslie has shewn that the sun's rays (which are the conductors of heat as well as light into the bosom of the ocean) penetrate with constantly diminishing energy, till at a certain depth they cease to have any effect. He calculates that at the depth of 17 feet they lose half their force; that at 34 feet (which is equivalent to the mass of an atmosphere), they become reduced to one fourth; that beyond 47 fathoms, they can scarcely produce a degree of light equal to the glimmer of the closing twilight, and that the greater depths of the ocean are never visited at all by the cheering influence of the great luminary of day, but are the regions of perpetual darkness and perpetual cold.

The observations in support of this conclusion are numerous. Lord Mulgrave, in the latitude of 66° north, let down a register thermometer 4680 feet, which shewed the temperature at that depth to be 26°, while the air above was at 48½°, and in latitude 69°, while the exterior thermometer indicated 59½° the temperature of the water at the depth of 4040 feet was only 32°.—It has been also proved, by numerous trials, that the bottoms of those majestic fresh water basins, the lakes of Geneva, Thun, Lucerne, and Maggiore, are almost all of them and at all times equally cold, being only a few degrees above the point of congelation; and that, in the principal Scottish lakes, the variable impressions of the seasons never penetrate more than 15 or 20 fathoms.

Instead of cold, however, Æquis's theory requires that there should be enough of *heat* at the bottom of the ocean to distil from time to time the whole "debris of the growing world!" His authority for this view of the system of the universe, a patent of two mere mortals for purifying coal gas!! Most truly has he remarked, "the knowledge of nature and philosophical subjects is not of the right kind to assist persons to take out patents." Neither, we would add, is it of that sort which is to be traced in the records of the patent office rather than in the great book of nature.—Let Æquis study the latter when next he theorises, and he will probably exercise his ingenuity to more purpose than he has done on the present occasion.

I am, Sir,

Your constant reader,

DELOS.

THE "THEORY OF THE DELUGE" AND "LOST COMET."

Sir,—I think it useful to trouble you with a few lines, in observation on two articles which appeared in No. 164 of the Mechanics' Magazine, under the heads, "Rotation of Bodies, Theory of the Deluge," and "the Lost Comet."

I will introduce my remarks on these articles, by requesting the writers of them to peruse, as soon as possible, an excellent paper in the last number of the Wesminster Review, "on the formation of opinions;" after which, I would recommend to their attention, a pleasant story about King Charles II. the Royal Academy, and the fish, which will serve as an exemplary instance of the prostitution of reason to authority, by the admission of consequences, without any examination of the premises.

The writer of the article, "Theory of the Deluge," quotes Dr. Silliman's journal, as follows: "supposing the solid earth suddenly stayed, or even slightly checked in her diurnal motion, the pacific ocean would, as it were in a moment, rush over the Andes and Alleghanies, into the Atlantic, which, in the mean time, would be sweeping over Europe, Asia, and Africa. A few hours would cover the entire surface of the earth, except, perhaps, the vicinity of the poles, with one rushing torrent, in which the fragments of disintegrated rock, earth, and sand, would be carried along with the wreck of animal and vegetable life, in one all but liquid mass." It is obvious," he continues, "that such is precisely the effect to be expected, should the earth come in contact with a comet, although ever so slightly. Dr. Halley, in an essay on the causes of the flood, (!) written in 1694, suggests that a change has been effected in the axis of the earth, by the shock of a comet, &c." I beg pardon both of Dr. Halley and Dr. Silliman, but I cannot refrain from suggesting, that neither of their ingenious fancies will, by any means, account for "the Universal Deluge," at least for *that which our venerable judges very properly declare, forms, "part and parcel of the law of this land."* Surely, nothing but the writer's ignorance of this law, could have allowed him to assert that his "rushing torrent," covered the earth in a "few hours," at the risk of being reminded by his majesty's Attorney General, that the waters rose gradually "for forty days and forty nights!" Indeed, had it been otherwise, I fear that, tossed upon "the rushing torrent," over the tops of the Andes and Alleghanies, the poor ark would have proved but a sorry sea boat. Alas! who would then have been left to preserve the breed of Sillimans' and Banks's, Lamas and Kangaroos? Happily, however, the antidotes to this *Illiac passion* of our globe are numerous and efficacious, independently of "the law," which is decidedly against it. Mr. Buckland too, must set his face against it, for Messieurs the Atlantic and Pacific oceans, while rushing round the globe, at the rate only of five hundred miles an hour, which is allowing the revulsion only half the velocity of the earth's rotation, could have found no time to leave the professors and Mr Banks's bowlders "on the pinnacles of the highest mountains,"* still less to deposit thereon such immense strata of shells, &c. Indeed, I fear that the poor pinnacles themselves would have stood but little chance of escaping the fate of the butchers who killed the great ram of Derby, who, according to the song, "were carried away in the flood—flood—flood" (of the blood).

Professor Buckland's flood marched over Europe from north to south, while that of Professor Silliman, rushed from west to east. It is probable they gave each other timely notice of their intentions—or what in the name of heaven would have become of us if they had met!—But there is no knowing what were the laws of gravitation and mechanics in those days! We have positive "proof" of their having been quite different to what they are at present.† Of this difference our author gives us another ample proof, when he assures us that the catastrophe he describes "is precisely the effect to be expected, should the earth come in contact with a comet, although ever so slightly."

Now, according to every law of *modern* mechanics, should two such bodies as this earth and a comet come in contact, they would unite into one mass, whose elements of motion would be formed from the aggregate of the motions of the separate bodies before the union.

Again, according to *modern* mechanics, were two such masses even to meet in opposite directions, and were they as dense, adhesive, and elastic as iron or platina, it will not be pretended that they would bound away from each other beyond the limits of mutual attraction! It is more probable, that they would both be broken into millions of fragments, which immediately acting upon each other by attraction and gravitation, would be collected and condensed into one homogeneous sphere, and assume the station and course *dictated* by its elements.

The foregoing observations will partly apply to the article "The lost comet," above alluded to. The comet of 1770, is therein accused of having paid a visit to the planets Pallas and Ceres, with each of whom he thought proper to leave a portion of his atmosphere, a kind of celes-

* See M. M. No. 156, published by Hunt and Clarke. Article signed F. M.

† See M. M. No. 156, above quoted.

tial bouquet as it were, which these ladies have ever since been seen to wear by way of garland, head dress, or *coma*. Indeed, the tenour of the article, is such as would even induce us to infer that Mr. Comet went so far as actually to divide his very person and substance between them, although it is not actually stated that either of the ladies evinced that increase of personal dimensions, which we might naturally have looked for after such an adventure.

The recorder, however, of this bit of scandal assures us, that both Pallas and Ceres, *subsequently* "exhibited marks of some great derangement." This may have been a serious, though not uncommon *accident*, to which all ladies are liable, or we may ascribe the "derangement" to a storm of jealousy, or even recrimination, for it would really seem, that between the two, they have effectually done for poor Mr. Comet, who has never been heard of since. Such a termination of the affair appears the more remarkable, on referring to the diminutive size both of Pallas and Ceres, neither of them being more than 100 miles broad, and it is said they are as broad as they are long. Mr. Comet must have been the very tiniest of his species, not to have been able to take them both off in his pocket! The *old* logicians used to say, "Omne majus continet minus." But, "nous avons changé tout cela," and the next discovery will be, that Jonas swallowed the whale!

I am, Sir, &c.

F. M.

Oct. 13, 1826.

FLUIDITY OF SULPHUR AT COMMON TEMPERATURES.

Having placed a Florence flask containing sulphur, upon a hot sand bath, it was left to itself. Next morning the bath being cold, it was found that the flask had broken, and in consequence of the sulphur running out, nearly the whole of it had disappeared. The flask being broken open, was examined, and was found lined with a sulphur dew, consisting of large and small globules intermixed. The greater number of these, perhaps two thirds, were in the usual opaque solid state; the remainder were fluids, although the temperature had for some hours been that of the atmosphere. On touching one of these drops, it immediately became solid, crystalline, and opaque, assuming the ordinary part of sulphur, and perfectly resembling the others in appearance. This took place very rapidly, so that it was impossible to apply a wire or other body to the drops quick enough to derange the form, before solidity had been acquired; by quick motion, however, it might be effected, and by passing the finger over them, a sort of smear might be produced. Whether touched by metal, glass, wood, or the skin, the change seemed equally rapid; but it appeared to require actual contact; no vibration of the glass on which the globules lay, rendered them solid, and many of them were retained for a week in their fluid state. This state of the sulphur appears evidently to be analogous to that of water, cooled in a quiescent state below its freezing point; and the slow property is also exhibited by some other bodies, but I believe no instance is known where the difference between the usual point of fluidity, and that which thus could be obtained is so great: in the present instance, it amounts to 130 degrees, and it might probably have been rendered greater if artificial cold had been applied.

M. F.

SIR ISAAC NEWTON.

"O'er Nature's laws God cast the veil of night,
Out blaz'd a Newton's soul, and all was light."

This wonderful genius, "whom to have bred might well make England proud," was born on Christmas day, 1642, at Woolsthorp, a hamlet of Colsterworth, Lincolnshire, 6 miles south of the town of Grantham. He was the posthumous and only son of a Mr. John Newton, (descended from an ancient and respectable family) and born about three months after his decease. When

12 years of age, he was sent to the Grammar school of Grantham, at which place he made a good proficiency in the languages, and laid the basis of his subsequent pursuits; after having spent a few years there, his mother, who had no intention of making him either a scholar or a philosopher, sent for him home, in order to instruct him and train him to agricultural affairs, and rendered capable of managing his estate. Instead of attending to the business of the farm, however, he was always studying and poring over his books, frequently without the knowledge of his mother.

At length the time arrived when he should be freed from a state so uncongenial to his taste; it was the effect of accident. Being one Saturday sent to Grantham market, he was discovered by an uncle of his, a clergyman, in a hay loft, working a mathematical problem: which problem, with what he had before observed, fully satisfied our divine, that his nephew's inclination to learning was invincible, and that he would never make a good agriculturist. He, therefore, persuaded Newton's mother to allow him to follow the bent of his mind, and to send him back to the grammar school. After continuing there some time, he was, in the year 1660, entered of Trinity College, Cambridge, of which place his uncle had been a member, and where he possessed a numerous circle of friends. Mr. Newton chiefly directed his attention to mathematics, and, by the amazing force of his genius, made such an extraordinary and rapid progress, that he excited the admiration, and engaged the intimate friendship of Mr., afterwards Dr. Isaac Barrow, who was then a fellow of Trinity College, and one of the most eminent mathematicians of his day.

His college studies were commenced by applying himself to the consideration of Euclid's Elements; but he shortly cast them aside, as they did not obtain from him that approbation which the singular excellence of that author's method of demonstration, (by means of which, the whole series and convictions of the truths proposed, is perpetually kept in sight, up to their original principles), so eminently deserves; and this we are to attribute to the great facility with which Newton understood the first propositions, they appearing so plain and easy to him, that he did not take the trouble of further examining into the book.

Of this neglect, however, he was fully sensible in his riper years, and he very ingenuously expressed his regret to Dr. Pemberton, for his error in applying himself to the works of Des Cartes, and other algebraical authors, before he had considered the Elements of Euclid, with that attention so excellent a writer deserves. Dr. Wallis's treatise more particularly occupied Mr. Newton's mind, and presented him with matter which set his unbounded invention at work, and opened the way to his new method of Infinite Series and Fluxions. In this way was he engaged till the year 1664, when he took the degree of B. A. His attention, about this time, was directed to optics, which produced HIS theory of light and colours. In 1665, on account of the plague, which raged at Cambridge, he was obliged to retire into the Country, where he remained about two years. During this period, however, he was not idle, his genius ever active and enterprising, was not likely to lie dormant. With what effect and success he pursued his studies will hereafter be seen; it is supposed, that it was at this time that he made his famous discovery respecting gravity, by the falling of an apple from a tree. He returned to College in 1667, and was in that year elected a fellow, and admitted to the degree of M. A. In 1669, Dr. Barrow resigned to him the business connected with the professorship of mathematics. As his thoughts had for some time been directed to optics, for the first three years he made them the subject of his Lectures, and in which the discoveries he had made formed the principal features. In the year 1672, Newton was elected a fellow of the Royal Society, and having now brought his theory of light and colours to a very considerable degree of perfection, he made a communication of it to the Society, and it was published in the philosophical transactions for that year. Our author's ideas on this subject were so original and unexpected, that no sooner did they make their appearance than he was assailed by opponents from all quarters; and being of a mild and gentle disposition, averse to the bustle and acrimony of controversy, he made up his mind not any more to publish, and laid by his optical lectures, after having been at the labour of preparing them for the press, and his analysis of infinite series which he intended should have accompanied them. He now turned his endeavours to the perfecting of his reflecting telescope, and so admirably did he succeed, that, though it was but six inches long, he had distinctly seen Jupiter plainly round, with the four satellites then discovered, and Venus horned. At the request of the Royal Society, he sent to them this telescope, together with a description of it, and other particulars, which they published in their transactions, 1672. During the same year, he published at Cambridge, "Bernardi Varenii Geographia generalis in qua affectiones generales Telluris, explicantum, aucta et illustra ab. Isaac Newton." octavo. From this period till 1679, he carried on a correspondence with Mr. Harry Oldenbourg, Secretary of the Royal Society; Mr. John Collins, Mr. John Flamsteed, and Dr. Edmund Halley; which letters contain a variety of curious and useful observations. In the year 1675, Mr. Hook having laid claim to some of his inventions in his theory of light and colours, he asserted his right to them with great spirit and complete success. In the winter between 1676 and 1677, Newton found out the grand proposition, that, by a centripetal force acting reciprocally as the square of the distance, a planet must revolve in an ellipsis about the centre of gravity placed in its lower focus, and with a radius drawn to that centre describe areas in proportion to the times. In the year 1680 a Comet appeared on which he made several observations; for some time he was inclined to believe that it was not one and the same, but two distinct and separate; this opinion was at variance with that held by Mr. Flamsteed; he held that its tail was a thin vapour emitted from the nucleus of the comet, ignited by its proximity to the sun. "And, I suspect," says Sir Isaac, "that the spirit which makes the finest, subtlest, and best part of our air, and which is absolutely necessary and requisite for the life and being of all things, comes from the comet." He also computed that the sun's heat in the comet, for that year, was to his heat with us at midsummer, as 28,000 to one, and the heat of the body of the comet 2000 times greater than that of red hot iron! About this time he received a letter from Mr. Hooke, explaining the nature of the line described by a falling body, supposed to be moving circularly by the diurnal motion of the earth, and perpendicularly by the force of gravity, which led him to enquire anew, what was the real figure in which such a body moved; and this investigation gave rise to his resuming his former thoughts respecting the moon. As Picart had measured a degree of the earth in 1679, by using his measures, he concluded that the moon is retained in her orbit entirely by the attractive force, and, consequently, that this power decreases in proportion of the squares of distance, as he had formerly supposed; upon this principle, he discovered the line described to be an ellipsis having one focus in the centre of the earth; and finding, by this means, that the primary planets really moved in such orbits as Kepler had affirmed, he had the satisfaction to see that this enquiry, which he had undertaken at first from curiosity, was capable of being applied to the most important purposes; a case in no wise singular, as it frequently happens that some of the most beneficial improvements in the arts, conferring or making incalculable benefits, are, to all appearance, the offspring of accident. Upon this he drew up several propositions in reference to his discovery, which he forwarded to the Royal Society, in 1683; these propositions exercised the ingenuity of all the mathematicians, and completely baffled their conceptions as to a correct conclusion; among these was Dr. Halley, who in the year 1684, month of August, made a journey to Cambridge, in order to consult our author, who informed the Doctor that he had completed a proof; this he transmitted in November, in consequence of which he received another visit from the same gentleman, who obtained his consent to have it entered on the register of the Royal Society. After this Sir Isaac was prevailed upon by Doctor Halley, and at the request of the society, to complete his Principia. The third Book of that work, being only a conclusion of some propositions in the first, was then drawn up by him in a popular form, with the intention of its being published in that way: he was, however, convinced that it was best not to let it appear without strict demonstration; at length, in the year 1687, about midsummer, under the care of Dr. Halley, the work was printed with the title of "Philosophiæ naturalis Principia Mathematica," quarto, containing, in the third book, the cometic astronomy he had discovered. The second edition, with many improvements, was published in 1713, quarto, and another still further improved by the author in London, under the care of Dr. H. Pemberton. It also was reprinted at Paris, with voluminous notes, four vols. quarto. Not long before the time when this work first appeared, the privileges and rights of the university of Cambridge were attacked by James the second, who sent down a mandamus to admit a Father Francis, an ignorant fellow, (with no other recommendation than that of being a monk) to the degree of M. A. On this occasion Newton appeared among the most zealous and active defenders of the immunities of that body, and was appointed one of the delegates to the high commission court, where they maintained their cause with such resolute courage, that the King and his advisers thought it most prudent to abandon the affair.

(To be continued.)

MECHANICAL TRIFLING.

Boverick, who made chains "to yoke a flea," must have possessed exquisite patience. Besides a chain of 200 links, with its padlock and key, all weighing together less than the third part of a grain, this indefatigable *minute artificer* was the maker of a landau, which opened and shut by springs; which landau, with six horses harnessed to it, a coachman sitting on the box, with a dog between his legs, four inside and two outside passengers, besides a postillion riding one of the fore horses, was drawn with all the ease and safety imaginable, by a well trained flea! The inventor and executor of this puerile machine, bestowed on it, probably, as much time as would have sufficed to produce Watt's steam engine.

STEAMING VINERIES AND RAISING WATER.

Sir,—I should be much obliged by answers to the following queries:—

First.—Having two vineries which, during the forcing season, I should like to *steam* for the purpose of killing red spiders and promoting vegetation, I beg to know where I can purchase an *air-tight moveable steam kettle* with a *furnace* thereto, for such purpose? *What sized kettle* would be sufficient for a house whose area is *forty feet by fifteen*, so that the steam produced should, at each time of being put in action, saturate the leaf of every plant in the house, and search every corner and crevice of the interior. It would be variously used from one to three days per week, and half an hour at each steaming?

Secondly—From a piece of water on low ground, I wish to raise a continuous stream for six hours per day, by means of pipes, twelve inches diameter, to a height of twelve feet above the level, and to a distance of an hundred yards.—Query, what horse power is required to effect this object?

Thirdly.—From the like piece of water, I should wish to raise a continuous stream for six hours per day, by means of pipes, twelve inches diameter, into a reservoir twenty-five feet above the level, and at the distance of a hundred yards.—Query. By horse mill or steam, what is the power required?

Your obedient humble servant,

QUERRRIS.

TO OUR READERS AND CORRESPONDENTS.

From inattention to the directions transmitted with the drawings illustrative of our first article in this number, on an Improvement in Carriages, our engraver has represented imperfectly in fig. 1, and incorrectly in fig. 2, the manner of affixing the sway-bar to the pole. The mode of connexion, in *both* cases, should be the same, with this single exception, that the pin does not pass through the pole in fig. 2. The reader will please refer to fig. 3 for a full explanation of these particulars.

Communications received from M. H. S.—N. W. S.—Inquisitor—J. S.—A. Mc Kinnon—A Subscriber—J. M. B.—N. H.—Edwin—and M. S.

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Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 168.] SATURDAY, OCTOBER 28, 1826. [Price 3d.

PRACTICAL PERSPECTIVE.

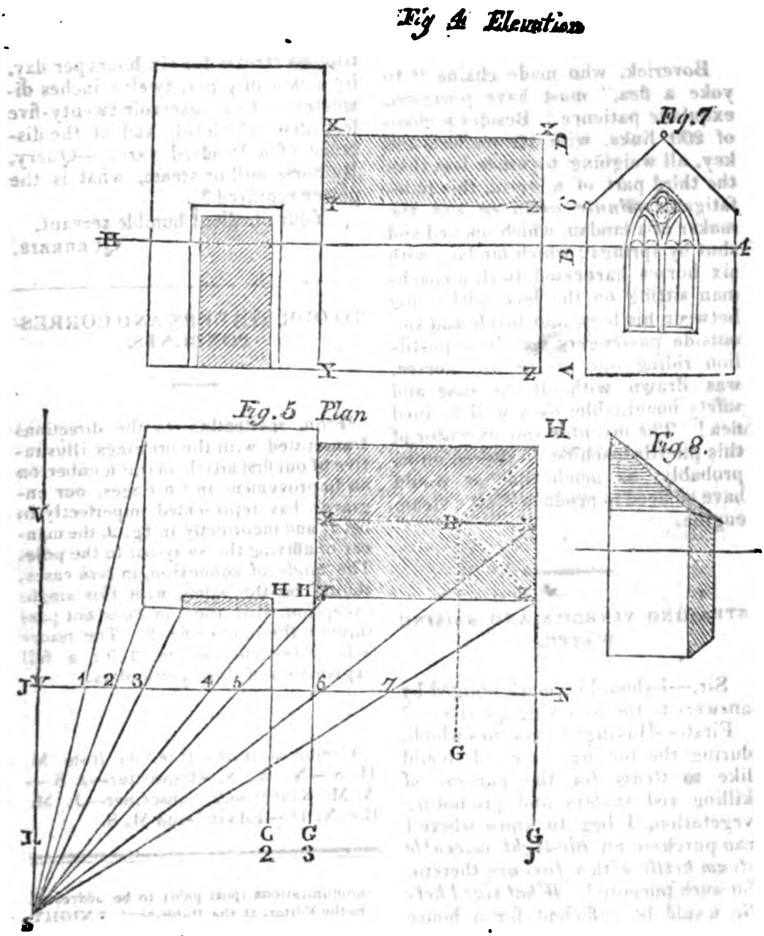

Fig 4 Elevation

Fig. 5 Plan

Fig. 7

Fig. 8.

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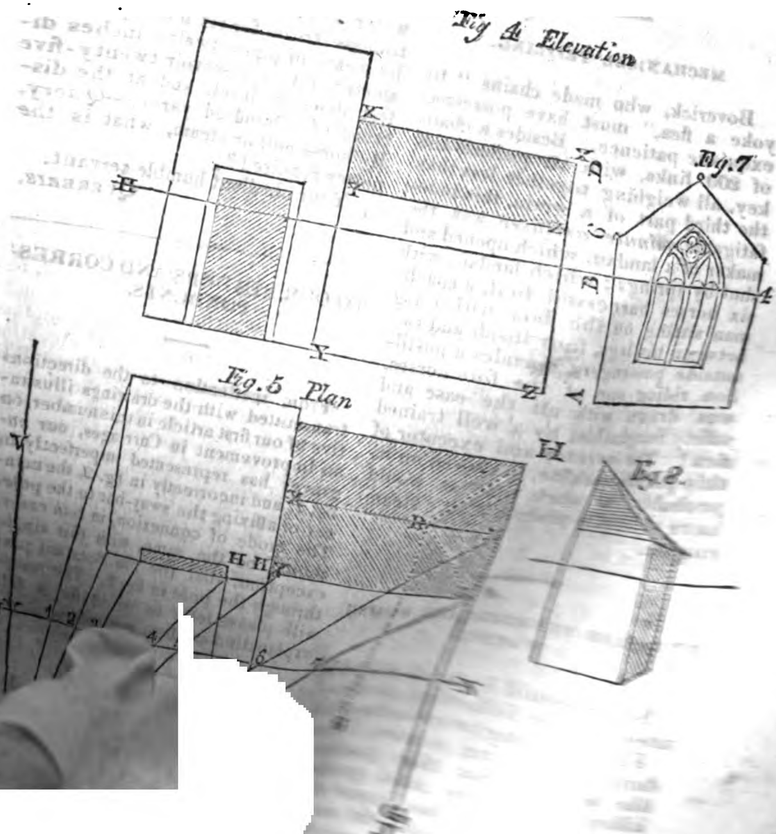
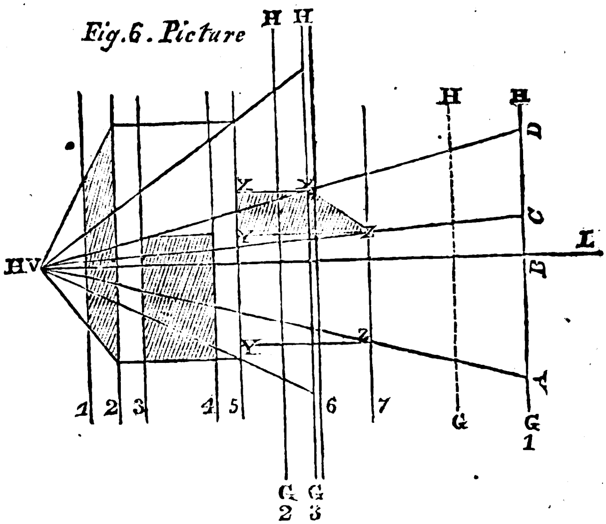


Fig. 6. Picture



PRACTICAL PERSPECTIVE.

(Continued from page 378.)

I shall, according to my promise, devote this letter to explaining the method of cutting off the perpendicular lines representing the heights of the walls, &c. in the picture, in their relative proportions, and, for this purpose, I must direct the attention to

Problem 2.

Figs. 4, 5, 6, 7, and 8.

Required, the elevation and plan being given, to depict the church, fig. 4, in perspective.

The plan, &c. being prepared and the perpendiculars raised, according to the preceding rules, to obtain the height of the wall, Y Z, its representation, must be found on the plan which will be the line Y Z, the width which on the picture, fig. 6, is enclosed between the perpendiculars, 5.7; then draw at right angles, with Y Z, fig. 5, from the end of the wall, Z; the line Z G, cutting I N at E, which, taking the distance between it and the vanishing point, transferred to H L, fig. 6, will give the point through which passes the line of elevation, G H 1, for the wall, Y Z, and also for the roof, XX, as it is gabel ended, fig. 7; had it been hipped, fig. 8, it would, on the plan, have presented another angle R, and the line of elevation would have been the dotted lines, R G, on the plan, and G H on the picture.

Then, from E, fig. 6, set off on the line G H 1, the distances, (from the elevation, fig. 4.) A B, B C, and C D, from which, draw lines to the vanishing point, V, and where they cut the perpendiculars 6, 7, draw the parallels, Y Z,—Y Z for the top and bottom of the walls, and X X for the ridge of the roof, which join by the line, X Z, and X X, ZZ, Y Y, is the true representation of the wall and roof, X X, Z Z, Y Y, in the elevation.

To ascertain the height of the tower and door, draw the lines, G H 2, G H 3, fig. 5 and 6, and proceed as before.

For windows, steeples, or other elevations, however numerous, these methods must be repeated.

For the rules for drawing circles, I must refer my readers to the second division of my subject, Oblique Perspective, which I purpose to commence in my next communication.

DR. CARTWRIGHT'S CLAIM TO THE INVENTION OF THE POWER LOOM.

Sir,—In an account which lately appeared of the power loom, the writer evidently labours under a mistake as to the original invention of that machine. He says, "the first power loom I remember was invented by a Scotsman of the name of Millar, (and not by a brother of Major Cartwright, as a correspondent of the Times has it,) I believe about the year 1795 or 1796; it was rather a clumsy concern, and did not answer the purpose, as was expected; yet there cannot be the smallest doubt that it gave the hint to those which followed. The first really effective I ever saw, was made by Mr. Horrocks of Stockport, in 1801 or 1802; and about the same time Dr. Cartwright tried his hand at improving it. Nobody will deny that Dr. Cartwright was a great mechanic, yet it is equally certain that he did not add any thing essential to the machine." The writer of the foregoing passage may possibly speak to the extent of his knowledge, but if it be suffered to pass unnoticed, the public might reasonably conclude that the friends of the late Dr. Cartwright, who possess the means of tracing the whole progress of his various inventions, were indifferent to his undoubted claim of being the original inventor of the loom for weaving by machinery.

It is a circumstance well known to his family, and within the personal knowledge and recollection of the individual who now addresses you, that the Rev. Edmund Cartwright had applied his mind to the construction of a loom to be worked by machinery as early as the year 1784. In March 1785, he took out a patent for his machine, then brought to some degree of excellence; and in the years 1786, 1787, 1788, and 1790, he also obtained patents for successive improvements therein. He had, in the mean time, established at Doncaster in Yorkshire, a considerable manufactory, worked by a steam engine, where muslins, calicoes, &c. were fabricated by this machine, very little, if at all, inferior to those woven by hand; and this, you will observe, was several years prior to the appearance of Millar's machine, which, clumsy and defective as your correspondent considers it to have been, he *has not the smallest doubt* gave the hint to those which followed.

In the year 1791 or 1792, a person of the name of Grimshaw, made an attempt to introduce Mr. Cartwright's looms at Manchester. He built a manufactory on a large scale, and several of the looms were actually erected, ready for working, when the whole establishment was destroyed by fire. As there was reason to suspect that this was not done by accident, no other manufacturer chose, at that time, to render himself obnoxious by introducing the use of machinery; and Mr. Cartwright's attention being directed to other inventions, from which he expected to derive greater advantage, his machine for weaving remained for some years nearly as much disregarded by himself as it appeared to be neglected by the public.

About the time, however, which your correspondent, whimsically enough, fixes upon for Dr. Cartwright to have *first tried his hand* at improving a weaving machine, that gentleman's original patent rights had expired, and several manufacturers were actually employing his invention with success. During the late war, the demand for English cotton goods had so prodigiously increased, that it was found impossible to supply it without the aid of machinery; and it then appeared that Mr. Cartwright's loom, (admitting that some improvements and modifications might have been supplied in the course of its adoption,) was the machine generally used in the principal manufacturing towns of England and Scotland. This fact had become so well known, that Mr. Cartwright, who had himself experienced nothing but loss and disappointment from inventions that had proved a source of infinite national advantage, was advised by some personal friends, resident in Manchester, as well as by several manufacturers themselves, to apply to government for some remuneration. Accordingly he did petition parliament to that effect, in the year 1808, and again in 1809, in which year a grant of 10,000l. was made to him by the Commons, on his Majesty's account, "for the good service Mr. Cartwright had rendered to the public by his invention of weaving."

In requesting the publication of this statement in your useful and valuable magazine, the writer has no desire to depreciate the ingenuity of other mechanics, or to deny that a more perfect machine may in time supersede the best that has hitherto been constructed; all we contend for is, that the loom invented by Mr. or (as he latterly became,) Dr. Cartwright, was the one in use during the most flourishing period of our manufactures, and that the invention was strictly original in him.

I am, Sir,
Your obedient Servant,
M. S———.

ANOTHER VIEW OF THE RESERVOIR CASE.

Suppose the ends of the reservoir had not been perpendicular, but possessed a declivity equal to that of the sides. What difference would that have occasioned, 1st in the depth left for the second set of labourers? And 2nd, in the total sum received for pumping out the cistern?

H. N.

Mr. A. Mc Kinnon, of Sheffield, has also proposed another view of the case, which we may, probably, hereafter submit to our readers.

A very correct solution, by this gentleman, of the case, as first stated, was received, but not in time to be noticed in our last.

MULTIPLICATION IN ONE LINE.

Rock Life Assurance office,
19th December, 1825.

Sir,—In page 376, of your fourth volume of the Mechanics' Magazine, one of your correspondents, W. W., requests to be informed the mode by which the multiplication of any number of figures, by any number of figures, may be effected in one line.

The following is the plan for multiplying any number of figures, viz.—Let the multiplicand be denoted by A, B, C, D, &c. and the multiplier by a, b, c, d, &c.; then the question will stand thus:—

Multiplier A, B, C, D.
Multiplicand a, b, c, d.

The first figure in the product will be $D\times d$, the unit figure of which must be put down, (as in common multiplication) and the tens figure carried to the multiplication for the second figure, which will be $\overline{d\times C}+\overline{D\times c}$; put down, as before, the unit's figure, and carry the remainder to the multiplication for the third figure in the product, which will be $\overline{B\times d}+\overline{C\times c}+\overline{D\times b}$; the fourth figure will be $\overline{A\times d}+\overline{B\times c}+\overline{C\times c}+\overline{D\times a}$; the fifth figure, $\overline{A\times c}+\overline{B\times b}+\overline{C\times a}$; the sixth figure, $\overline{A\times b}+\overline{B\times a}$; the seventh figure, $A\times a$, the whole of which last product must be put down, and the multiplication is complete. The same rule applies to any number of figures, as it is only necessary to extend the number of single multiplications, as in the above plan, until the whole of the products are brought into one sum; that is to say, the middle figure of the product will consist of the sum of as many single multiplications as there are figures in the multiplicand (where there are the same number of figures in the multiplicand as in the multiplier, as in the above example.)

When the number of figures in the multiplier are less than the number in the multiplicand, the plan will be as below:—

Let the multiplid. A, B, C, D, E, F.
and the multiplier a, b, c, d.

Figs. in the product.

1. $= \overline{d\times F}$
2. $= \overline{d\times E}+\overline{c\times F}$

3. $=\overline{d\times D}+\overline{c\times E}+\overline{b\times F}$
4. $=\overline{d\times C}+\overline{c\times D}+\overline{b\times E}+\overline{a\times F}$
5. $=\overline{d\times B}+\overline{c\times C}+\overline{e\times D}+\overline{a\times E}$
6. $\overline{d\times A}+\overline{c\times B}+\overline{e\times C}+\overline{a\times D}$
7. $=\overline{c\times A}+\overline{b\times B}+\overline{a\times C}$
8. $=\overline{e\times A}+\overline{a\times B}$
9. and last $=\overline{a\times A}$

In each case, of course, the unit figure only being put down, and the tens, &c. carried to the next figure.

To make the plan clearer to those who may not be accustomed to the analytical mode of explanation,

let the multiplicand = 4567
and the multiplier = 2345

Product = 1 0 7 0 9 6 1 5

- 5 = $\overline{5\times7}$ = 35
- 1 = $\overline{5\times6}+\overline{4\times7}$ + 3 = 61
- 6 = $\overline{5\times5}+\overline{4\times6}+\overline{3\times7}$ + 6 = 76
- 9 = $\overline{5\times4}+\overline{4\times5}+\overline{3\times6}+\overline{2\times7}$ + 7 = 79
- 0 = $\overline{4\times4}+\overline{3\times5}+\overline{2\times6}$ + 7 = 50
- 7 = $\overline{3\times4}+\overline{2\times5}$ + 5 = 27
- 0 = 2×4 + 2 = 10
- 1

Some years ago, wishing to ascertain how the above mode of multiplication was to be performed, I analysed a multiplication sum as below, and thence discovered the mode: thus—

678
354

32	= 4×8 for 1st fig.	In the product.
28	= 4×7 for 2nd fig.	
24	= 4×6 for 3rd fig.	
40	= 5×8 for 2nd fig.	
35	= 5×7 for 3rd fig.	
30	= 5×6 for 4th fig.	
24	= 3×8 for 3rd fig.	
21	= 3×7 for 4th fig.	
18	= 3×6 for 5th fig.	

240012

By the above, it is readily seen that, the first figure consists of the product of the two right hand figures; that the second consists of the product of the two right hand figures, diagonal-ways, into the two middle figures; that the third consists of the product of the two right hand figures into the two left hand figures, also diagonal ways, added to the product of the two middle figures; that the fourth figure consists of the product of the two left hand figures, diagonal-ways, into the two middle figures; and that the last figure consists of the product of the two left hand figures; in each case, of course, the units only being put down, and the tens carried to the next operation.

I am, Sir, &c. &c.

H. Hubert, Jun.

[In addition to this communication, which would have been sooner inserted, but that it was accidentally mislaid, we have received similar answers from R. Edwards, J. S., Jack Long; and S.—C W. refers to Walkingham's Tutor's Assistant, p. 162, where the operation is also fully explained.]

CELLAR DRAINING.

Why does Milk extinguish burning Pitch?

Sir,—In the autumn of last year I built a house; it stands upon rather a rising piece of ground, which is very gravelly and spongy at about eight feet below the surface; there is a cellar under the passage or hall, which is eight feet deep, in which a well is sunk, six feet still deeper, making, on the whole, nearly 14 feet to the bottom of the well. Now, in this situation, there is such a rise of water, that it generally overflows, at least a foot deep in the cellar floor, making that place entirely useless. The water cannot be drained off, unless at a very great expense, and an intrusion on neighbouring property. I am about fixing a pump, which I suppose will do something for me, but the water rises so rapidly, that I much fear whether any ordinary quantity, for domestic purposes, will keep it under. My plumber tells me there is a sort of cement which will make the cellar water proof, and that if the bottom and sides, to a certain height, be drawn with it, my purpose will be gained.

Now I wish, through the medium of your ingenious publication, to know whether there is such a cement, and whether it is really found to answer or not; if not, I shall feel myself much obliged to any one who can inform me of the most effectual way, having an eye to economy, to rid myself of so unpleasant a winter companion.

Though quite unconnected with the above subject, can any of your chemical readers say, why skimmed milk should be the most effectual extinguisher of flaming and boiling pitch? Water, it is well-known, when poured in suddenly, is attended with much ebullition and danger, whilst old milk completely deadens the flame as quick as possible.

INQUISITOR.

Lincoln.

[Inquisitor is referred to the letter of a builder, in our present No. on Parker's cement.]

SILVERING WOODEN ORNAMENTS.

Sir,—I should be much obliged to any of your correspondents, that would favour me with the simplest method of silvering small wooden ornaments, and the preparation of the whiting and size. I believe that a red powder is the principal ingredient employed to make the silver adhere to the whiting, without the size generally used. A particular friend of mine is in the habit of doing this, but, as he refuses to give me the receipt, any of your correspondents so doing, will confer a great favour on, an Old Subscriber,

T. D.

Near Golden Square.

INSTRUCTIONS FOR THE USE OF PARKER'S CEMENT, AND REMARKS ON THE ECONOMY OF ITS APPLICATION.

Take a small quantity of the cement, and add as much water as will bring it to the consistence of paste or dough, and make it mix quickly: it will soon set and become hard. If it appears to get hot, and retain its heat for some time, it is good; but if, after setting (for even an indifferent article will set a little,) it soon loses its warmth, and begins to feel damp, it is bad; and if you can easily reduce it to a paste again, it is good for nothing. If you plunge your hand into the middle of the cement in the cask, and if it is good, it will generally feel warm. When exported, it ought to be in sound and good casks, and kept dry and free from air.

To make a good tank, I recommend the following method.—Four inches of the brick-work, at least, should be set in cement, and one good coat laid over the same. The bottom should have an addition to the brick-work, worked in cement to nine inches, and then sound plain tiles should be broken into four pieces, and bedded in cement, with a coat over. Observe, also, not to let the angles be pierced by the workmen's trowels; to prevent which, the writer of this generally orders a little to be put into them, and rounded off.

Cisterns, I recommend to be good thick stone for the front and bottom, and what brick-work is to be cemented, to have plain tiles bedded in cement, and coated over the same as the tank, which prevents, in a great measure, the water oozing through the wall.

To execute in cement or composition an old front, rake out all the decayed mortar, cut away the damaged and decayed bricks, and hack the sound ones, especially if they have been coloured—which must be expected to be the case if they have even stood only forty years. Good cement, and sharp sand, should be used, in about equal quantities—the sand to be well washed; as much may be gagged or mixt, as will ruff in and fill out to about 1¼ yards. The workmen then take a rule, and float off, keeping on till they have done a length or scaffold, and then, after throwing on some water, they add a fine coat, which they well hand-float. After jointing the same, they next mix a little lime and water, which should be passed through a fine sieve; with this they wash the work over, that it may the more easily take the colouring or painting.

As I have gone thus far to describe the quality and working, of what is called Parker's cement, I shall proceed to describe its use, &c. When brick-work has been done from fifty to sixty years, the joints of the same, or, more properly speaking, the mortar, even when pretty well done, begins to decay, and frequently even at an earlier period. The bricks also often require to be repaired and pointed, every fourteen or fifteen years; and after a few more years, you cannot keep out the damps. Now a front can be well done with Parker's cement in the most workman-like manner, and with the best materials, for the price of tuck pointing. It may be objected, that every three or four years it will require colouring, but this is not an expensive job. The interest of the cost of one tuck pointing, will be more than sufficient to compensate that expense. Take care also, to employ a person that will faithfully use the genuine article, for there is much of a spurious and adulterated sort that is vended about; and those who seek cheap jobs, will frequently fly to it, to remunerate them for a low priced contract. When that is the case, a good fresh lime, even of chalk and sharp well-washed sand, would be far better than their spurious cement. It is of importance always, to purchase your cement from a merchant who is not only an honourable one, but who has a quick sale.

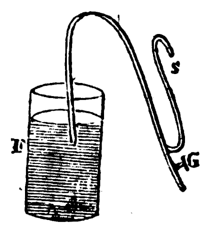
A BUILDER,

Who has not any interest to serve, but as a well wisher to the public.

HYDROSTATICS AND HYDRAULICS, CONTINUED.

Of the Syphon.

The *syphon* is nothing more than a bent tube, having one of its legs longer than the other. The shorter leg is immersed in the fluid contained in a cask or other vessel, when, if by applying the mouth to the lower orifice the air be drawn out of the tube, the water in the vessel will flow off till it be completely emptied. The same thing may be effected in a neater manner, by filling both legs of the syphon with water, and then immersing the shorter one in the fluid. Some syphons are furnished with an extra pipe and stop-cock, as represented in the following figure; by means of which, the air is extracted from the syphon with much greater facility. When the short leg of the syphon is immersed in the fluid, F, and the stop-cock, G, closed, if the mouth be applied to the extremity, S, of the small pipe, and the air withdrawn, the fluid will fill the tube, and on the cock, G, being opened, will issue from the orifice of the longer leg.



It is obvious that the atmosphere, which has a tendency to raise the water in the shorter leg of the syphon, by its pressure on the surface of the water in the vessel, has the same tendency to prevent the water from falling from the orifice of the longer leg, by its pressure there; and therefore, if the legs were of equal length, no water could possibly run out. But when the outer leg is longer than the inner one, the column of fluid which it contains being likewise longer, will, by its superior weight, cause the water to flow from the lower orifice;

and the velocity of the issuing fluid will increase, as the difference between the two legs of the syphon is made greater. To prove this last, take two syphons of the same bore, but the outer leg of the one being considerably longer than that of the other, when it will be found that the same vessel will be emptied by that which has the longest leg, in a much shorter time than it would by the one with the shorter leg. The syphon is the means, by which the deception of Tantalus's cup is produced; but as this is familiar to almost every one, I shall not stop to describe it here. See Mechanic's Magazine, vol. 1, p. 15.

By the principle of the syphon, we may explain *intermitting springs*, or those which at some seasons flow with considerable violence, and at others are perfectly dry. In order to explain them clearly, we must have recourse to the subjoined figures, one of which represents a simple contrivance, by which the principle of them may be explained, and their action seen; and the other, the section of a natural spring.

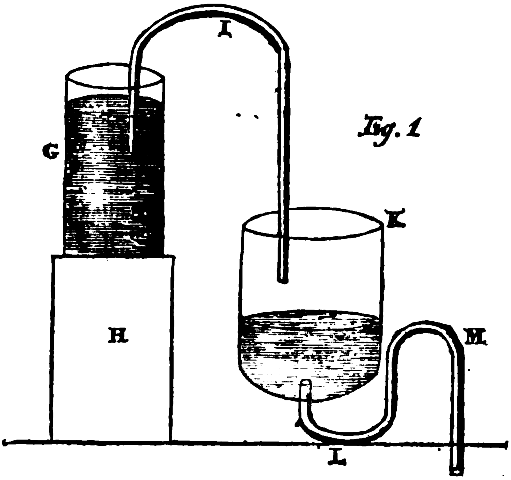


Fig. 1

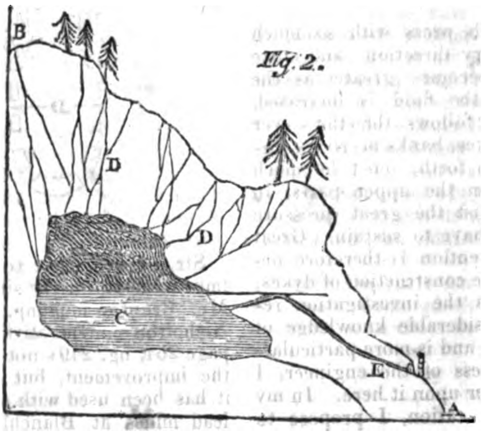


Fig. 2.

In fig. 1, G represents a vessel of water, supported on the stand, H; I is a syphon of small bore, slowly conducting the water from G into K, into the bottom of which is fixed the bent syphon, L M, of a much larger bore than I. When the water in the vessel, K, has reached the level, M, of the bend of the syphon, L M, it is discharged with great rapidity, and the stream stops of course, when the vessel is empty. It will not flow again till the water reaches the level as before, when it will be again discharged; and so it will continue, alternately flowing and stopping, till the water in G is exhausted.

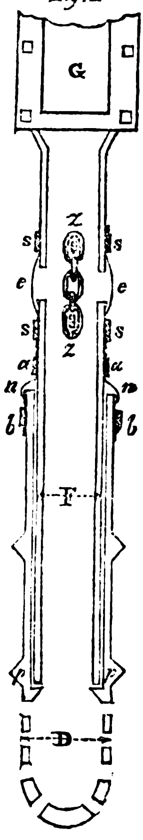
In fig. 2, A B is the side of a hill; C is a cavity in the rock, and D D, numerous small fissures, through which the water gradually percolates into C. When the water in the cavity has reached the level of the top of the syphon-formed crack, E, it is rapidly carried off through E, which does not cease running till the cavity is nearly emptied. In course of time, the water again accumulates in C, and when it reaches the level of the top of the channel, E, is again conveyed through it with considerable velocity. The connexion between the two figures is easily perceived. The syphon, I, represents the fissures, D D, gradually depositing the water in the vessel, K, which corresponds with the cavity, C; and the larger syphon, L M, represents the channel, E, which rapidly carries off the accumulated water.

Since fluids press with so much force in every direction, and since that force becomes greater as the altitude of the fluid is increased, it necessarily follows, that the lower parts of dykes, banks of rivers, canals, and so forth, must be much stronger than the upper parts, in order to resist the great pressure which they have to sustain. Great care and attention is therefore necessary in the construction of dykes, &c.; but as the investigation requires a considerable knowledge of mathematics, and is more particularly the business of the engineer, I shall not enter upon it here. In my next communication, I propose to treat of specific gravity generally, and the method of ascertaining the specific gravity of solids and fluids.

J. M. N.

IMPROVEMENT IN BRUNTON'S PUMP.

Fig. 1



Sir,—I beg leave to hand you an improvement on the sinking part of Mr. Brunton's pump, taken from Nicholson's Operative Mechanic, page 264, fig. 249: not that I claim the improvement, but knowing that it has been used with success in the lead mines at Blanchland, in the county of Durham, and also in some of the lead mines at Alston Moor, in Cumberland.

Mr. Brunton's pump is supposed to be placed in the centre of the pit or shaft, and that the snorehole, or bottom piece, radiates the bottom of the pit as the sinkers proceed; but it often happens, the pumps are not placed in the centre, and, in that case, Mr. B.'s pump would only radiate a part of the shaft. Should the pumps be placed at some distance off the centre of the pit, by this improvement, there is no occasion to throw the whole stand of pumps out of the plumb line, so as to place the snorehole or bottom piece, in the deepest part of the water in time of sinking.

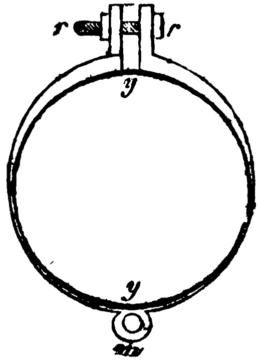
As an explanation of the drawing will shew the improvement more explicitly, I will here give it:—

Explanation.

Fig 1, is an upright section of the pump; G represents the bucket door, or clack-seat piece, without a flange at bottom; F is a pipe of the same diameter as the pipe G; these two pipes are connected together with a piece of short-linked coil chain, bearing on two iron bars, put through the two pumps at Z, Z. The space betwixt the ends of these two pipes, is closed by a leather hose, *e*, *e*, screwed to each pipe, with two screw hoops at S, S, S, S. This leather hose being made fully at *e*, *e*, so as to allow the pipes, F and D, to move to any side without endangering or bursting it. The pipe, D, is hung to the pipe, F, by a leather hose of double thickness, at *n*, *n*, screwed to the pipe, F, at *a*, *a*, and also to the pipe, D, at *b*, *b*. As the pit is sunk, the snorehole piece is allowed to slide down the pipe, F, by unscrewing or slackening the hoop, *a*, *a*, and as the sinkers proceed in the pit, the snorehole piece can be moved and placed in the deepest water; *p*, *p*, snugs to throw off the shot.

Fig. 2, is a plan of the screw hoop, with its joint, *m*, and screw, *r*, *r*. The hoops should have two iron plates, *y*, *y*, thinned at each end, to prevent the leather hose from puckering or cramping, as the hoops are screwed tight.

Fig. 2.



I should be very glad if the above meet the eye of any of the ingenious engine wrights, employed in the collieries in the neighbourhood of Newcastle upon Tyne, and to hear from them, through your valuable magazine, if they have either used this improved sinking pump, or that they approve of its utility.

I am,
Your obedient servant,
A constant subscriber,
Z. Y. X.

FASHION AND POTATOES.

The influence of authority and fashion, in human affairs, is well exemplified in the history of the common potatoe. The introduction of this valuable plant into France, received, for more than two centuries, an unexampled opposition from vulgar prejudice, which all the philosophy of the age was unable to dissipate. At length Louis XV. wore a bunch of the flowers of the potatoe in the midst of his court on a day of festivity, and the people then, for the first time, obsequiously acknowledged its utility, and began to express their astonishment at the apathy which had so long prevailed with regard to its general cultivation.

SIR ISAAC NEWTON.

(Concluded from p. 400, No. 165.)

Our author was chosen one of the representatives of the convention parliament in 1688, the sessions of which he attended till its dissolution. In the same assembly sat Mr. Charles Montague, afterwards Earl of Hallifax, who had been the college companion of Newton, and was well acquainted with his abilities and merit. That gentleman having been appointed chancellor of the exchequer, undertook the great work of recoining the money of the realm, and knowing no person so well qualified to surmount the difficulties of the undertaking as our author, obtained for him, 1696, the office of warden of the mint. In this situation, which he filled with honor to himself and benefit to the nation, he rendered services so important, that in the course of three years after, he was rewarded with the more responsible and profitable appointment of master to the mint, a place worth then from 12 to 1500*l.* a year, and which he held during the remainder of his life. Upon his promotion to this place, he appointed Mr. William Whiston, of Clare Hall, his deputy in the mathematical chair at Cambridge, allowing him the entire profits accruing from it: and about four years afterwards he procured him the honour to be his successor in that post. In 1699, the Royal Academy of Paris having adopted a new regulation for the admitting of foreign members, Newton was immediately chosen one; and in 1703, he was elected president of the Royal Society, and retained that honourable station till the time of his death. In 1704, Newton published his "Optics, or a Treatise of the reflections, refractions, inflections, and colours of light," London. quarto. This work is the result of his occasional labours for thirty years, in bringing to perfection the experiments on which his "new theory of light and colours" is founded; and they were made with a nicety and precision which alone could satisfy HIS mind; this theory seems to have been his favourite invention. In his speculations concerning infinite series and fluxions, and the power and rule of gravity in preserving the solar system, there had been some, though obscure hints, given by others preceding him; but he was without dispute the first person who conceived the idea and engaged in the subtle and delicate study of the anatomy of light; who dissected a ray of light into its primary constituent particles, which then allowed of no farther separations; who discovered the different refrangibility of the various particles thus separated, and that these constituent rays had each a particular colour inherent to it; who shewed that rays falling in the same angle of incidence have alternate fits of reflection and refraction, that bodies are rendered transparent by the minuteness of their pores, and opaque by their largeness, and that the most transparent body, by having a great thinness, will become less pervious to the light.

His assiduous attention had not however all this time been alone occupied by this subject; on the contrary, it seemed to embrace in its ramifications all that we know of natural bodies; he discovered that, at a distance, there was a mutual action between light and other bodies, by which all the various changes of the former were produced. To ascertain the true state of this action was what he had all along been trying to discover, but, after all, by its extreme subtilty, it escaped even *his* most penetrating spirit. He has, however, furnished sufficient matter for those who may hereafter engage in the pursuit of this object.

Dr. Samuel Clarke, with the approval of Newton, translated his optics into Latin, and he was so pleased with the correctness and elegance of the performance, that he made the Doctor a present of 500*l.*, or 100*l.* to each of his children. It was published at London, 1706, quarto. A translation of it in French, by Peter Caste, was also published at Amsterdam, 1720, 2 vols. 12mo., and reprinted at Paris, 1720.

In the year 1705, Queen Anne, influenced by this extraordinary merit of this great man, conferred on him the honour of knighthood.

Two years subsequent, Whiston, by our author's permission, published his algebraical lectures, under the title of *Arithmetica Universalis sive de Compositione et Resolutione Arithmeticæ Liber.* octavo, which book was turned into English by Mr. Raphson. A second edition, with improvements by the author, having been printed under the superintendence of Mr. Machin, Secretary to the Royal Society, the translation by Mr. Raphson was revised and corrected by Mr. Curm, and an improved edition of it, illustrated with notes, was published by Dr. Wilder, of Trinity College, Dublin, in 1769, in two octavo volumes; a Latin edition of the work, with remarks by Castilion, afterwards made its appearance at Amsterdam, in 2 volumes quarto. In the year 1711, our author's *Analysis per Quantitatum Series Fluxiones et Differentias cum Enumeratione Linearum tertii ordinis*, was published at London, in quarto, by William Jones, Esq. F. R. S. who met with a copy of the first of these pieces among the papers of Mr. John Collins, to whom (as it has already been shown) it had been communicated by Dr. Barrow. It was inserted in consequence of the controversy relating to the invention of fluxions, which also gave occasion to the printing, in 1722, by consent of Sir Isaac, of a collection of Letters by him and others under the title of *Commercium Epistolicum. D. Johannis Collins, et aliorum de analysi promota jussu Societatis Regiæ in Lucum editum.*

In the year 1714, the honourable House of Commons having appointed a committee to consider the petition of Messrs. Ditton and Whiston, for encouragement to a new way by which they proposed to discover the longitude at sea by signals, Sir Isaac was applied to for his advice, and the committee, after having received his written opinion, thought proper to reject the petition. In the following year, Mr. Leibnitz, with the object of gaining credit to the pretensions that the method of fluxions had been borrowed from him, attempted to baffle Sir Isaac's skill by his famous problem of *trajectories;* it however proved but a matter of amusement to Sir Isaac; at the time he received it, which was about four o'clock in the afternoon, when returning from the mint, and fatigued with the business of the day, he sat down to study it, and finished a solution before he retired to rest, although it was the most intricate problem the ingenuity of the proposer could invent.

Upon the accession of George 1st. to the throne of England, Sir Isaac was by that prince particularly noticed, and it was at the desire of this illustrious individual that Sir Isaac gave a finishing hand to the fluxion controversy. Queen Caroline, who delighted in the conversation of learned and intelligent men, took particular pleasure in that of Newton, and she often publicly declared, "that she thought herself happy in coming into the world at a juncture of time which put it in her power to converse with Sir Isaac Newton."

At her solicitation he drew up an abstract of his Chronology, and imparted a copy of it to the Abbe Conti, a Venetian nobleman, then in England, upon an assurance of secresy. But this Abbe, who had professed a high regard for Sir Isaac, on his return to the continent, very dishonourably did him all the injury he could, by distributing several copies of it; and by procuring a person, not only to translate it into French, but to attempt a confutation of it. This version was printed at Paris, in 1725, and a copy of it, without the commentary, under the title of "*Abrege de Chronologie de M. le Chevalier Newton, fait par lui même et traduit, sur le Manuscript Anglois,*" was forwarded to Sir Isaac by the publisher, under the pretence of asking his consent to the publication; but though a direct and positive refusal was given, yet the whole of the work appeared the same year. Upon this he promptly entered into a defence of himself, which was published in the Philosophical Transactions, vol. 34, under the head of Remarks upon the observations made upon a Chronological Index of Sir Isaac Newton's, translated into French: and published at Paris. A translation of this paper appeared in the French capital, with a letter of the Abbe Conti in answer thereto.

Our incomparable philosopher had ever enjoyed a regular state of health, until he attained his 80th year, when he became subject to a retention of urine, which was thought to be occasioned by a stone in the bladder, and was considered incurable. However, by observing a strict and regular regimen, he obtained considerable intervals of ease, although, at times, the paroxysms of pain were so violent, as to occasion the sweat to pour off his face; but such was his patience, that he was never heard to utter a complaint: and as soon as he had a moment's relief, he would smile and converse with the utmost cheerfulness. It is

thus, * * * *

He whose vast capacious mind, explores,
All nature's scenes, and nature's God adores
* * *
Expels, with skilful hand the young disease,
And softens anguish to the smile of ease.

CAWTHORN.

Till this time, he had studied and continued his attendance on business without interruption; but now he was rendered incapable of so doing, and was obliged to trust the performance of his duties at the Mint, to his nephew, Mr. Conduit. On the morning of the 18th of March, 1726-7, he read the newspapers, and conversed with his physician, Dr. Mead, having then the perfect use of his senses; but he was eventually deprived of them in the course of the next evening, and he breathed his last on the 20th of the same month, aged 85 years.

The last honors paid to the remains of this wonderful man, were such as became his exalted merit, and that high estimation in which he was held by all the learned and the great of Europe. His body lay in state in the Jerusalem Chamber, adjoining the House of Lords; and, on the 28th of March, was conveyed to the Westminter Abbey, the Lord Chancellor, the dukes of Montrose and Roxburgh, and the earls of Pembroke, Sussex, and Macclesfield, bearing the pall. He was interred at the entrance of the choir, on the left hand, where a stately monument, with a most elegant inscription on it, was raised to his memory.

This ornament to science, and the pride of his native land, was in his person of a middle stature, and, in the latter part of his days, inclined to be corpulent. His countenance was pleasing and venerable at the same time, especially when he took off his peruke and showed his white hair, which was pretty thick. He never used spectacles, and lost but one tooth during the whole of his long life. His character has been drawn by Dr. Pemberton, Fontenelle, and others. He had a very modest opinion of his own abilities, and when a friend of his had been saying some very handsome things of his wonderful talents, he very unaffectedly assured him, that if he had done any thing worthy of notice, and of service to the world, it was owing to his patience of thought and industry, rather than to any particular sagacity. He was, when engaged on any particular problem, so engrossed with it as entirely to neglect his meals; his temper was remarkably mild and equal, so that any accident, however provoking and aggravating, could scarcely disturb its serenity. One particular instance exhibits his equanimity in a striking light. He had a favourite little dog, named Diamond, which, one day, was left in his study, when he had been called into an adjoining room. Upon his return he had the mortification to find that Diamond had overthrown a lighted taper among some papers, containing the nearly finished labours of many years, by which means they were set on fire and nearly consumed. This loss, as it took place when Newton was far advanced in life, was irretrievable, yet instead of venting his resentment on the author of this mischief, he only rebuked him with this exclamation,—"O Diamond, Diamond, thou little knowest the mischief thou hast done." In his religious sentiments, he was a firm believer in the truth of divine revelation, and a serious christian. His discourses concerning the formation of the universe, he employed to demonstrate the being of God, in opposition to every kind of Atheism. He adhered to the communion of the church of England, but detested and held in abhorrence all kinds of intolerance towards nonconformists. In his disposition he was very humane, never allowing animals to be slowly put to death, for the sake of delicacy, nor could he eat those which had been reared in the family, but with the greatest repugnance.

Several works of his composition have been printed since his death, under the superintendance of various eminent men.

MATHEMATICS PRACTICALLY APPLIED TO THE USEFUL AND FINE ARTS.

By Baron Charles Dupin. Adapted to the state of the Arts in England by Dr. Birkbeck.

(Concluded from our last.)

The matters demonstrated are of course not always so self-evident as that one right line is not two right lines, or so simple as the mode of drawing a straight line with a ruler and pen; but in a greater or lesser degree the disposition to embarrass plain truths by mere verbiage is every where but too manifest.

We are well aware that it is by beginning with the simplest demonstrations that the scholar is best conducted to the more recondite truths of geometry. But the sort of demonstrations to which we object are those which give no help whatever to the scholar; which make the matters treated of neither more plain nor more certain than they were before; and which only serve to bewilder, instead of enlightening the understanding. Thus we have in one instance nearly a page, (21) with a diagram to boot, occupied in demonstrating an axiom the truth of which it does require some little, *but so very little*, reflection to perceive, that it obtains almost the instantaneous assent of the mind, namely, *that two straight lines which are at an equal distance from each other, are at an equal distance at every point*. And then we are told, (p. 22,) that "this equality of distance in all their points, presented by parallel lines when they approach to or recede from each other, is of considerable importance to mechanics." "For *example*, it is *applied* to the movements of jennies and mules for making cotton thread, to printing, to engraving, to rail roads, to the movement of drawers in their respective frames, to the movement of pistons in pumps," &c. According to which mode of shewing "mathematics practically applied," the author might with equal propriety have added, that it is also by studying this *remarkable* property of parallel straight lines that the tailor makes the button suit to the button hole, (each point in the outline of the button describing, *like the piston*, a right line parallel to the axis of the button hole,) or that any other workman makes any thing else straight and fitting. However learned-like this style of demonstration may be, it seems to us to be at variance with every common-sense view of the subject. The utmost that can with truth or reason be said of such *examples*, as are here given, is, that they *exemplify* what parallel lines are; not that they show how the properties of parallel lines may be *applied*. To talk of *applying* geometrical properties in this way, is as much as to affirm (which would be absurd,) that such properties exist *independent* of the corporeal forms in which they are exhibited. Parallelism, like hardness or softness, is but a quality of objects. Every person who has ever tried to fit any article depending on "the equality of parallels comprised within parallels," from a piston to a coat button, must be fully aware of the importance of observing exactness in that equality; but though you were to multiply a thousand fold, the instances which M. Dupin has given of such parallelism, you would not make any one a whit the wiser, or, to speak practically, more adroit in the production of parallels. A botcher would still be a botcher, notwithstanding all your instances.

The manner in which mathematics may be here "practically applied" to the aid of the workman is simply this: show him how he can test or prove the parallelism of his lines, and you will do all that mathematics can do for him.

Perhaps the importance of such parallelism might be beneficially enforced by some considerations on the effect which symmetry has on our ideas of the beautiful in art. A lesson on this head would have been more to the purpose, at least, than the many instances *to no purpose*, which crowd the pages of M. Dupin and his English adapter.

We should be doing an injustice to these gentlemen, however, were we to leave it to be supposed that, amidst all the superfluous display in which they have indulged, they have not interwoven much of both apt and useful instruction. We know not, indeed, that they have *omitted* any thing that is necessary to a proper understanding of the subjects treated of. It is with their exclusive pretensions to usefulness only that we have here to find fault. While we readily admit that in the specimen before us, they have done all that is needful to make the reader acquainted with the properties of lines, angles, &c. we feel that we should be complimenting them at the expense of truth and candour, (a sort of compliment for which they have no occasion,) were we to allow that they have done this either better, or indeed as well, as others who have preceded them. Dr. Birkbeck speaks of "the admirable specimen which has *at length* been furnished by the celebrated Baron Dupin," as if nothing, at all like it, had ever before been seen. Now, on comparing the 32 pages of the "admirable specimen" which are now before us, with the 10 pages of Dr. Gregory's "Mathematics for Practical Men," which comprehend the section of "Practical Geometry," we can discover no difference between them but what is decidedly to the advantage of the latter. While in the English specimen, we have briefly all that is required and no more; we have in the French all that is required and a hundred things beside. It is "the sterling bullion of one English line," lengthened once more into furlongs of French tinsel.

Nor is Dr. Gregory the only writer whom M. Dupin has for a competitor in this branch of his labours. We need scarcely remind our readers of the excellent essays on "Mechanical Geometry" which appeared in the Mechanics' Magazine some time since from the pen of our ingenious correspondent G. A. S. Nobody who has studied these well can have much to learn from the lessons of M. Dupin on the same subject.* There is also an edition of Euclid by Mr. Wallace, of Glasgow, which we have been informed is extremely well illustrated by practical applications; but this we have not ourselves seen.

The diffuseness of which we complain, in the lessons of Messrs. Dupin and Birkbeck, is objectionable, not merely on account of its bad taste and inutility, but on account of the additional and unnecessary tax which it tends to impose on the pockets of their readers. We learn from the cover of the number before us, that "the original work forms three volumes," which it is proposed to re-publish here at 12s. each, or 36s. for the whole. Now, judging from the specimen before us, we will venture to say, that all that is really useful, in M. Dupin's Lectures, (to English readers at least) might be comprehended in a third of the space, and published at a third of the price. Dr. Gregory's book costs 1's. and it includes, substantially, all we are given to expect from M. Dupin and Dr. Birkbeck, for 36s. Even 14s. is too large a sum for a humble mechanic to spare easily, out of his earnings; and, though we will not say that a large original volume, like Dr. Gregory's, so closely printed, and so abundantly illustrated by engravings, could well be furnished for a less sum, yet we cannot conceal from ourselves, that before scientific knowledge can be as extensively diffused among our operatives, as the friends of improvement desire, something cheaper still, or at least better adapted (by publication in parts or numbers,) to the convenience of persons of small incomes, must be provided.

We apprehend, that neither 14 nor 36 shilling books, were the sort of works that Mr. Brougham had in his eye, when, in his practical "Observations upon the Education of the People," he spoke of the "essential service" which would be rendered by "the composition of elementary treatises on the mathematics," &c. and, we feel well assured, that if book speculators would but join a little more of real philanthropy with their projects of individual gain, and not grudge, (as we know some of them do,) the extra trouble which attends receiving money in many small sums instead of a few large ones, they would find, in a vast increase of purchasers, an abundant recompense for bringing works of art and science, more than they at present are, within the reach of every class of the community.

* The author intends, we believe, to print them in a separate form. He will confer a public service by so doing.

CLOCK-WORK.

Sir,—I think the following question would meet with the approbation of the intelligent clock-makers, and quite appropriate to the Mechanics' Magazine. The insertion of it will much oblige your respectful,

Humble servant,
FELIX FORD.

October 18, 1826.

There is a spring-clock, whose

great wheel has ninety-six teeth, on the arbor of which is the fusee. This great wheel drives a pinion of eight, on the arbor of the centre wheel, of eighty-four teeth, which turns round once in an hour. This centre wheel, of eighty-four teeth, drives a pinion of six, on the arbor of a contrate wheel, of seventy-two teeth, which drives a pinion of six, on the arbor of the balance-wheel, of twenty-seven teeth, moving parallel to the horizon. From these data, it is required to find the length of a new pendulum to this clock, the former being, by some accident, lost. Also, to find how many rounds the fusee must exactly make in seven days?

P.S. On page 110 of the first vol. of this Magazine, there are directions for killing cockroaches, which are there asserted to be infallible. Now, the fact is, those directions are a most palpable hoax on the public, by the author of them. F. F.

CASE IN EMERSON'S TRIGONOMETRY.

Sir,—Living in the country, at a considerable distance from town, I contrive to have several numbers of the Mechanics' Magazine sent me at once, having begun with the first number. This will account for the lateness of my noticing Academicus's kind communication, relative to the obscure case in Mr. Emerson's Trigonometry, which you were good enough to state for me, for explanation, on page 164, vol. 5. Although Academicus has given a very satisfactory demonstration of the proposition itself, on true geometrical principles, for which I tender him my best acknowledgments, yet this is not the sort of elucidation of the case I wished to have. What I wish to have shewn is, algebraically, how the secant of A is equal to the tangent of A + tang. ½ complement of A, when A is equal to a given arch. T its tangent, S its secant, $a =$ complement, and t its tangent. These substitutions being made, Mr. Emerson refers to Scholium, pr. II. of his Trigonometry, whence he deduces $S = \frac{r^2+t^2}{2t}$ and $T = \frac{r^2-t^2}{2t}$, and $S-T=t$. Now these expressions, in the first place, I would wish to have elucidated; then to proceed to shew how the secant of A is found, as before asserted. My sole object is to follow exactly the author, Mr. Emerson, in his analytical method, though I must confess, and so must the skilful geometer confess, it would be next to impossible to demonstrate the proposition itself more elegantly, and on fewer distinct principles, than Academicus has done.

Your's, to serve,
FELIX FORD.

October 20th, 1826.

DIMINUTION OF SPIRITS AND WATER IN BULK WHEN MIXED.

Sir,—Dip-Stick, the gauger, says that 30 gallons of water added to 90 gallons of strong rum, will not fill a 120 gallon cask. I wish some of your intelligent correspondents would satisfy me as to the truth of Mr. Dip-Stick's statement.

I am, &c.
LION.

Exeter Mechanics' Institution.

NOTICES TO CORRESPONDENTS.

J. M. B.'s vindication of "gratuitous lecturing," in our next.

H. H. shall have an early place.

Communications received from G. S. —J. M.—F. F—S–i–a—A. M.—A Young Country Painter—Julius—W. K. M.—H—— y D.—Mr. Jones—A. Cook—A. M. Z.—Pneuma—Mr. Burns —Miss S. P.—M. M.—Imitator.

ERRATUM—Page 390, col. 1, second line from the bottom, for "in *right* angled triangles," read "in *similar right* angled triangles."

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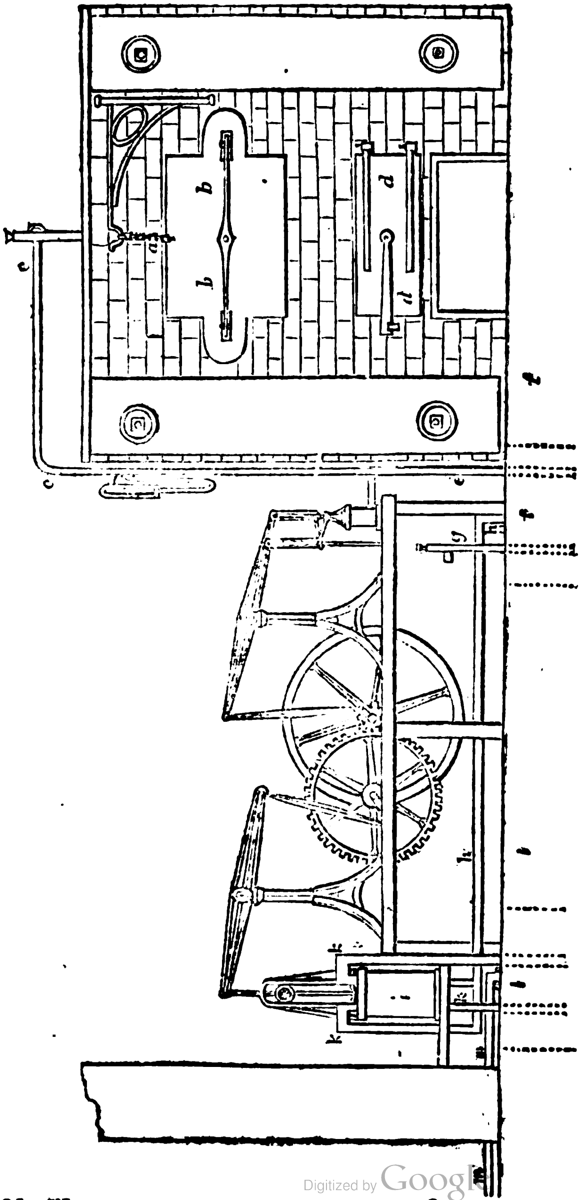
GAS GENERATING AND PURIFYING PROCESS.



BROADMEADOW'S GAS GENERATING AND PURIFYING PROCESS.

The principal features in Mr. Broadmeadow's invention consist; first, in substituting brick ovens for iron retorts; secondly, in exhausting the ovens and condenser of the gas generated, by the application of cylinders; and thirdly, in purifying the gas, so generated, either wholly or partially, by admitting into the gasometer a certain portion of atmospheric air.

One mode of effecting these purposes, will be fully understood, by reference to the prefixed engraving.

a, is an oven.

The size and number of the ovens need not be restricted; but may be varied as circumstances may demand.

b, *b*. The oven door.

d, *d*. Door of the fire-grate.

e, *e*, *e*. A Pipe, through which the gas is conveyed from the oven to the condenser.

f. The condenser, into which a small hand-pump, *g*, is inserted to draw off the coal-tar.

h, *h*, *h*. A pipe, through which the gas passes from the condenser, *f*, into the exhausting cylinder, *i*.

The piston of this exhausting cylinder receives its motion from a small steam engine, or other mechanical power. The engine is supplied with steam from a boiler fixed on the flue, and heated by the waste fire of the furnace.

k, *k*. Two pipes; one leading from the top, and one from the bottom of the exhausting cylinder, to the purifier, *l*.

m, *m*. An outlet pipe, to convey the gas from the purifier *l*, into the gasometer.

The advantages to be derived from the adoption of this patent process, of generating and purifying gas, are thus detailed by the patentee.

"In the erection of works, on the ordinary plan, one of the principal items of charge, is that for iron retorts, together with the hydraulic main, and other necessary connexions; and in conducting works on the same principle, an enormous expense is annually incurred, by the oxydizing or burning away of the retorts. Indeed, the oxydation of the retorts is so rapid, that, however the time of their duration may vary, from difference in the quality of the iron, or mode of constructing the furnace, they cannot withstand, on an average, more than eight or nine months' exposure to the fire.

"In the patent process, no retorts are used; but ovens constructed of brick, &c. Consequently, the cost of first erection, and the subsequent annual charge for wear and tear, is greatly diminished.

"The ovens, it must be confessed, are also subject to wear and tear; but the expenses thus incurred, are, comparatively speaking, too trivial to deserve mention. For, at works erected on this principle at Abergavenny, an oven, which has for the last two years been in constant use, is apparently none the worse for wear; and a less sum than twenty shillings each, per annum, is found adequate to keep them in repair.

"As each of these ovens contains a charge equal to about six full-sized iron retorts, and requires to be charged but once in twenty-four hours, there is not only a saving in the cost of first erection, and annually in the expenditure for wear and tear, but also daily in the time and labour usually expended in the drawing of the charges, and in re-charging.

"The next improvement, and which has been already stated, as one of the principal features in Mr. Broadmeadow's invention, is that of his patent application of an exhausting cylinder, or other apparatus, to exhaust the gas from the condenser, thereby causing a partial vacuum, and enabling the gas to flow from the ovens into the condenser as fast as it is generated. By means of this exhausting cylinder, a portion of atmospheric air, equal to about one part to eight parts of gas, is admitted into the gasometer; which process, however contrary it may appear to those practised in the common mode of gas-making, is decidedly beneficial. For, the oxygen of the atmosphere mixing with the sulphuretted hydrogen, precipitates the sulphur, and gives to the lighted gas a much greater degree of brilliancy. This mode of purifying is, indeed, so proper, that when the coal used is of good quality, no other purifying process is required. As the admission of too great a portion of atmospheric air would prove injurious, the requisite speed at which the exhauster should be worked, is shewn by a water-gauge.

"The advantages to be derived from the adoption of this patent process are; first, *the cost of erection* of works on this principle is, at the least, one-third less than on any other; second, the annual outgoing for the *wear and tear of retorts* is entirely obviated; third, the gas is improved and much more *effectually purified*; fourth, the *coke* from the coal being carbonized in larger quantities, is of a *very superior quality*; and is now selling at stations, on this principle, at the best market prices, which, hitherto, has never been obtained by gas-coke made in the ordinary way; and fifth, the *amount of fuel* required to carbonize a given quantity of coal is diminished, insomuch, as the removal of the pressure from the inside of the generator, is well known to aid in all distillatory processes."

SQUARING OF FRACTIONS.

Sir,—As it may at first appear rather extraordinary that the square of a fraction should be another fraction, smaller than the original fraction itself, I trust you will insert the following attempt to prove that the squares of fractions are generated in the same manner as in whole numbers. It may interest the junior readers of your Magazine.

If it appears unnatural that ½ squared, produces ¼, that is, that the square of a fraction is less than the fraction itself, let us suppose the fraction ½ to represent ½ a foot, then ½ squared produces ¼; but 6 inches squared, produces 36 inches. But, if it be considered that ½ a foot in length being squared produces ¼ of a *square* foot (144 inches,) for the foot is squared as well as the fraction, it will, when squared, give the same result as the 6 inches. Again, it will be more clear, if you use an algebraical symbol; thus,

put $a = 1$ foot,
— $b = 1$ inch,

Then ½ of a, or $\frac{1a}{2}$ squared, is $\frac{1^2 a^2}{4}$. But $1^2 a^2 = a^2$. Now, therefore, $a^2 = 12^2 b^2 = 144 b^2$. Then $\frac{a^2}{4} = \frac{144 b^2}{4}$, or ¼ of $a^2 = 36 b^2$. Or again, ¼ of a square foot = 36 square inches.

I remain, Sir,
Your constant Subscriber,
H——Y D.

79, Gower Street.

GRATUITOUS LECTURING.

Sir,—I think the letter in your last, of your correspondent, Trebor Valentine, is to be considered as an attack upon "gratuitous lecturing," rather than for the mere purpose of letting you know, that the members of the Derby Mechanics' Institution had acted prodigally, in acknowledging the favours of their worthy lecturer. For my part, I cannot perceive in what manner the question can be affected by this particular instance. Does it not show that, instead of producing servility, gratuitous lectures call into action, gratitude on the one side, and respect and esteem on the other, without one feeling of obligation, or the slightest sacrifice of independence? I may be allowed to quote the words of Pope in this case, as quite applicable. "We are each of us so civil and *obliging*, that neither thinks he is *obliged*."

The only objection raised against mechanics receiving gratuitous lectures is, that it affects their independence. How this can be, has never been proved by facts, nor supported by argument, and exhibits a vast deal more of pride than sense; it is a position quite untenable, which I shall shortly endeavour to prove.

It will, I think, be allowed, that a person who offers his services without fee to a Mechanics' Institution, is a friend, and that he considers those to whom he offers them, as his friends. In that case, how can it be regarded as an obligation which will bind those who receive it, to feel any thing approaching servility? If a friend makes me a present, I do not thereby, surrender to him my independence. It lays me under an obligation to him which is just as agreeable to my feelings to accept as it is to pay. At the most, it lays the members under a feeling of gratitude to him, who, to instruct and edify them, sacrifices his time, and exerts his talents.

A grateful mind
By owing owes not, but still pays, at once
Indebted and discharg'd.

Can such feelings produce aught like slavery? It would exhibit a greater want of true independence of mind, to reject lectures or services, on such a ground, than to accept of them. It shews a jealousy and caution approaching cowardice, and would give the world but a poor opinion of the uprightness of the minds of mechanics, to suppose that they could be affected by kind offices *given* to them. No ill effects have as yet arisen from it; it is next to an impossibility that any should; and I hope the operatives of Great Britain will be too mindful of their characters, ever to show such a delicate squeamishness in guarding them. Indeed, any precaution would be needless and uncalled for; it would be, indeed, a wasteful and ridiculous excess of prudence.

These remarks have been called forth, on account of T. V.'s covert attack upon the matter in question. If you think them worthy a place in your Magazine, their insertion will oblige

Your obedient servant,
T. M. B.
Ordinary member of the
London Mechanics' Institution.
Oct. 24, 1826.

We readily give this defence of gratuitous lecturing, insertion, though, as most of our readers are probably aware, we entertain a view of the subject decidedly opposite to that of our worthy correspondent. It would not, perhaps, become us to say, with what justice to ourselves, T. M. B. avers that the impolicy of giving gratuitous lectures "has never been proved by facts nor supported by argument;" but we may take leave to remind our readers, that we have, at least more than once, made the attempt to do so; and that both Dr. Birkbeck and Mr. Brougham, have also put on record, opinions to the same effect. (See Mechanics' Mag. vol. 1. pp. 114-180.) We may farther venture to assert, that T. M. B. has, by no means so clear a field in the discussion of this question as he seems to suppose; his "*only* objection," is but one of many that have been offered, and that, by no means the most important.

EDITOR.

ON THE POSITION AND STRENGTH OF FLOOD-GATES.

The most celebrated philosophers, who have written on this subject, are Mr. Maclaurin, Mr. B. Martin, Mr. Fletcher, Dr. Hutton, Mr. Wolfenden, and Mr. John Leslie. Mr. Martin's enunciation of the problem requires "the angle of position, so that the gates shall *resist* the water with the greatest *force* possible." Now it is extremely obvious that the gates will *resist* the water with the greatest *force* possible when they are the strongest, that is, when they are the shortest; consequently, they will resist the water with the greatest force, when they are in a straight line, or when they make *no* angle with each other.

Mr. Fletcher requires "the position of the flood-gates so, that they may resist the water with the greatest *ease*." It is very evident that the gates will resist the water with the greatest *ease*, when the pressure of the fluid is the least, for they will then have the least to do, and this will be the case when the salient angle, made by the gates, is indefinitely small. In the solutions by all the abovementioned gentlemen, it is taken for granted, that each gate, when pressing against the other, partly strengthens the other, which cannot possibly be the case. Each gate is acted upon exactly in the same manner as if it were placed in an inclined position against an upright wall, and were acted upon by a weight pressing upon it in a vertical direction; or we may consider each gate as a beam of wood resting in an inclined position, and having to support a constant weight, which acts upon it in a vertical direction. Now, from the principles of mechanics, it appears that the strength of a beam in an inclined position, is as the square of the radius to the square of the sine of the angle of elevation, but the pressure of the water on each gate is exactly in the same ratio, and that in every position of the gates. How, then, can there be a maximum or minimum, when the resistance of the gates and the pressure of the water against them, have always the same constant ratio, in every position? Hence it follows, that the pressure diminishes as the strength of the gates diminishes, or as the gates lengthen. Let us suppose the gates to be very long, then the salient angle will be very small, and the strength of the gates very small, and the pressure against them very small; suppose the gates to become parallel, there is then no pressure, and the gates being infinitely long, have no strength; it appears then the solutions are all wrong, and the problem impossible.

Engineers generally place the gates in such a position, that the strength of the gates and ease in opening them, may, jointly, be the most advantageous. When the gates are required to be opened frequently, the salient angle is made less, or the angle of position greater. Most of the above mentioned philosophers have determined the angle of position to be 35·16; Mr. Leslie makes it 45°, and Mr. Wolfenden, different from all the rest. In practice, the angle of position is seldom more than 15°, and it is scarcely ever made so great as 35°.

M. J.

Warminster.

CORNWALL STEAM ENGINES.

Sir,—I have now before me the return of the work done by the steam engines employed in various mines in Cornwall, dated December, 1825. Perhaps some of your numerous correspondents can throw some light on a few observations I wish to make on it.

1st. What is the reason that the engines vary so enormously in their effects? Those of 42 engines pumping water, vary from 15 millions up to 43 millions of pounds, raised one foot high, with one bushel of coals; and there is almost every possible variety between these quantities.

2d. What is the reason that the engines raising the ore, &c. out of the mines, produce effects so vastly disproportionate to those employed in pumping? Of eighteen engines, the greatest weight raised amounts to only 6,231,491 lbs. one foot high, with a bushel of coals. The least, 1,618,835 lbs.

As to the first question I observe, that generally, but not uniformly, the large engines raise more than the lesser ones. The diameter of the least cylinder is 20 inches, that of the largest is 90 inches. Are we to suppose that the very great difference is the consequence of some of the engines being in better repair than others? It cannot surely arise from the different quality of the coals, or from the superior skill of the men who attend the fire.

But I most wish for information on the second question—can we possibly suppose that the loss by the action by the crank, and the friction of the simple machinery necessary for winding up the kibbles, can amount to so immense a quantity? Or can it arise from the delay incidental to this sort of work, in emptying the kibbles? This, surely, cannot alone create the difference; as steam is not consumed when the engine stops.

By the bye, I should be very glad if you could inform me whether any idea has ever been formed of the loss of power incurred by the alternating motion of the steam engine, and by arresting 40 or 50 times in a minute, the motion of so large a mass of matter; or, in other words, whether any estimate of any kind has ever been formed of the saving in this respect, which would result from a rotatory motion, if it could be discovered?

I am, Sir,
Your humble servant,
A. M. Z.

IS LIGHT MATERIAL OR IMMATERIAL.

Sir,—It is, I think, much to be regretted, that the study of the very interesting and useful science of optics, has of late been so generally neglected and laid aside by scientific men, while so much attention has been given to many other sciences of minor importance, or of mere speculative interest. Whether this arises from an assumption that little or nothing remains to be investigated in the science, or that the utility of its practical applications is not considered to compensate for the trouble of investigation, I am unable to determine; but I conceive the fact is indisputable, and believing as I do, that many of the phenomena of the science have not been sufficiently understood, or at least satisfactorily explained, and that many very important results *may* be obtained by an assiduous cultivation of its principles, I am anxious to exert my humble endeavours, to introduce it once more to the notice of your correspondents, and to induce them, if possible, to assist in the removal of the anomalies which appear to me to encumber the science.

With this view, and for the sake of securing a firm foundation for subsequent investigation, I would beg to propose for discussion the following fundamental inquiries.

Is light *material* or *immaterial?*

If *material*, how are we to account for its transmission through solid transparent bodies *in every possible direction*, in conjunction with the admitted principle, that its rays can only proceed in right lines? for, I think, it cannot possibly be imagined, that the particles of solid transparent media are so constituted, as to present right-lined interstices or pores in every possible direction, for the admission of light; because such an arrangement of particles would, I conceive, be utterly incompatible with that dense and inelastic texture, for which they are so remarkable. Again, when solar light is decomposed by the surfaces of such bodies as are said to possess colour, what becomes of the rays that are not reflected? Are they absorbed, and permanently retained by chemical affinity; or can we consistently suppose, that by contact with such surfaces, their activity and agency are at once arrested and destroyed, by some cause of a mechanical nature?

If light is supposed to be *immaterial*, in what manner can the operation of its undeviating attributes and properties be explained? Is it probable, that such an agent can be amenable to the laws of chemical or mechanical science?—If we are bound to determine the solution of this latter point, by analogies derived from previously authenticated facts, we cannot hesitate to decide it in the negative; but whether we should invariably confine ourselves to analogy in the investigation of subjects of this nature, is of itself an enquiry of very considerable importance. I confess I am not an advocate for restraining the faculties of man by any such restrictions as these; for it appears to me not a little absurd, to resist the introduction of a theory, merely on account of its novelty, or, in other words, because we cannot find analogous principles in our previously conceived ideas; but although I have thus expressed my opinion upon the general question, I am so perfectly undecided upon that which gave rise to it, that I should be glad to have the sentiments of some of your scientific correspondents upon it, as well as upon the other branches of the subject, before I advance any further into the consideration of the intricacies which it appears to involve.

W. K. M.

Commercial Road.

RULES FOR CALCULATING TONNAGE.

Sir,—While your excellent pubfication has been the means of diffusing so much useful information on ship-building, I have not observed that, for the tonnage of ships, any practically correct rule has been given. It is probable, therefore, that the improved method of computing the tonnage, given by Mr. Parkin, the present master shipwright of H. M. Yard at Chatham, will not be unacceptable, especially when his well-known talents as an artist and able practitioner are considered.

For ships of, and similar to, the Royal Navy.

1. Take the length on the gun-deck from the rabbet of the stem to the rabbet of the stern-post, or between the perpendiculars. Then take 23-24ths of this length, and call it the *keel for tonnage.*

2. To the extreme breadth add the length of the gun-deck, or length between the perpendiculars; then take 1-23rd of this sum, and call it the *depth for tonnage.*

3. Set up this depth from the limber strake; and, at that height, take a breadth also from out to outside of the plank at dead flat, and another breadth between that and the limber strake; add together the extreme breadth, and these two breadths; take one-third of the sum, and call it the *breadth for tonnage.*

4. Multiply the length for tonnage, by the depth for tonnage, and the product by the breadth for tonnage, and divide by 49. The quotient will be the burthen in tons nearly.

The following trials shew the accuracy of the rule:

	Tonnage by common rule.	Tonnage by Mr. Parkin's rule.	Actual Tonnage.
Victory, of 100 guns	2162	1839	1840
London, 90	1845	1575	1677
Arrogant, 74	1614	1308	1314
Diadem, 64	1614	1141	965
Adamant, 50	1044	870	886
Dolphin, 44	879	737	758
Amphion, 32	667	554	549
Daphne, 20	429	329	374

For the Commercial Navy in general.

1. Take the length of the lower deck, from the rabbet of the stem to the rabbet of the stern-post; then take 31-32 of this length, and call it the *keel for tonnage.*

2. To the extreme breadth add the length of the lower deck; then take 3-55ths of the sum, and call it the *depth for tonnage.*

3. Set up this depth from the limber strake, and, at that height, take a breadth also from out to outside of the plank at dead flat, and another breadth at two-thirds of the height. Add the extreme breadth, and then three breadths together, and take one-fourth of the sum for the *breadth for tonnage.*

4. Multiply the length for tonnage so obtained, by the breadth and depth for tonnage, and divide by 36·666, or 36 2-3rds, and the quotient will be the burthen in tons.

The following examples shew the use of the rule.

	Tonnage by the King's or common rule.	Tonnage by Mr. Parkin's rule.	Tons actually received on board.
Granby, East India Ship	786	1179	1179
Northington, ditto	676	1053	1064
Union, a Collier	193	266	289
Friends' Goodwill, ditto	182	254	277

It is said that facts speak the truth; if so, the actual instances of application to ships here given, utter the loudest praise in favour of the rule. In our Encylopedias Mr. Parkin's calculation, has obtained the first mention; as well as in other works of note on the subject; there is, therefore, no doubt, but that it will be duly appreciated in your excellent "Mechanics' Magazine."

I am, Sir,
Your humble servant,
A FRIEND TO SCIENCE.

PRACTICAL PERSPECTIVE.

(Continued from p. 402.)

SECTION II.—OBLIQUE AND CIRCULAR.

The practice of oblique perspective varies only from parallel in the situation of the intersecting line and the vanishing points, which are simply explained in,

Problem 3.

TO PUT A CUBE INTO OBLIQUE PERSPECTIVE.

Let figs. 9 and 10, be the elevation and plan of a cube; H L, 1, the horizontal line, and S, the station, from which draw, parallel to the sides, B A and D B, the indefinite lines, S O, S O, and in drawing the visual rays, distinguish the ray 2, to the nearest angle of the plan, B, by the letters, V L, and then first determining the width, as in problem 1, draw the intersecting line invariably at right angles with V L, and its intersections with the parallels S O, S O, give the vanishing points, V 1, and V 2; and the corner, B, of the plan, being in this fig. in contact with I N, gives the point of elevation; otherwise find it as in problem 2. Now the horizontal line, H, in the picture, (fig.11) being prepared as in problem 1, find the distances, A B, and B C, as in problem 2; and draw the lines, D C, and E A, to V; and the lines C K and A L, to V 2, and the figure will be completed.

Fig. 9. & 10.

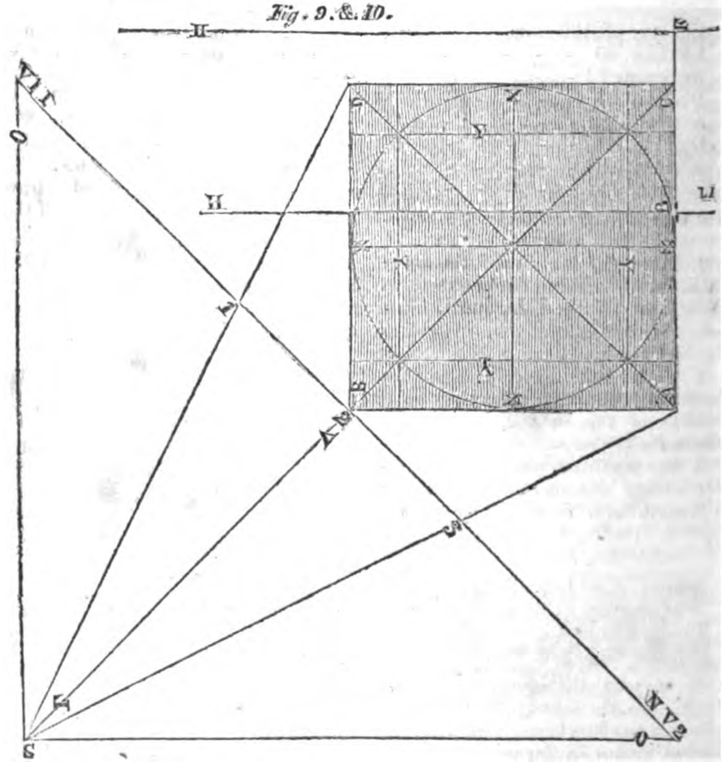
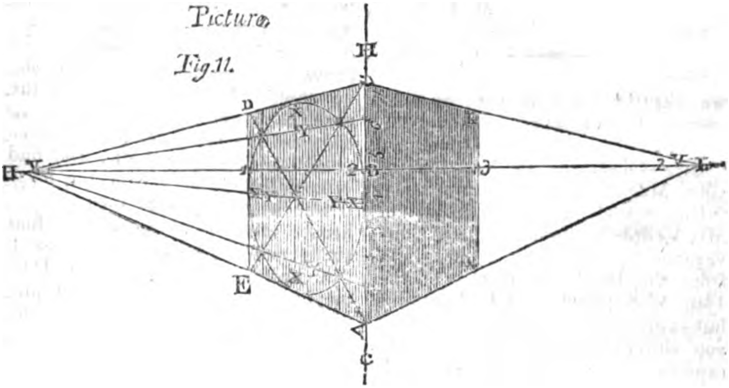


Figure 12,

Is the same cube, showing the effect of placing the horizontal line H L, 2, above the elevation, fig. 9, when the distances must be taken thus: first set off from F, on G H, the space (see the extended line, fig. 9,) F C, for the distance of the upper face of the cube, from H L, 2, and then the space, C A, and proceed as before.

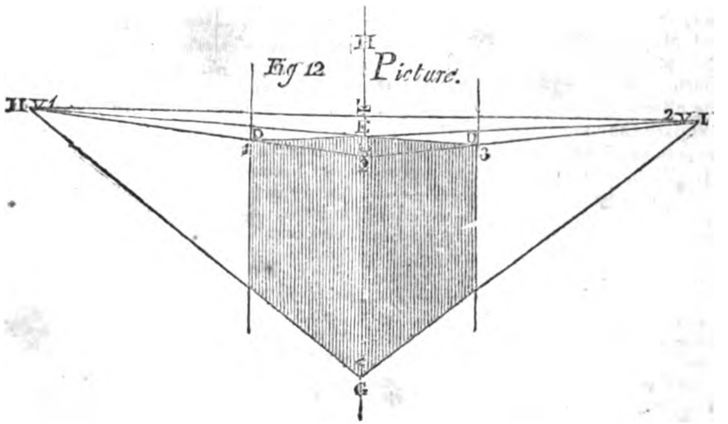


Problem **4.**

TO PUT A CIRCLE INTO PERSPECTIVE.

First enclose the circle in a square, and then, by the preceding problems, find the representation of that square, viz.

Let A C D E, fig. 10, be a square, enclosing the circle, X X X X, and let A C D E, fig. 11, be the representation of the square; then draw through fig. 10, the diagonals, A D, B C, and the diameters, X X, X X, and where A D, and E C, intersect the circle, draw the parallels, Y Y Y Y. Now divide A C D E, fig. 11, by its diameters and diagonals, X X X, A D, and E C; and to find the situation of the parallels, Y Y Y Y, divide the perpendicular of the square, A C, into seven equal parts, and lines drawn from 1 and 6, to V, will be the parallels required; draw the segments, X X X X, through the intersecting points, vide fig. and the true representation of the original circle will be obtained.



The length of this letter warns me to conclude for the present; but in my next, I intend commencing the third division of this treatise, "Mechanical Perspective," when many examples, explanatory of the preceding rules in their most complex form, will be introduced.

M. H. S.

MR. VALLANCE'S NEW MODE OF CONVEYANCE.

Sir,—Observing in No. 162 of your Magazine, an article from a "Correspondent" on the subject of Mr. Vallance's "New mode of Conveyance," preceded by a paragraph from the Brighton Gazette of the 14th of September last, I cannot but express my surprise, that *before* you suffered a blow to be struck, especially one so ill concealed, it did not bring to your recollection the more full and explanatory review of this invention, which appeared in the Brighton Herald on the 16th of the same month, just two days after; and more particularly, since the whole article was repeated in four or five of the London daily and evening papers; besides, being on a subject so legitimately connected with your publication, one can hardly imagine that the same eyes, which were keen enough to detect the poison of a *secret* dagger, would not be equally sharp-sighted in discovering the antidote offered up so *publicly* for correction.*

I always considered, that one of the professed principles of your journal was, to uphold and cherish the efforts of genius; but when you compare the comments of your "Correspondent" with the real merits of Mr. Vallance's invention, as described in the *latter review*, coupled with the hostile spirit in which those comments were published to the world, you will discover no very friendly or honourable feeling, towards an individual who has put into practice one of the greatest improvements connected with "conveyance," which the annals of science have yet recorded. The real object of the writer, is obviously intended to decry and *not* to examine,—to ridicule, and *not* fairly to criticise, what he could *not* comprehend. But, as I have witnessed (with many others,) the *proof* of Mr. Vallance's invention, and experienced the effect by *actual conveyance*, I am able to expose the blunders of your correspondent.†

For example, he speaks of "Goods and passengers being propelled by means of an *alternate* exhaustion, and admission of air; secondly, that this great gun of Mr. Vallance's, was to shoot in a twinkling, men and things of all weights and sizes, from the Land's End to John O'Groat's, or any where else," &c. &c. &c. neither of which passages are warranted by the paragraph he quotes.

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* We are not sure that we comprehend the preceding paragraph; but it would seem, as if our correspondent accused us of being accessary to some "secret dagger" scheme, of which Mr. Vallance is the threatened victim, because we disregarded a certain "antidote" which appeared in the Brighton Herald, and four or five London papers. We hope it may suffice for our vindication, to state that we never saw the "antidote" of which he speaks, until favoured a few days ago with a copy of it by himself.—EDIT.

† We should be sorry to think that it is only one of "the *professed* principles of our journal, to uphold and cherish the efforts of genius." If we have not practically exemplified the principle to the satisfaction of every one, it has not, at least, been from any want of very earnest endeavours to do so. We have re-perused the article which has given so much offence to our correspondent; and we think of it, as we did at first, that, though it does treat in a tone of ridicule, this very serious project of Mr. Vallance, it by no means exceeds the limits of fair and "honourable" enough, criticism. Nor, from what we know of Mr. Vallance, do we think that he will feel at all obliged to this very kind friend, for taking a mere piece of pleasantry, (at the worst) in such dudgeon. It is not by attempts like this, that *true genius* is ever endangered, nor by suppressing them, that it is to be upheld and cherished. Mr. V. must rather feel, with us, that when a project can *stand* the test of ridicule, it must be served, instead of injured, by the attack which calls forth a fuller exposition of its merits.—EDIT.

In another part of the same equitable performance, he ridicules the idea of a "Vacuum being filled before the persons in the carriage pass over the space;" but if he were capable of thinking, and had given the circumstance one moment's thought, he would have seen that air, of the natural density, must necessarily fill that part of the cylinder *behind* the front of the carriage, *before* those sitting in the carriage could *arrive at that particular space*. The expression is therefore correct, although the editor of the Brighton Gazette might have given the fact more distinctly, if he had informed us, that when in that part of the cylinder where the moment before had been what your "correspondent" calls the "vacuum," the space is filled with air of the natural density, *before* the passengers in the carriage *can arrive at it;* since they are seated behind the end of the vehicle, against which the air presses to drive it along.

In asserting, also, that "the impracticability of so vast an application of the principle appeared to every one too palpable to admit of question for a moment," he exhibits an "ignorant impatience" to discredit a valuable improvement in the teeth of reality, although it is susceptible of the greatest advantage to every branch of the community, which is wholly irreconcileable with any just enquiry, for the ends of science.

Your correspondent measures the intellects of others by his own, to a degree which reminds us, that an ignorant savage, who had never seen any thing larger than a canoe, or witnessed the operation of any elementary first mover, would pronounce exactly in the same way with reference to a proposition for building a first-rate, or for constructing a steam engine of 250 horse power. But in order that this "wonderful, yet again wonderful, and after that, out of all whooping" correspondent, may form some clearer notions as to the principle he presumes to designate impossible, as regards application to our service, I must request you to give insertion to these remarks, with the whole paragraph, headed "*New Mode of Conveyance*," in the paper I send herewith, which appeared, as I before observed, in several of the London daily and evening papers, of the 16th of September, and following days.

One who has both seen and experienced, the efficacy of Mr. Vallance's New Mode of Conveyance.

P.S. A load exceeding half a ton has been moved in the cylinder at the rate the air pumps drew the air out of it, with a pressure of *fifteen* grains per square inch; in other words, the seven thousandth part of a vacuum a degree of exhaustion, imperceptible to feeling, and utterly immeasurable by the barometer gauge.

We subjoin the article referred to in the Brighton Herald, leaving out a part of the introduction, which is of no moment.

"Our readers may remember that about two years ago, we discussed, somewhat at large, a principle of motion by which it was stated we might be conveyed from one place to another ten times as fast as we now can travel, that is, 100 miles an hour, instead of ten.

It may be recollected that the principle, or theory, alluded to, was, that by properly combining the operation of steam engines and air pumps, such as are daily used for certain large manufacturing processes, we might create a kind of artificial wind; which, if made to blow in a previously constructed channel, would draw, or drive, a properly constructed carriage, at any rate, not greatly exceeding what has been adverted to; since, as in manufacturing processes, air is daily caused to move at rates varying from 200, to nearly 700 miles an hour, a proper combination of the same apparatus must certainly enable us to cause it to move at the lower rate of 100 miles an hour; and as the current of a river will carry a vessel down, at nearly the rate at which itself moves in its channel, so would this current of air carry us along with a velocity nearly equal to its own.

This, in brief, is the theory. What we have witnessed of the practice is as follows:—It being impossible to give motion to the whole atmosphere, as

Nature does when she causes a wind, we were first shewn into a construction which formed a channel, within which the motion of air could be so directed, as to cause it to blow full against any object placed inside such channel.

This channel (which is, in fact, a very large tunnel,) did not, in the present instance, connect any two distant towns, it being of a length sufficient only to illustrate the principle; but it was self-evident that it (or another,) might be extended to any length required. On the bottom of this channel, or tunnel, was a railway, on which ran a carriage. This carriage had a circular end, composed of thin boards. This circular end was as large as the tunnel, excepting about an inch all round; and was fixed to the carriage, so as to stand across the tunnel, as the sail of a ship stands across the line of her length: consequently, if motion were given to the air within the tunnel, it would press, or blow, full against this end of the carriage, and tend to push the carriage forward; as the sails of a vessel, going right before the wind, are pressed against by the atmosphere at large.

Each end of this tunnel was so connected to large air pumps, that air could be drawn from one end of it, while the atmosphere was, at the same time, permitted to enter freely at the other.

After examining the structure of the apparatus sufficiently to give us to understand as above, we got into the carriage; and on the air pumps being set in motion, we were moved along the railway from one end of the tunnel to the other. When we arrived there, the motion of the carriage was reversed, and we were moved back again.

We continued riding in this way until we were so convinced that the invisible and intangible medium we breathe, might be rendered a safe and most expeditious means of getting from one place to another, as to be tired of riding.

Further investigation gave us to perceive that the carriage might be stopped, and its motion reversed at pleasure; that so trivial was the degree of exhaustion (or vacuum) necessary to enable the atmosphere to drive the carriage forward, as the air pumps drew the air from before it, that though we were exposed to this vacuum (as it is called) at every other turn of the carriage, yet did we experience no inconvenience from it. In fact, our feelings gave us no intimation on the subject, and we were wholly ignorant of it until it was pointed out to us. We were satisfied that persons or goods might be taken up, or set down, in any place through which the tunnel ran or whose trade and population were at all important. And, as we were also convinced that it would be impossible to be overturned, it was out of our power to resist the belief that we had witnessed the operation of a principle by which we may be conveyed more safely, more cheaply, and many times more expeditiously, than we now travel.

We cannot expect to carry to the minds of those who have not witness- the operation of this principle, the conviction felt by us who have. But, of this we are satisfied, that whoever sees it, will, with us, be convinced that we can render the principle practically effective, whenever we choose to be at the expense of doing so.

"It stands now exactly as the steam engine stood, when Watt had completed the first one he made; that is, certain in its effect, provided we will be at the charge of combining the necessary apparatus. We have steam engines and air pumps amply large for the purpose. So far from there being any insuperable difficulty in the construction of the tunnel, that parties are ready to contract for, and guarantee, the execution of it, as relates to being airtight: and although we should begin by going only at the rate of 10, 15, or 20 miles an hour, yet have we no doubt that, in the time necessary to instruct us how to manage the carriage under higher velocities (as sailors get the trim of a new ship,) we should be able to go several (and we see not why *ten*) times faster than we now travel.

"The chief, if not the only difficulty to surmount in this, as in most scientific improvements in their origin, is *public incredulity*. This difficulty was felt and experienced at the onset, in respect to the construction of steam engines—in cutting canals—in laying down rail roads—in rendering steam engines locomotive on them, and superior to the tempest and the wave at sea. But, as the same spirit of perseverance, which enabled us to overcome these past difficulties, will cause us to triumph over those before us, with reference to this principle of motion, we are satisfied that it is necessary only to go on, and prosper."

IMPROVED LINCH PIN.

Colchester, August 28, 1826.

Mr. Editor,—To promote the

comfort of society by the extension of new discoveries, is an object in which I have no doubt you will readily concur. I am therefore induced to request your insertion of this letter. The lamentable accidents which have sometimes occurred from the upsetting of vehicles, caused by the loss of the linch-pin, though, perhaps, not very frequent, are certainly of sufficient importance to deserve a share of attention. For the prevention of these occurrences, several useful inventions have been applied to wheels, but owing to several causes they have not proved of the utility wished for. One or two of these, I believe, have been secured by a patent; the advantage of these, therefore, could only be enjoyed by a few. Others have been too complicated to be brought into general use; and some have not been easily applicable to carriages already in use; not a few have also been too expensive to be generally applied. Added to this, the best I have observed or seen described, do not appear to be sufficient to prevent accidents when in the hands of careless people, much less can they be of the service required, to guard against the mischievous or malicious designs of evil disposed persons; for it is a fact, though probably unknown to many of your readers, that the pins and screws have been frequently taken from wheels for mischievous purposes.

Having directed my attention to this, I believe I have succeeded in producing an invention which will answer all the ends required. I have subjoined a diagram and description, which will, I hope, be easily understood.

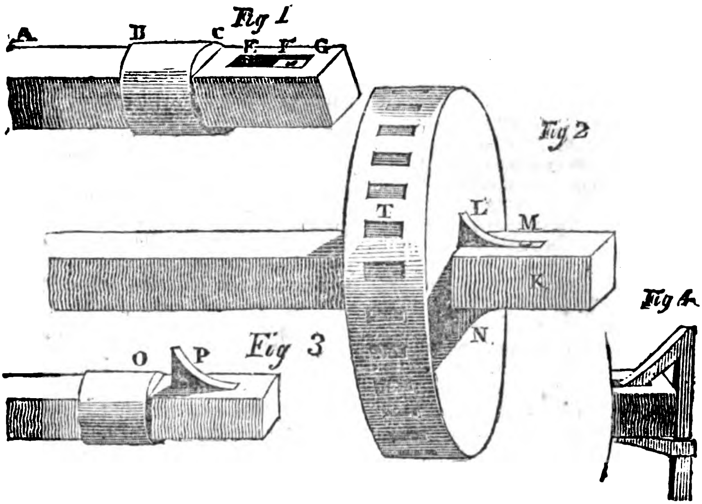

Fig. 1. A, B, C, represent half of what is commonly called the axletree; from A to B is the part between the wheels; from B to G is that part of the arm upon which the wheel is to be fixed; from C to the end is the projecting part of the arm, represented as square, for the purpose of a clearer explanation. From E to F is a hole through the arm, such as is used for admitting the common linch-pin; F, G, represent a cavity sunk about half an inch deep, in the midst of which a hole is pierced through the arm, for the purpose of admitting a rivet, the use of which will be hereafter explained.

Fig. 2. T, K, represent the axle with the wheel, or rather the nave, fixed upon it, with the piece of iron, L, proposed as a substitute for the linch-pin, projecting from the arm in such a manner, as, it is obvious, must prevent the wheel from slip-

ping off. The iron, L, is rivetted to the arm at M, part of it being so thin, as to have a spring which renders it capable of being pressed down into the cavity below it, represented in fig. 1, at E, F. N, represents a piece of iron similar to L, upon the opposite or under side of the arm, capable of being pressed into the same cavity, being fastened by the same rivet, and is adopted only as a double security, in case one should be injured.

Fig. 3, represents the axle with the iron springs, O, P, prepared ready for putting on the wheel. Now, it is obvious, from their form being sloping on one side, and perpendilar on the other, the wheel will easily press them down into the cavity within the arm, whilst it slides over them. When the wheel has arrived at the part, O, the springs will resume their place, as in fig. 2, at L, N, and so fasten the wheel.

Now, in order to take off the wheel, it is only necessary to press the springs into the cavities with the screw-pincers, as in fig. 4, or with any thing else which may prove similarly serviceable. The wheel in use will slide off and on, as easily as a door will latch and unlatch.

Now it appears to me that this will answer all the requisites which I have pointed out. First, it is not so complicated but that it may be easily made by any person accustomed to the manufacture of carriages of any description. Secondly, it is not too expensive to be applied to all sorts of vehicles. Thirdly, it is capable of being applied to all carriages already in use. Fourthly, in the use of this, accidents cannot occur from the carelessness of servants, nor can the mischievous trick be played with this, of removing it from the carriage. Lastly, it will not be secured by a patent to the advantage of a few, as it is here offered to every one who likes to make use of it, and to the ingenious, to make what improvement they can upon it. All the return I ask from the public is, that they will generally adopt the plan, if seen to be of the utility expected.

JOHN BARNARD.

P. S. This mode of securing wheels, may be thought deficient in strength, but, by making it in a little different manner, this objection will vanish. The piece of iron, L, may be made thick and strong, and joined to the arm by a hinge at M, the spring being placed within the cavity of the arm.

HINTS TO PAVIORS, BY COLONEL F. MACIRONI.

In our 137th Number, we gave a brief account of a plan by Colonel Maciron, for improving the pavement of London, (as well as other cities) by means of pressure applied in three different stages of the work; first, to harden the ground previously to laying the stones; second, to fix and depress them when laid; thirdly, to equalize and perfect a pavement after it has been some time in use, by applying the pressure, only on the protuberant parts. We have since been favoured, by Col. M., with a copy of the pamphlet, from which that account was taken; and as only a few copies of the same were printed, for private distribution, we feel happy in having obtained the author's permission to reprint, for the use of our readers, all that part of it which was not included in our former extract. It will be found to contain much useful information, and sensible remark.

"However true it may be, that an observant traveller cannot fail of being struck with admiration at the excellence of the turnpike and other roads throughout this country, he must, at the same time, be very much surprised at the badness of the *carriage pavement*, even of the principal streets of this astonishing metropolis. It is difficult for him to understand how, in a country where every mechanical art is best understood and actually applied to the most useful purposes—where ingenuity, guided by science, is ever on the research, and ever sure to be rewarded for each fresh improvement—how, in the very capital of such a country, the carriage pavement should be, perhaps, worse than that of any other metropolis in Europe? It is, to be sure, justly boasted, that this city enjoys the advantage of commodious and matchless foot-paths, and that the existence and goodness of such foot-paths is, in one point of view, of more general convenience and personal comfort than that of a perfectly level and easy carriage pavement, inasmuch as the safety and convenience of the thousands who walk,* should be preferred to that of the dozens who ride in their carriages. But, in a city like this, teeming with life and activity, throughout which so many thousand public conveyances perpetually travel at so rapid a rate, the state of the *carriage pavement* must surely be a matter of very great importance.

Previously to pointing out what I conceive to be the most advantageous method of improving the carriage pavement of London, I think it will be expedient to offer a few observations on the nature and construction of such pavements on the Continent as are most remarkable for their excellence and durability.

The ancient Roman paved roads, such as the Via Appia, the Sabina, the Flaminian, Emilian, &c. &c., first claim our attention. Of these, there are still tracts of many miles in perfect repair in Southern Italy, especially in the neighbourhood of Rome. A good foundation of gravel, broken limestone, or of basalt, was sometimes applied, where the nature of the soil required it. It is unnecessary to mention the cause-ways of solid masonry, over which they were at times carried, as such causeways, in certain situations, were as indispensable as they would be at the present day under the same circumstances of locality.

The stones composing the pavement of these roads are uniformily of basalt,* of a polyangular shape, containing, on an average, about four or five feet surface, and about twelve or fourteen inches in depth or thickness. They are generally more or less slightly pyramidical, and placed with the base or broadest surface uppermost.† It is by no means in every instance, as is asserted, that these stones are laid in a bed of mortar; in many situations I have found it to be otherwise.‡ Neither are their edges chipped with any great nicety; the juxta-position is, however, well contrived, and indeed very remarkable; for although they vary *ad infinitum* in shape, angles, and more or less in size, they are fitted together as though each had been expressly cut for its situation.

It would appear, that in many places large tracts of these roads have been intentionally destroyed, either for the sake of the materials, or for the purposes of war and devastation; other portions have, in the lapse of ages, disappeared with the gradual changes to which the surface of this earth is subject, especially in inhabited districts, when barbarism rapidly succeeds civilization, or civilization barbarism. Such portions, however, as have been left to contend with the mere wear and use for

* It appears somewhat surprising and anomalous, that in this most aristocratic of all countries, so much attention should have been bestowed on the construction of footpaths. In monarchical France, no such accommodation was ever thought necessary for the "*canaille*," who, consequently, are left to scramble out their way in the mud, amongst the carriages, and under the hoofs of "their excellencies" horses.

Even at Bagdad, Aleppo, and Damascus, there are commodious footpaths to a considerable distance beyond the suburbs!

* The preference for basalt was so decided, that where the roads, for instance, traverse the Appenines, composed of marble and the hardest limestone, basalt has still been used, though it must have been conveyed thither at a great expense. In some instances, however, I have observed a single line of large marble or limestone blocks applied as an edging or "curb" to the basalt.

I am inclined to believe, that this exclusive use of basalt is attributable to its being, although harder, less slippery than marble or limestone. I have particularly remarked in the town of Caserta, where some of the streets are paved with limestone, and the rest with basalt, that the former alone are most inconveniently and dangerously slippery, although both kinds of stone are cut and laid in a similar manner.

† I should, however, recommend the upper and lower surfaces to be equal.

‡ In most cases no more mortar was used than was sufficient to fill up the interstices, which, from the shape of the stones, were wider below than at the surface.

which they were constructed some two thousand years ago, are in as good oder and preservation as ever.

The pavements most similar in construction and solidity to the ancient Roman, are the modern Neapolitan. The stones of these are also of basalt, but in lieu of being polyangular, they are rectangular quadrangles, mostly squares, generally of about four feet surface, and six inches in thickness. The sides are very accurately wrought, as well as the surface, which is left as rough as is consistent with a good level. These stones are laid in a thick bed of the best Puzzolana mortar, and always so arranged, that the lines of junction are never parallel with the line of road,* but cross it diagonally. This pavement excels in evenness and level, is very permanent, but expensive, and liable to become dangerously smooth, which renders it necessary, from time to time, to cut grooves on its surface. The city of Naples being admirably provided with sewers and sub-ways of the most solid construction, the necessity for disturbing the pavement very seldom occurs, so that the expense, though great, is pretty much confined to the first laying.

The pavement of modern Rome is also of basalt. The stones are parallelograms of about two cubes in length; and on being set up endways, they present about ten inches square surface. Although they are accurately cut and equal in size, they are simply fashioned by a few skilful blows of the hammer. More mortar is used in the construction of these pavements, than even in the Neapolitan. I have observed the bed of the best Puzzolana mortar, on which they are laid, to be above a foot thick.† Rome being provided with the most extensive and complete sewers and sub-ways of any city in the world, its pavement, or, as it may be called, this horizontal wall, has likewise very seldom any occasion to be disturbed.‡

* Opposite the Foundling Hospital may be seen a bit of expensive pavement, the stones of which are most accurately wrought and fitted together, but the lines of junction, being parallel to the line of road, deep furrows have been worn between the stones, in a few weeks after they were so carefully laid. Moreover, having no kind of *condensed* homogeneous foundation, it cannot be expected to retain its level, if subjected to the shocks of heavy carriages.

† When the Roman or Neapolitan pavement is fresh laid, care is taken to cover it a foot deep with earth or rubbish, to protect the mortar until it is set from the jars of the carriages. The London paviors, who use no mortar, but lay their stones in loose gravel, nevertheless take especial care to imitate this practice, and carefully protect their loose stones and gravel (from the cold I suppose!) with a stratum of earth or rubbish, which speedily produces pools of mud or clouds of dust. This is not merely ridiculous, but an abominable nuisance.

‡ At present there are in Rome but few streets which exhibit the ancient polyangular pavement. In most parts of the city it lays at the depth of from eight to twelve feet beneath the present surface. The accumulation over the whole extent of the Forum Tranjanum, which was cleared away by the French in 1813, was, on an average, about twelve feet. That over the Forum Romanum, situated between the Mons Capitolanus and Mons Aventinum, was still greater.

I believe it will be found that the level of most cities has a tendency to gradual rise; as more materials are introduced into them than are ever taken out again. The numerous sackings, burnings, and subversions endured by Rome in the barbarous wars of the lower empire, and the "good old times" that followed, have produced such a considerable rise in its level. This has necessarily been greater in the lower parts, between the celebrated seven hills, whose relative elevations have diminished proportionately. Thus the famed Tarpeian rock or precipice, on the south side of the Capitol, has by the process of subtraction from the top, and addition to the bottom, during more than two thousand years, been reduced to less than forty feet in height.

(To be continued.)

TO CORRESPONDENTS.

Communications received from G. W.—W. Crosbie—A Juvenile Philosopher—M. H. S.—F. M—Nathan Short—A Constant Reader—Amicus—R. M.—Astronomicus—Lector—and R. H. H.

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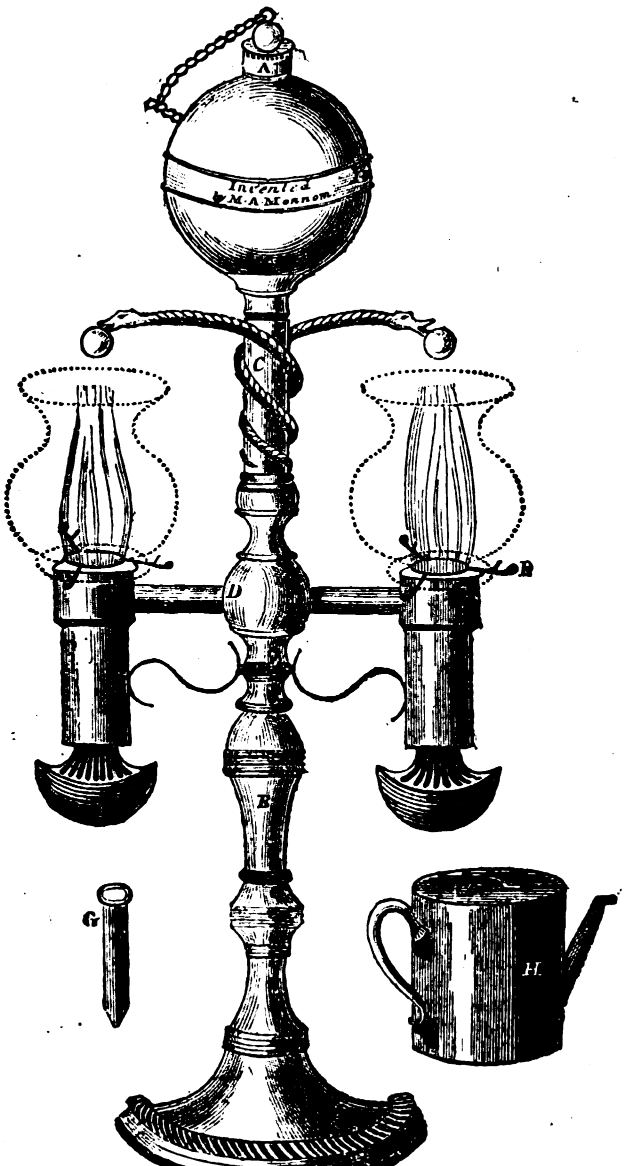
MONNOM'S TALLOW LAMP.



MONNOM'S TALLOW LAMP.

We, some time ago, gave a brief notice of a new lamp, invented by Mr. M. A. Monnom, Broadway, Worcester, in which tallow, or grease of any description, is burnt with as much convenience as oil or candles, and with more effect. We now present our readers with a drawing of a very handsome lamp of this description, which Mr. Monnom has just finished. The drawing is one-third of the size of the lamp. In using this lamp, it is found that one pound of tallow will continue to burn for eighteen hours, producing a light equal to eight candles, of six to the pound. The following are the inventor's instructions for managing the lamp:—

"Having placed your wick on the slider, screw it down by turning the glass-holder, or thumb-ball, F, which raises or lowers the wick, as occasion requires. Turn the reservoir to the right, till B faces the burner; this shuts the communication, while the top, A, may be taken off, and the reservoir filled; when the top is replaced, the reservoir may be removed from the part, D, or turned to the left, and the lamp lighted; the heater, C, must be placed in such position, as will keep the tallow in a melted state. In re-lighting, the heater, G, is intended to be made hot, and placed for a few seconds in the air tube, which sets the wick and slider at liberty. E, is the stand in which the part, D, is made to swivel, for the convenience of turning the light. H, is a tin vessel, in which the tallow must be first melted and poured into the reservoir."

FOLDING MUSLINS, PULLICATES, &c.

The Indian method of folding their muslins, consists merely in doubling a piece of twenty yards to reduce its length to ten yards, which is again doubled, in order to reduce it to five; and thus they continue to re-double, until the piece is a moderate length, capable of being contained in a chest or bale. Thus often redoubled, an Indian piece cannot be examined throughout, unless the whole piece be again unfolded; and this, in large transactions, would be utterly impracticable. British muslins are folded generally to a yard in length, with a small allowance for extra measure; and as the folding is alternately from right to left, every part can be instantly examined upon a table or counter, every fold opening as easily as the leaves of a book, in its uncut state. The piece, when folded, is reduced by doubling it longitudinally to about nineteen inches, and it is then folded across, to the breadth of about thirteen inches. An ordinary sized trunk 39×19 inches, thus contains three layers of pieces, in which package, goods for exportation to the colonies are generally packed, the trunk there forming an article of merchandise as much in general demand as the muslins which it contains.

The Indian ornaments of gilt silver threads, which were at first woven into one end of each piece, although they did not exceed the value of two pence each, have been either greatly curtailed or entirely given up, upon principles of economy. Even the cost of this trivial ornament has been computed to have amounted, annually, in Glasgow and Paisley, to about 30,000*l*.

Pullicate, and other handkerchiefs are most commonly folded up in dozens. For the Africans, and some other foreign trades, pieces, containing only eight handkerchiefs, are preferred. These are still imitations of Indian precedents, confined to markets, where competition continues to exist, not only with the British company, but with the Americans, and others trading with India. A species of pale orange-coloured India handkerchief, distinguished by the name of Mudrus, being in extensive reputation in the Caraccas, and other Spanish settlements in South America, at the period of the capture of Trinadad, in 1795, patterns were procured by some British traders, who ordered very large quantities to be manufactured in Scotland, of the same quality and appearance. With such effect were these imitated in texture, in dye, in finishing, and even in the packages, that some hundreds of pieces sent to London for exportation, were actually seized at the Custom House, as India goods, either illegally imported, or stolen from some of the Company's ships in the river. A scrutiny, however, clearly ascertained that these goods were not Indian, but British, and that no trespass against either the privileges or the property of the company had been even attempted. The goods were of course released, and permitted to proceed to their destination, where, after examination and trial, it was found totally unnecessary longer to conceal their origin, and a very extensive trade, through direct channels, has been since carried on for similar goods.

ELEMENTS OF ARITHMETIC, ALGEBRA, AND GEOMETRY, *For the use of Students in the Edinburgh School of Arts, by George Lees, Teacher of Mathematics in the Scottish Military and Naval Academy*, 8vo. Pp. 207.

The volume before us has been pointed out to our attention, as affording another proof, in addition to those mentioned in our 165th and 166th numbers, of the injustice of imputing to our men of science, a neglect of the wants of the working classes in regard to scientific instruction,—a proof the more remarkable, that this volume happens to have been published some months ago, by the very same booksellers who are now putting forth the translation of M. Dupin's Lectures, as at *length* furnishing what nobody of our own country had previously offered to supply.

"The object of the present publication," says the author, Mr. Lees, "is to supply the *Students of the Edinburgh School of Arts, and those of similar Institutions*, with a condensed yet comprehensive course of mathematics;" and he adds, "it is intended to publish a second volume, containing Plane Trigonometry, Mensuration of heights, distances, surfaces, and solids, the most useful proportions of Conic Sections, the application of Algebra to Geometry, and Fluxions or the Differential and Integral Calculus; to which will be added, as an appendix, the principles of the more abstruse parts of Mechanical Philosophy, embracing more particularly, Statics and Dynamics." How much more do M. Dupin and Dr. Birkbeck propose to supply?

The price of this first volume of Mr. Lees, is only 5s. and in this respect it comes more within the reach of persons of humble means, who are desirous of learning arithmetic, algebra, and geometry, than any other work on these subjects which has yet fallen under our notice.

The characteristics of Mr. Lees' style, are distinctness and brevity, in a very high degree. His aim seems to have been to produce a text book, rather than a book of lectures; and, as a text book, it may be safely recommended, as containing every necessary principle and rule, and yet leaving ample room to expounders and to readers, to exercise their demonstrative and reflective powers.

The work is chiefly deficient in practical illustration; and, though we would not have had it lengthened by such an idle accumulation of identical proportions as we find in Dr. Birkbeck's adaptation of M. Dupin, we should have seen with pleasure, the place of many abstract demonstrations supplied by real examples, selected from the practice of the arts. The *abstract* style, so common to works of this description, is one of the principal secrets of that mystery in which they have, hitherto, appeared shrouded to the vulgar eye; but what truth is there in mathematics, *of practical use to the million*, which may not be as well demonstrated by forms that are real and familiar to every one, as by the ideal formations of the preceptor's ruler and pen? Since, besides, it is going out of the beaten path, at any rate, to teach mechanics mathematics; would it not be well if men of science would go a little farther out of the way, and teach them it in a language and style that every one may readily comprehend?

Mr. Lees makes a very proper

distinction in his introduction. "When quantity," he says, "is considered in the abstract, that is, apart from all considerations of its existing in any material object whatever, the same is called *Pure Mathematics*. When quantity is considered as not abstracted from the object of its existence, the science is called Mixed Mathematics. That quantity cannot exist unless in some physical object, is certainly very evident; it is, nevertheless, convenient and philosophical, by a process of mental abstraction, to *conceive of it separately*. By this means we become armed with a series of *speculative* truths, which enable us to push our way through new and untried difficulties; to overcome every obstruction, however formidable, by which truth may be encompassed, and to proceed with a firm and sure step, in all our scientific investigations."

It might have been added, with equal correctness, that it is by employing the language of pure, when speaking of mixed mathematics, that teachers of this science perplex the understandings of their scholars so much as they frequently do. Thus, in *pure* mathematics, there can be no difficulty in comprehending why a point is *nothing*, since all things in that science, lines as well as points, and areas as well as lines, are *imaginary*. But, when the same sort of language is applied to *mixed* mathematics, which treat of *real* quantities, there is no end to the incomprehensible absurdities which it involves. M. Dupin and Dr. Birkbeck, for example, tell you in their mathematics *(practically applied!)* that "extension has three dimensions: viz. length, breadth, and thickness;" and, that "all the bodies in nature have these three dimensions;" or, in other words, that length, breadth, and thickness, are each equally necessary to the constitution of a body; but that when length, which in its compound state is *something*, happens to get separated from breadth and thickness, it is resolved into *nothing!* You look for a solution of this seeming paradox, and find it thus explained:—"A geometrical line *has only length*, but neither breadth nor thickness;" a line is formed of a "continued succession of points," and a point is *nothing*; ergo, a line which is formed of a number of points, or nothings, must, on the principle *e nihilo nihil fit*, be nothing also, whatever its length may be. But how, you may ask, comes *a point* to be nothing? You are requested to fancy, "that a body gradually diminishes in length, breadth, and thickness," till "each of these dimensions is reduced to zero," and you have then "*the point of geometricians*." The length is gone, the breadth is gone, and the thickness is gone; and the absence of all these is what geometricians chuse to call their *point*. Well, suppose you yield them *the point*, there are still one or two knotty difficulties to be solved.—In the first place, how can a succession of points or nothings, or, in other words, a succession of *the absence* of length, breadth, and thickness, produce the *presence* of any one of these dimensions? And if the placing of a number of points or nothings in a row, can conjure back (as M. Dupin and Dr. Birkbeck say it does,) the dimensions of *length*, why should it not also conjure back the dimensions of breadth and thickness? How, in short, can the three dimensions be otherwise than one and indivisible? M. Dupin and Dr. Birkbeck, leave these difficulties quite unsolved, and yet, in the teeth of them, require their pupils to believe, that a point is nothing, and length, the product of nothing! Then we have this length of nothings spoken of as "*separating* two portions of the surface of a body," and a mass of the same nothings represented as "constituting the *thickness* of a body!" Was there ever such confusion of thought and language?

We are aware that many eminent geometricians, before M. Dupin and Dr. Birkbeck, have indulged in similar definitions; neither can we exempt Mr. Lees from following, though with a halting step, in their train; but from whom ought we to expect the abandonment of such unmeaning subtleties, if not from writers who profess to give mathematics a practical application to the business of life, and to make it plain to the meanest capacity? Even as regards pure mathematics, it is but a species of quibbling at best, to talk of points, lines, and areas after this fashion. Were a learner simply informed, that in pure mathematics all quantities are considered as *ideal*, he would be told at once, and in a few words, every thing that is necessary to give him a perfect comprehension of that *ideality*. The quibbling and *the mystery* begin, from the moment that the teacher essays to tell you what the component parts of this ideality are, and how they may be added, multiplied, divided, reduced, and reproduced. He is obliged, in order to express the *ideal* differences between them, to make use of terms that usually express *real* quantities only—as length, breadth, and thickness; and delighting, apparently, at having thus two meanings to his pen, either of which he may employ as best favours the display of his ingenuity, he rings you many curious changes about points, lines, &c. being at once something and nothing: so minute, as to be nothing, and so long, yet thin, that they have neither breadth nor thickness, &c. &c. The scholar learns absolutely nothing from all this, but he is perplexed and puzzled by it, and his preceptor has the merit of having made the truths he professed to teach, incomprehensible! Is it merit of this sort, however, of which men who would introduce mathematics into the workshop, ought to be ambitious?

We hope we shall not be considered presumptuous, if we venture to affirm, even in the face of the many high authorities on whose side M. Dupin, Dr. Birkbeck, and Mr. Lees have ranged themselves, that in mixed mathematics, that is, mathematics *practically applied*, a point, a line, a surface, &c. are all, in degree, as much matters of reality, as a bullet, a long pounder, a target, or any thing else equally solid and substantial. Matter, we all know, is infinitely divisible, although not infinitely within the power of man to divide; indeed, it is impossible to conceive of it otherwise; divide, and sub-divide as you will, you can never get beyond a remainder atom. What difficulty then is there in imagining, that the lines which define a square, a circle, or any other shaped body, consist of the outmost *tangible* atoms of that body? Or that even a line itself, however thin, must also have its particular dimensions; its breadth, and thickness, as well as length? It is surely, at least as easy, and quite as rational, to imagine matter so minute, that eye cannot discern, nor hand dissect it, as that a point or line may occupy space, (have "*position*" as geometricians say,) and be visible to every eye, and yet *be nothing!*

We have hinted that Mr. Lees is nearly as censurable in this respect as our friends M. Dupin and Dr. Birkbeck; he commences, on geometry for example, with the old standard definition which we have just been doing our best to explode: "A point, is that which has position but not magnitude." It is but fair to observe, also, that, like M. Dupin and Dr. Birkbeck, he sometimes falls into the error of demonstrating what needs no demonstration, and of making a distinction where there is no difference. His third definition in geometry is in these terms: "If two lines are such that they cannot coincide in any two points without coinciding altogether, each of them is called a straight line." Now, the simple fact is, that the two lines here spoken of, have no existence at all; for, as M. Dupin freely owns, "when any two right lines terminate in the same two points, *they form, consequently, only one right line.*" Again, the first problem which he introduces has, for its object, to establish "that any *two* sides of a triangle are, *together*, greater than the *third* side." He might, we think, have taken this for granted with as much safety as that, "when equals are added to equals, the whole are equal," or any thing else in the list of axioms. Mr. Lees, like most other geometricians, defines an axiom to be "a self-evident truth." He would have defined it better had he said that, in the sort of language which is the fashion among geometricians, an axiom is something perfectly plain, made less plain by putting it in different words. Thus, when they say "the whole is greater than its part and equal to all its parts taken together," and, "that all right angles are equal to one another," (Mr. Lees, p. 150,) they mean, literally, no more than that a whole is a whole, and all right angles right angles. Is it not time that of such learned nonsense there should be an end?

Although Mr. Lees' work is not, for the different reasons we have mentioned, all that we should wish a book of mathematics for the use of the people to be, we feel bound to recommend it, as being, on the whole, the best, at a low price, which has yet appeared.

LIGHT OF THE MOON AND PLANETS.

Sir,—I shall feel much obliged if you will give an early place to the following observations on some "Remarks on the Light of the Moon and Planets." The "Remarks" of which I speak, appeared lately in one of the Edinburgh Journals, and were written by professor Leslie. I am rather anxious that you should comply with my request, because the paper is of such a nature, that it cannot be too soon exposed to the general censure it merits.

Mr. Leslie labours to prove, that the moon is of a phosphorescent nature; this has been partly admitted by Dr. Herschell and others, but no new arguments have been here advanced to strengthen the hypothesis. However, suppose we admit it as an authenticated fact, is this sufficient of itself, to prove that the moon shines with its own inherent light, and not, as has hitherto been supposed, by the light which it receives and reflects from the sun? The phosphorescent light which the moon inherits, may be sufficient to enable us to see nearly the surface of one hemisphere, a short time after new moon, or to see "the old moon in the new moon's arms;" but how does it happen that this inherent light should be so feeble at one time, (at the time of new moon) and so resplendent at another, (at the time of full moon)? If the moon acted like a perfectly polished mirror, the light of the sun would not be reflected, and we should only see the sun's image in it. But is not this supposing the moon's surface to be something different from what is generally admitted by philosophers; and is not the hypothesis dragged into the professor's second article, rather to bewilder the reader, than to elucidate the subject under consideration? For aught that I know, there may be substances, of which, if Mr. Leslie were to make a moon, the effect produced might be totally different from what it is at present; it might, perhaps, be so made as to reflect more light, perhaps less, perhaps none at all. That the phases of the moon correspond to its different situations with respect to the sun and earth, daily experience renders extremely obvious; and that the light which we receive from the moon, is occasioned by the *action* of the sun upon the surface of the moon, is just as evident; but how, or in what manner these things are effected, is not quite so clear. The following, which are Mr. Leslie's concluding remarks on the subject, can scarcely be said to elucidate it much. "Were we to indulge *imagination*, we might suppose that the moon has been a comet, which chancing to come near the earth, and to cross its path at right angles, was constrained to obey its predominating attraction, and, henceforth, to circulate about our planet. Its approximation, by raising stupendous tides, would have occasioned one of those overwhelming convulsions, which this globe appears to have repeatedly suffered. But the new satellite would soon lose its fiery constitution, and conglomerate into a solid mass. In its subsequent progress, it will gradually assume a more earthly appearance. But when it shall have attained, in the succession of distant ages, the ultimate term of melioration, the moon will no longer cheer our nights, by her soft and silvery beams; she will become dim and wane, and seem almost blotted from the blue vault of heaven. To our most distant posterity, this prospect is indeed gloomy; but other changes will arise to renovate and embellish the great spectacle of the universe." Now who, let me ask, except a *great philosopher,* would have ventured to publish such a reverie as this? From the earliest records, is there any mention any where made, that the moon is less bright than formerly; or which even intimates that she is "growing dim with age?"—What a fortunate idea it is though, to conceive that when the good lady has become perfectly dark, some other comet may perchance come in contact with her, kick her out of her orbit, usurp her place, and shine with greater lustre! In such a case, one might be allowed to *wonder,* what place she would fly to, or what would become of her poor inhabitants; one might, perhaps, *conjecture,* that she would again become a comet; and after she had got well lighted up again, become dark, and so on. What a beautiful mode is this of providing a constant succession of new moons after the old ones have become useless! And may we not be allowed to extend this hypothesis, and to *imagine* that a new sun may be obtained in the very same manner, should the present one, which is now pretty old, chance to grow dull, or lose its heat, or its brilliancy, or in any other way become useless? This supposition would be a gloomy prospect indeed to our most distant posterity; but if another new sun should step in, in proper time, just as good as the old one, where would the harm be of losing what had become useless? Sed de his satis.

Your's respectfully,

J. W.

Warminster.

MAGNETIC NEEDLE. POLARITY OF SOUND.

Sir,—For myself and friends, I write to solicit information on the following points.

What is the best form for a magnetic needle, the best temper of the steel, and the best sort of suspension for making a magnetic compass? Should the needle carry the card of points or degrees, or traverse above it? I should be glad to be informed of the amount of variation for any places in England, recently observed. The best observations are said to be by Col. Beaufoy, published in the early volumes of Thomson's Annals of Philosophy.* A Mr. Wheatstone is said to have discovered that *sound,* like light, is subject to *polarization:* See Annals, No. xxxii. page 87, and Edin. Encyclop. vol. xvii. page 562. Now can any of your readers shew, that any sounds, or sonorous vibrations, or soniferous particles of matter, are endued with any thing like the property called *polarity?* At present this notable discovery seems "matter of moonshine."

Your's, &c.

A. M.

A. M. has sent a third enquiry, which we have transmitted to the writer of the articles on Practical Perspective, who will, no doubt, give the information desired, in the course of his lessons on that subject.—EDIT.

IMPROVEMENT ON WOULFE'S APPARATUS.

(By a Correspondent of the Liverpool Mercury.)

Of all the apparatus used by chemists, few, perhaps, have undergone so many changes as Woulfe's bottles; an apparatus, the employment of which secures the chemist from those dangerous accidents to which the old method of distilling substances, the products of which were not easily condensed, was liable. The large glass recipients used at the time sulphuric acid was prepared from the common copperas, and in the manu-

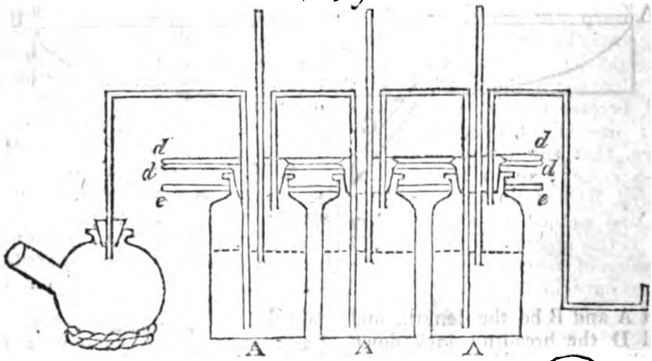
* Our correspondent and his friends have, we presume, overlooked the letter of Colonel Beaufoy, in our 162nd No.

facture of nitric and muriatic acids, were in continual jeopardy, and the only security the operator could promise himself, was, to be derived from the continual application of damp cloths to keep the receivers at as low a temperature as possible.

The apparatus which bears the name of Woulfe, though originally proposed by Glauber, an eminent German chemist, is rendered so very secure, by the introduction of the safety-tube, that we may safely say, these dangerous acids may now be distilled without the possibility of an explosion taking place.

To those already acquainted with the construction of Woulfe's apparatus, a description of its several parts, and their uses, would be superfluous; and to enter into an elaborate explanation for such as are not aware of its utility, would be foreign to my purpose, it being my intention only to give an account of a modification, which will put even the tyro in chemistry in possession of a method of making this indispensable apparatus himself, without going to the expensive price required for the three-necked bottles now in use, and one which will certainly prove a preservative of the connecting and safety-tubes. Without descanting further on the economy of the construction about to be described, or saying any thing more in its favour, I shall proceed to give an explanation of the following sketch, and leave it to the candid reader to judge for himself.

Fig 1



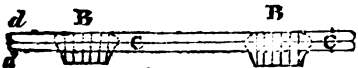


Fig. 2

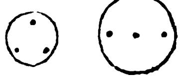


Fig. 3

Fig. 1. A A A are the bottles, which do not require to be manufactured for the purpose, as almost any bottle or jar, having a mouth wide enough to admit a large cork, and the neck sufficiently deep to hold it firm, will answer the purpose, the bottles being all of a size. Fig. 2. a section of the parts shown in fig. 1, by the same references. The corks B B must project from the bottles sufficiently to allow of their having the wedge-like form given to their sides, as at *c c*.—*d d* are two slips of mahogany, with holes cut through them, according to the number of bottles, and the sides of the holes to be so formed, that the upper board, *d*, when pressed upon, shall force the corks into the bottles, and the under board, *d*, draw all the corks from the bottles, without their slipping through. In either case the hands may hold both of the boards, *d d*, and, consequently, when the corks are fixed between them, they may be screwed together. *e e* in Fig. 1, is only to assist the hand in withdrawing the corks.

The corks have holes drilled

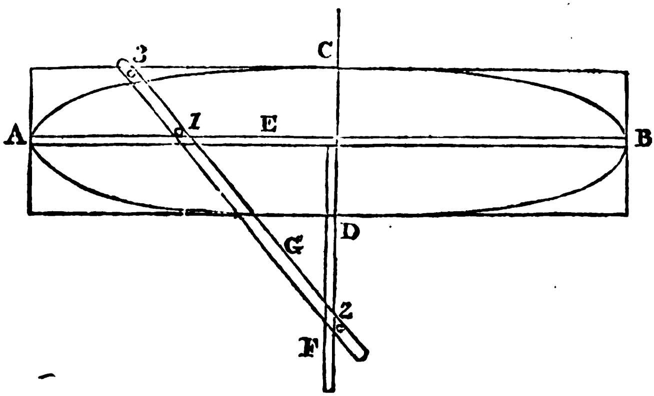
through them to receive the connecting and safety tubes. The smaller the corks can be made, without bringing the holes too close together, the better; and, of course, if the holes are made at the corners of a triangle, they will require a less surface to be at the same distance, than if made on a straight line.—(*See fig.* 3.) It may perhaps be almost needless to add that the corks should be well steeped, or boiled in oil.

HENRY D——.

The glass-tubes may be procured from the makers of barometers and thermometers, who will also bend them to any pattern.

METHOD OF DESCRIBING AN ELLIPSIS OF ANY LENGTH AND HEIGHT BY MEANS OF RODS.

By Mr. M. Saul, of Lancaster.



Let A and B be the length, and C and D the breadth; tack down the rod, E and F, for the conductors of the rod, G; put a nail in at 1, and another at 2, and the pencil at 3, it being half the width and length; then run the nails on the side of the rods, A, B, and F, till you describe one half of the ellipsis, after which take up the rods E and F, and put them on the other side of the centre.

This method is found to be very convenient to the gardener in setting out grass plats, as it may be described with his rake shaft, by merely drawing a centre line each way, marking on his handle the length and breadth, and then tracing it round.

PRACTICAL PERSPECTIVE.

(Continued from p. 426.)

SECTION III.—MECHANICAL.

The two preceding divisions contain the substance of the most elaborate treatises on the subject, for however endless the modifications, they may all be reduced to these simple forms, as will be more fully developed in the course of this section, which, with reference to mill-work, will also contain much explanatory matter, in regard to circles, &c., hitherto purposely omitted.

Machinery can usually be divided into cylindrical and conical; drums, shafts, water wheels, spur and face geer, &c., may be referred to the former; bevel and mitre geer, &c. to the latter; and under one or other of these heads, are also classed columns, wheels, cannon, turpery of every description, &c. &c.

To divide a circle into any required number of equal parts, the diameter in feet or inches being given.

Rule.—The diameter of a circle is to its periphery as 7 to 22; divide therefore the number of parts required by 3, and the diameter, divided by the product, will give the width of each part.

Example.—Required in the circumference of a circle, divided into 27 parts, whose diameter is 36 inches, the width of each part.

27 ÷ 3 = 9; 36 ÷ 9 = 4 inches. Answer.

The width of a part and the diameter of the circle being given, to find the number of parts.

Rule.—Multiply the diameter by 3, which, divided by the width given, will be the answer.

Example.—Required in the circumference of a circle, whose diameter is 6 ft.? the number of parts 3 inches wide.

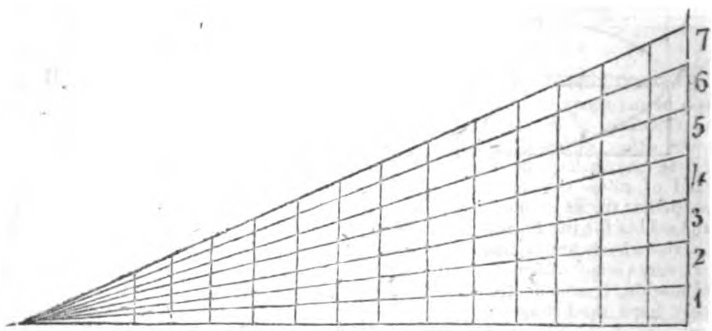
Dia. 6ft. × 3 = 18ft. × 12 = 216 inches ÷ 3 = 72. Answer.

The above rules are near enough to the truth for any practical purpose, and I, therefore, have thought it unnecessary to enter into the question of the proportion the diameter bears to the periphery.

The following scale of sevenths, for circular perspective, will save much time in practice; it may, as is apparent, be lengthened if necessary.

M. H. S.

(To be continued.)



PRIZE CHRONOMETERS.

The following is the order of merit, in which the remaining ten chronometers stood at the end of the trial, 1st of May, 1826, out of the forty-eight, which started according to the prize computation. See Mechanics' Magazine, Dec. 10th, 1825, pp. 126 and 127.

	20	″
French . N.	3912 . . .	2·62
French . . .	975 . . .	3·46
Desgrange .	35 . . .	6·54
Molyneux .	862 . . .	7·32
Cathro. . . .	1703 . . .	8·63
Mc Cabe . .	168 . . .	8·82
Ellicott . . .	947 . . .	9·46
Jackson . . .	512 . . .	9·72
Cotterell . .	647 . . .	10·28
Webster . .	638 . . .	10·44

It appears, from the above, that Mr. J. M. French, of the Royal Exchange, gained *both* the prizes, and that his chronometers were the only two *within* the limits of the first prize.

The accuracy of these two Timekeepers surpasses, we believe, every thing on record. The one varied only *six-tenths of a second*, on its mean daily rate during the 12 months, while the other varied something less than a second!

It further appears, from the following statement of the rates of these chronometers, as continued at the Royal Observatory, that one of them has varied but one second and seven hundredths in fifteen months; while the other has varied only "*sixty-three hundredths of a second in seventeen months*;" so that an expert navigator could have sailed to China and back again with the one, and not have been out of his longitude more than half a mile; while, with the other, a voyage might have been performed round the world, and the greatest error need not have exceeded fifty or sixty perches!!

	No. $\frac{20}{3912}$		No. 975		Extremes of temperature at noon.
	Mean daily rate	Extreme variation.	Mean daily rate	Extreme variation.	
	"		"	"	° °
May . . .	+4·49	0·9	+2·15	0·9	64 to 52
June . . .	+4·23	1·3	+1·85	2·2	79 -- 57
July . . .	+4·12	2·2	+2·63	2·0	78 -- 64
August . .	+4·45	1·9	Sent abroad by Government		78 -- 66
September. .	+4·72	2·6			70 -- 53

HINTS TO PAVIORS BY COL. MACIRONI.

(Concluded from p. 432.)

The next kind of pavements that it may be necessary to mention, are those of Florence, of Sienna, of Milan, and some other cities of Northern Italy. These may, indeed, be assimilated to a kind of stone rail-road, as there are particular tracks allotted for the wheels, and others for the horses. The tracks for the wheels are composed of stones of very large dimensions; they are of marble, lumacular limestone, or of a very hard sand-stone; most of them, particularly at Florence, weighing several tons. They are laid with much precision, in lines of about three feet broad. The spaces for the horses between these lines are paved with small stones, and are, as well as I can recollect, about four feet wide. In some of the squares, the small pavement predominates; while the lines of large stone-way cross it in every necessary direction. Nothing can be more easy or agreeable than this pavement, which is suitable to carriages of every description, without the limitation or confinement of an iron rail-road, but with nearly the same smoothness.

Among the causes which appear to me to have contributed to the extraordinary duration of these ancient Roman pavements, the geological nature of the surface over which they are constructed is not the least prominent. With the exception of the Pontine Marshes, and some tracts about Brindisi (Brundusium), Taranto, and Peruggia, nearly the whole of them have been carried over a surface of volcanic tuffo, of greatly compressed Puzzolana, or of calcareous or basaltic rock; all which furnish the best possible foundation. In countries were chalk, clay, gravel, or sand, are frequent at the surface, as in England, France, Alsace, part of Lombardy, &c., even these Roman pavements, when not kept in repair, have speedily become impracticable for carriages.

The size and weight of the stones composing the ancient Roman pavements certainly do, *when once well laid on a compressed substratum*, oppose much *vis inertia* to the weights which roll over them, while their polyangular shape prevents any acute, or even right angles, being presented to partial pressure. This polyangular shape, and the excellent juxta-position of their sides, prevents any continuous line of junction being presented to the course of the wheels, which would so much tend to create ruts, and other irregularities; moreover, the stones being slightly pyramidical, produces a tendency to conduct the shocks towards the inferior centre of each, or laterally to the superior edges, which are well supported by the surrounding ones.

It is necessary also to remark, that the carriages used in Italy, both anciently and at the present time, are what would be deemed in England very light. Besides which, the wheels of the modern Roman and Neapolitan carts are of a larger diameter than any used in England. It would appear that the carts of the ancient Romans were generally two-wheeled, drawn by two, or four oxen. Travelling was for the most part performed on horseback, or in litters carried by two mules. Chariots for travelling do not appear to have been used at all, much before the close of the republic. They were both two and four-wheeled, but not made to carry more than two persons, besides the driver. They do not appear to have had any springs; the wheels were very low, and not more than thirty-two or three inches apart. So that, altogether, it may be presumed they were more calculated to bruise the bones of the riders, than injure the pavements over which they bounced.

Such, in a very few words, are the best pavements I have had an opportunity of observing, and there is reason to believe there are no better existing. It does not, however, follow, because they are good, and perfectly well adapted to their respective purposes and localities, that any of them might be applied with advantage to the streets of London. I think it may be easily shown, that neither the ancient nor modern Roman, the Tuscan, nor Neapolitan, would possess the qualities required for such an application.

To pave London after the ancient Roman plan, would, in the first place, be attended with enormous expense, and entirely new stones would be required for the whole undertaking. Stones of so large a surface would also become most dangerous for horses, at any pace faster than a walk,—or when drawing heavy weights,—or upon an acclivity. In London, waggons and carts are in general use, of far greater burthen than any which were anciently or are at present used in Italy. Some of our stages and vans, to a very considerable weight, moreover, add great velocity. I shall be told, perhaps, that in proportion to this horizontal velocity, the vertical gravitation is diminished; but these carriages have very small fore-wheels, upon which the drivers, with extraordinary stupidity, contrive to place the greater part of the load.* Such small wheels, so overloaded, descend with great violence into the least depression of the pavement, and are thrown up (to fall again) by the slightest protuberance.

I very much doubt whether, even in point of durability, either the Roman or Neapolitan pavements would succeed in London. Considering the friable nature of most descriptions of mortar, I suspect, that the repeated shocks of very heavy carriages would pulverize and detach it from the inferior surface of the stones, part of it would work out, and the stone become loose.* A further great objection to any such solid masonry pavements is, the frequent necessity of partially taking it up to lay gas and water pipes, and to repair our trumpery crumbling brick sewers.†

The foregoing objections will equally apply to the modern Neapolitan pavements. The modern Roman has not the defect of being too smooth, but it has that of homogeneous solidity, which will not admit of its being perpetually displaced for the temporary purposes above mentioned. Moreover, where are we to get a sufficient quantity of such Puzzolana mortar as is employed in Italy, with which the pavement becomes as one rock ?‡

With regard to the pavements, or, as I have ventured to call them, the stone rail-ways of Florence, Sienna, Milan, &c. &c., the objections to their adaptation to the streets of London must also be obvious enough. Independently of the enormous expense of th materials, such a system could never answer in streets where vehicles of all descriptions, going at every degree of velocity, have occasion to cross, pass, and run abreast of each other, over the entire breadth of the street. Such large

* The pertinacity with which this custom is followed is somewhat suprising in this scientific country. What are we to say to the riders too. We frequently see five or six in front on a stage coach, without a single person behind, or even inside!

* I have seen portions of ancient Roman road broken up by the passage of heavy artillery. A very few such large stones displaced, will render the road impassable for carriages.

† Our sewers are admirably planned and levelled, but the materials and the construction are very short of the necessary solidity.

‡ I have frequently seen portions of such pavements undermined, and displaced by torrents, without a single stone being detached from the masses of several square yards' surface, into which the pavement was broken. On one occasion, I remember the water having undermined the whole breadth of pavement, so as to admit of my crawling under it from one side to the other. I immediately after passed over it in my carriage, as safely as over a bridge.

stones, whether of granite or limestone, would soon become dangerously smooth, their longitudinal edges would wear, and ruts continually be formed along them.*

It remains for me to observe a new method of paving, which has been lately attempted in Piccadilly, but which I am confident will not be found to possess any advantages over the old plan in general use, *at all commensurate to the great inconvenience and expense attending its formation*. According to this method, the old pavement is taken up for a space of about thirty or forty yards at a time, and a regular road is laid with gravel and broken granite, *à la Mc Adam*, upon which the paving stones are subsequently laid, and the operation repeated for another forty yards. It, however, takes at least ten days or a fortnight to harden in succession each of these tracts, sufficiently for the application of the paving stones, and these successive hardenings are to be performed by the carts, carriages, and horses of the public, with so much inconvenience and annoyance as amounts to a complete nuisance! After all, this pavement of such troublesome and *expensive* production will not stand much longer than the old. When any portion of it has to be taken up for pipe laying, &c., how is that portion to be restored to an equal density with the rest? In fact, there is no species of pavement that I have ever seen or heard of, to the application of which to the streets of London there would not be many great objections. I, however,

* In that delectable imitation of the French, which is exhibited on the Hammersmith road, of which one portion is paved and the other not, the high ridge, which must perpetually exist at the edge of the paved portion, has afforded many good jobs to the surgeons and weelwrights. *A propos* of French roads—I will venture to digress so far as to observe, that with the exception of their straightness, their construction in other points is very bad. They are in general three times too wide—they are too much arched or elevated in the middle, and when this part of them is paved, nothing is done to the lateral portions, which are not. From being too wide, so much care cannot be bestowed on their construction, at the same expense as would suffice were they narrower. Secondly, the carriages and carts not being obliged to get out of each others way, form regular tracks and ruts for those going and those coming, out of which they never dream of moving. These French carts and waggons are of quite as barbarous and rude a construction as they could have been in the days of Clovis or Charlemagne, save and except, peradventure, that very ingenious invention of the modern French, for the express purpose of enabling the said carts to keep exactly and undeviatingly in the same ruts. For whereas in different districts the carts vary more or less in width, so that cart A would not be able to go exactly in the rut of cart B, it is contrived, that their axletrees should have six or seven inches to spare, over and above the portion confined in the nave of each wheel. The linch pin is affixed to the extremity of the axle, so that the wheels are at liberty to wash to and fro from side to side, and adapt themselves exactly to the ruts, which the French road-makers so highly appreciate. In passing by a French cart you must therefore be careful to allow for, at least, six inches of concealed axle, which ever and anon darts out from the nave, like the tongue from the snout of a snake.

The middle portion of a French road, which is generally paved, is so much arched, that carts are naturally induced, if not compelled, to take the centre of it; so that those going in opposite directions invariably use the same track, out of which they only momentarily move at the instant of meeting. Deep ruts are thus soon worn even in the most substantial pavement—the difficulty of repairing which, unless throughout the whole extent at once, must be sufficiently obvious. I have here alluded only to the two or three main roads of France. In the others, which they regard as secondary ones, I have travelled for scores of miles where the ruts have been so deep, that on one of my wheels falling in, it could not touch the bottom, but rested on the nave and axle.

Besides the consequences of the defects of locality and of materials, I have remarked three principal causes of the speedy deterioration of highways. Their being too wide—too much arched—or their having but little traffic upon them;—all which circumstances conduce to the carriages keeping in one track, and to the consequent formation of ruts and holes. The only defect in the English high roads is their having so many unnecessary, and often dangerous turnings and windings. Here and there, they are even too narrow; and buildings have been suffered to encroach upon them.

flatter myself, that, after much observation and reflection, *I have hit upon a method that would combine economy with durability, and with what is here quite indispensable, the admissibility of partially and frequently disturbing it, with no greater inconvenience or expense than occurs according to the present system.*

Having thus far therefore endeavoured to show, that solid cement-laid pavements, or even such as derive their solidity from the size and weight of the stones, would severally present many objections to their adaptation to the streets of London; I will now proceed to state what I conceive would prove a cheap and efficacious succedaneum.

The author then proceeds to give the explanation of his system of pressure, which has been already inserted in our 137th number.

HYDROSTATICS AND HYDRAULICS.

(Continued from p. 409.)

Specific Gravity.

In my last communication I proposed to enter fully upon the subject of Specific Gravity; but as you have already inserted so many papers upon this subject, I shall only briefly notice it, and mention some of the practical rules for obtaining the specific gravity of solids and fluids.

The simplest and most natural way of finding the specific gravities would be to take the absolute weights of a cubic inch, or any other determinate quantity, of each substance; and the numbers thus found would be the specific gravities. But as it is difficult to form two bodies of the very same size, and often impossible, as in the case of precious stones, to give a determinate form to the substance under examination, we are obliged to weigh them in a fluid, and deduce their specific gravities from the losses of weight they severally sustain. Water is the fluid which is always employed for this purpose, not only because it can always be had without much difficulty, but because it can be procured of the same temperature and of the same density in every part of the world. The specific gravity of water is always called 1·0000, and with this, as a standard, the specific gravity of every other substance is compared. Thus, if a certain quantity of water weighed 4lbs. and a similar quantity of mercury 56lbs. the specific gravity of the mercury would be called 14; because 4, the weight of a given quantity of water is to 56, the weight of the same bulk of mercury, as 1, the specific gravity of water, is to 14, the specific gravity of mercury. In order, therefore, to determine the densities of bodies, we have occasion for no other instrument than a common balance with a hook fitted beneath one of its scales, though in general they are provided with several other conveniences. This is commonly called the *Hydrostatic Balance.*

When the substance to be examined is heavier than water, suspend the solid, by means of a piece of horse hair, to the hook beneath the scale, and find its weight in air. Fill a jar with water, and find the weight of the solid when immersed in this fluid. The difference of these weights is the loss of weight sustained by the solid. Then, as the loss of weight is to the weight of the solid in air, so is 1·0000, the specific gravity of water, to a fourth proportional, which will be the specific gravity of the solid. For example: Suppose I have a piece of brass which weighs in air 129 grains, its weight in water I find to be only 113, and the difference or loss of weight is 16 grains, then, 16 : 122 =1·0000 : a fourth proportional, which, in this instance; I find to be 8·0625, the specific gravity of brass. But as the third term of the preceding analogy is always 1·0000, the fourth proportional or density of the solid will always be found by dividing the weight of the solid in air by its loss of weight in water, as in the foregoing example; : 129 ÷ 16= 8·0625. If the solid substance consists of grains of platinum, metallic filings, &c. place it in a small glass bucket, which generally accompanies hydrostatic balances. Find the weight of the bucket in air when empty, and also its weight when it contains the substance to be examined; the difference of these weights will be the weight of the substance in air. Do the same in water, and the weight of the substance in that fluid will be obtained in like manner. Its specific gravity will then be found as before.

If the substance is lighter than water it is necessary to fasten to it another solid heavier than water, so that they may both sink together. Find the weight of the denser body, and also of the compound body, both in air and in water; and by subtracting their weight in water from their weight in air, find how much weight they have severally lost. Then say, as the difference between their losses of weight, is to the weight of the light body in air, so is 1·0000 to the specific gravity of the body.

For example: I take a piece of deal and a piece of brass to make it sink in water.

The brass in air weighs, . . .	129
———————in water, . . .	113
Loss of weight,	16
The compound, ...	140
———————, ...	100
	40

and difference, 24. Weight of deal in air, 11. Then as above, 24 : 11=1·0000 : 0·4583, the specific gravity of the deal.

When the substance is a powder which absorbs water, or is soluble in it, place a glass phial in one scale and counterpoise it by weights on the other. Fill the phial with the powder to be examined, and having rammed it as close as possible to the top, find the weight of the powder. Remove the powder from the phial, and fill it with water, and find its weight; then the weight of the powder divided by the weight of the water, will give the specific gravity of the former. By this method, also, the specific gravity of fluids may be very accurately determined; but it may likewise be done as follows: Take any solid (glass for instance,) heavier than water, and the given fluid: find the loss of weight which it sustains in water, and also in the given fluid. Then, since specific gravities are as the losses of weight sustained by the same solid, the specific gravity of the fluid required will be found by dividing the loss of weight sustained by the solid in the given fluid by that which it sustains in water.

In all experiments to determine the specific gravities of bodies, pure distilled water must be used when great accuracy is required; but for all common purposes rain water is sufficiently pure. The reason for using horse-hair in the foregoing experiments is, because that substance is nearly of the same specific gravity as water, and will not imbibe the moisture as silk or cotton would do.

The specific gravity of fluids is found in a different and more expeditious manner by means of the instrument called the *hydrometer*.—It acts upon the principle, that solids sink deeper in fluids of less specific gravity, than in those of greater; but is so well known, that it would be needless to describe it here. Those who are not acquainted with it, may see the principle upon which it acts, by taking a small phial with a few shot at the bottom, and putting a small stick, say six inches long, through the cork—it will sink to a certain depth in pure water, but in a mixture of salt and water, it will not be found to sink nearly so deep; thus showing the superior specific gravity of the compound. When properly made, these instruments indicate the specific gravities of different fluids with great accuracy.

In order to determine the strength of spirits, with the greatest expedition, Professor Wilson, of Glasgow, employed a very simple method. His hydrometer consists of a number of glass beads, the specific gravity of each of which varies in a known ratio; when the strength of any spirit is to be tried, the glass beads, which are all numbered, are to be thrown into it. Some of those whose specific gravity exceeds that of the spirit, will sink to the bottom, while others will swim on the top, or remain suspended in the fluid. That which neither sinks to the bottom, nor rises to the surface, will indicate by its number the specific gravity of the fluid.

J. M. N.

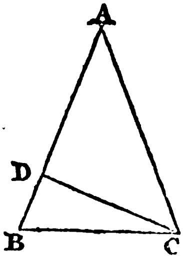
(To be continued.)

THE CASE IN EMERSON'S TRIGONOMETRY.

Sir,—When the "case in trigonometry," by Felix Ford, appeared in your Magazine, (vol. v. p. 164,) I sent, what I considered, the simplest demonstration possible of the proposition; and, at the same time, the resolution of the simple algebraic expression, which seemed to have puzzled your correspondent. My paper was acknowledged as received, (vol. v. p. 208,) but was not inserted, owing, I suppose, to the previous reception of the answer to the same question from Academicus, inserted pp. 255, 256. My demonstration being essentially the same as that quoted there from Dr. Gregory's Trigonometry, I never would have thought of recurring to the subject, had not your correspondent, Felix Ford, again called the attention of your readers to it.

My demonstration was made in total ignorance of Dr. Gregory's; and as it is in form simpler, perhaps you may be inclined to insert it now, along with the resolution of the algebraic expression, which Mr. Ford seems so much to require.

In the triangle, A B C, let A B = A C, and let C D be drawn from one of the equal angles, C, perpendicular to the opposite side, A B.



Then, since A C D + D C B = D B C.

A C D + 2 D C B = D B C + D C B = a right angle.

Therefore, D C B is ½ the complement of D C A.

Now, to C D as radius, A C is sec. and A D tang. of A C D, and D B is tang. of D C B. Consequently, using the symbols of your correspondent, (A being put for A C D, and a for D C B,) D C $= r$, D B $= t$, A C $=$ S, and A D $=$ T. And, since A C $=$ A D $+$ D B, therefore S $=$ T $+ t$, or S $-$ T $= t$.

From this diagram too, Emerson's formulæ are easily deduced; thus, 2 D B, A B + A C² = B C² + A B², (*Euc.* ii. 13.) Therefore, (since A B = A C, and B C² = D C² + D B²,) 2 D B × A C = D C² + D B², or $2\,t \times S = r^2 + t^2$.

Therefore, $S = \dfrac{r^2 + t^2}{2\,t}$.

Again, since A D² + D B² + 2 D B × D A = A B², (*Euc.* ii. 4;) and since A B² = A C² = A D² + D C², therefore A D² + D B² + 2 D B × D A = A D² + D C², and therefore, 2 D B × D A = D C² − D B², or $2\,t \times T = r^2 - t^2$.

Therefore, $T = \dfrac{r^2 - t^2}{2\,t}$.

Then, $S - T = \dfrac{r^2 + t^2}{2\,t} - \dfrac{r^2 - t^2}{2\,t}$

$= \dfrac{r^2 + t^2 - r^2 + t^2}{2\,t}$;

That is, $S - T = \dfrac{2\,t^2}{2\,t} = t$.

Therefore, $S = T + t$.

I am, Sir,
Your obedient servant,
NATHAN SHORT.

Oct. 30th, 1826.

NOTICES TO CORRESPONDENTS.

Aurum's reply to T. M. B. on Gratuitous Lecturing, in our next.

Communications received from A. P. —R. W. D.—Jacka —Chelmeriensis— R. W.—J. Greaves—T. M. B.—T. T.— J. F. E.—H. R.—A Euclidian—Inquisitor—H. C.—U.—Mr. Jones—M. H. S.

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Mechanics' Magazine,

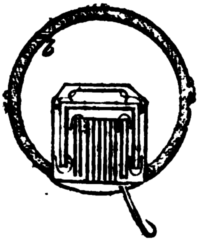
MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 169.] SATURDAY, NOVEMBER 18, 1826. [Price 3d.

"The Philosopher may very justly be delighted with the extent of his views, and the Artificer with the readiness of his hands; but let the one remember, that, without mechanical performances, refined speculation is an empty dream; and the other, that without theoretical reasoning, dexterity is little more than a brute instinct."

Dr. Johnson.

JONES' APPARATUS FOR DRYING GRAIN.



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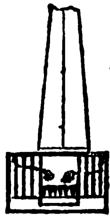

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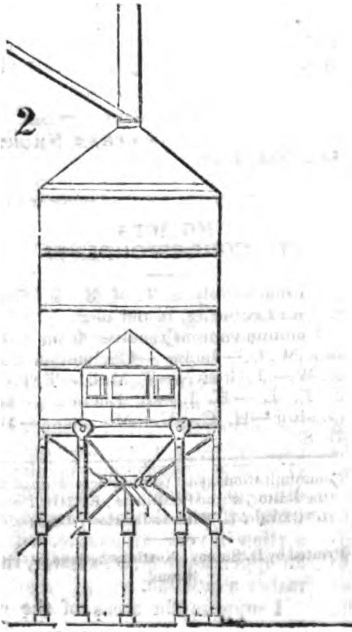


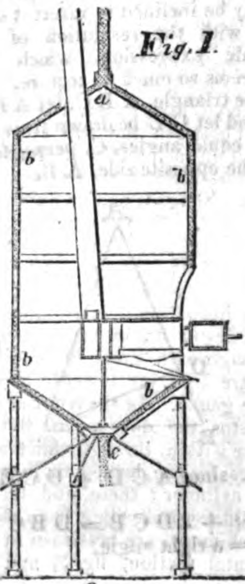


Fig. 1.

JONES'S APPARATUS FOR DRYING GRAIN.

Among the various subjects connected with rural economy, perhaps none is of greater importance than the preservation of grain; and in a country like this, where the season of harvest is frequently interrupted and protracted by wet and cold weather, the difficulty of housing the corn in a perfectly dry state is greatly increased. In damp seasons the moist condition of the grain is such, that when heaped together, fermentation and germination soon takes place, the farina is decomposed, and the nutritive properties are in a great measure destroyed.

To meet this evil, kiln drying is commonly resorted to, but that is a very tedious and troublesome process, and after all is frequently found to be ineffectual, as in drying the under strata of grain, the upper necessarily, in some degree, absorbs the moisture emitted from below, and the whole becomes sometimes impregnated with the effluvia emitted from the ignited fuel. To avoid these and many more inconveniences attendant upon the employment of a kiln, and also to expedite the process of drying grain, Mr. James Jones, of high Holborn, has constructed a very simple apparatus. It consists of two concentric cylinders closed at top and bottom, by two concentric cones, leaving a passage between the two all round, of about an inch and a quarter wide. A vertical section of the apparatus is shown in fig. 1, and an external view at fig. 2. The outer cylinder is about six feet diameter, and to the apex of its cones, about twelve feet high. The body is strengthened by iron hoops, and is supported upon iron legs; its surface is perforated through with small holes, 2300 in a square foot, or it might be made of wire gauze. In the front of the apparatus the door opens to the fire-place within, through which are passages for the heated air to pass into the cylinder; these, and the circuitous flues proceeding from the fire to the chimney, are best seen in the horizontal section, fig. 3, and in the vertical section of the fire-place detached, fig. 4. The chimney passes up nearly in the middle of the apparatus, and by this contrivance, the air in the interior of the cylindrical body becomes greatly heated, and communicates that heat to the metal plates which form the cylinders and cones. The grain to be dried, is now admitted into the apparatus by means of a hopper at top, whence it proceeds through a pipe, and a small aperture, *a*, in the apex, on to the surface of the upper internal cone; there distributing itself all round, it slides down the passages, *b*, *b*, *b*, *b*, between the two cylinders to the point, *c*, of the lower cone, where it is discharged through a spout into a sack, or receiver.

In passing through this apparatus, the grain becomes heated, and in its descent the moisture evaporates, and passes off through the perforations of the cylindrical body; as the strata of grain is very thin, the heated air passes very rapidly, and the moisture is readily taken up by it.

WOULFE'S DOUBLE CYLINDER ENGINES.

Sir,—Having lately turned my attention to ascertaining the comparative advantages of different constructions of the steam engine, I have been particularly interested by Woulfe's double cylinder engine, which appears to surpass all others in obtaining the greatest possible power from a given quantity of steam, but I could no where find a method for computing the exact power, and remembering something to have passed in your Magazine on the subject, I found, in page 395, vol. iv. a letter from E. Fearnley, much to the purpose; but not going quite so far in the investigation as I wished, I have constructed a table, showing at one view, the pressure on the pistons at different times of their descent, which, if you think it worthy of insertion in your Magazine, will form an appendix to E. F.'s letter, though rather a late one.

I suppose the areas of the cylinders to be one 10 and the other 100 inches; the stroke equal; that steam of a pressure of 30 lbs. to the inch, be admitted above the small piston, (which, on filling the large cylinder, will expand to three pounds on the inch, sufficient for condensation,) and a power of 10 lbs. on the inch, to be maintained by condensation on the other side of the large piston Then at every tenth of descent, the pressures will be as under; for instance, at the end of the first tenth, the pressure on the small piston will be 10×30=300, minus the pressure on the other side, from the 'escape steam' (so to call it), which acts equally on the upper side of the large piston, and which, being now expanded into nearly twice 19-20ths of the space it occupied in the small cylinder, and the pressure being inversely as the space occupied, exerts a power of 15·7 lbs. on the inch, which, multiplied into the area, 10× 15·7=157; therefore, the pressure on the piston will be 300—157=143. Then the pressure on the large pis-piston will be 100×15·7=1570+ 100×10=2570, &c.

Tenths of Descent	Pressure in lbs. per in. of the Escape Steam.	Pressure on the small Piston.	Pressure on the large Piston.	Sum of the Pressures.
1	15·7	143	2570	2713
2	10 7	193	2070	2263
3	8·1	219	1810	2029
4	6·5	235	1650	1985
5	5·4	246	1540	1786
6	4·7	253	1470	1723
7	4·1	259	1410	1669
8	3·6	264	1360	1624
9	3·3	267	1330	1597
10	3	270	1300	1570

Total 1859

The mean of which is 1895, which shows the very great advantage to be derived from the use of these engines; indeed, I wonder they are not more common. If any of your correspondents, being acquainted with one of these engines at work, would, through your Magazine, have the kindness to state whether the effect produced is really as much as theory warrants us to suppose, they would confer a favour on many of your subscribers.

Your's, &c. J. F. E.

MISCELLANEOUS HINTS.

(Continued from p. 366.)

"Chi predica al deserto perde il sermone,
Chi lava la test' all' asino perd' il sapone."

Among the minor exhibitions of the inherent functions of matter, which concern us in a domestic or economical point of view, is the oxidation of iron. To treat chemically or geologically on the important and ubiquious element, oxygen, is not my present purpose; although it will be necessary for me to point out a few simple *facts*, on which to establish the humble hints which I venture to submit to the consideration of your readers.

The great increase in bulk produced in iron, particularly wrought iron, by its combination with oxygen, would be familiar to most people and superfluous for me to indicate, were there not so few amongst the multitude, of whom it might not be said, "they have eyes, and see not—they have ears, yet do not hear." It is certain, however, that the more minute, and what are called trivial, because familiar functions of matter, are equally important, inherent, and characteristic, as the most extended and comprehensive. The habitual contemplation of the former, is highly calculated to advance us in the knowledge of the latter, which are only analogous repetitions or combinations of the same immutable qualities, on a larger scale of concomitant modes of action. To speak as much as possible *sans pretension*, and on a level with the subject of rusty pipes and screws, I will only venture on a few illustrations from the most simple actions of life, begging my reader to remember, that there is, or ought to be, "reason in roasting figs."

A man, for instance, will look up with superstitious admiration at the clouds; but observe not the condensation of his breath, on entering his cellar for a bottle of wine. He is awe-struck at the thunder; but draws his cork, and thinks of nothing but the contents of the bottle. He sees the bits of cork attracting each other, according to their masses, on the surface of his potation; but sees nothing like it in the general laws of attraction. He declares the lightning to be a *singular* and awful phenomenon; while he makes no reflections on the sparks which he draws from the back of his cat. He might observe, that every portion of matter when sufficiently at liberty—every drop of rain, or dew, or mercury—every air or soap bubble, assumes a globular shape; while he ascribes the shape of this earth, and of other spheres, to imaginary causes, totally foreign to matter's immutable properties. He attributes the circulation of his blood to extrinsic and capricious design; but heeds not the analogous circulation of the waters of the earth, through river, cloud, and ocean. He marvels at the combination which constitutes his own, and some other organized identities; but swallows his salt, without perceiving the equally necessary and inherent shapes which that mode of matter assumes on crystallization. He manures his garden, and feeds his cabbages with the remains of other cabbages; but, notwithstanding Mr. Allan's lectures, and the evidence of his senses, he sees not that he himself bears a similar relation to all that precedes, surrounds, and succeeds him. He is not surprised to see an ant-hill swept away by a shower of rain; but if he hears of a city or a province overwhelmed by a flood, he ascribes it to some fanciful and ridiculous cause. He sees the glands and tissues of his body, secrete humours which solidify upon their union with oxygen, and, that as he grows older, his body becomes more and more rigid, exsiccated, and dense; but he perceives nothing analogous to this process, in the operations of volcanoes, and the gradual diminution of the waters of the globe. But whither, in the name of patience, am I wandering? Pray, gentle reader, shew me the way to the Bank of England, for it was thereabouts that I had proposed to myself to look for the first little fact concerning iron-rust, or oxidation as they call it."

So, then, I was going to say, that such persons as made use of their eyes while passing the bank, previous to the erection of the new façades, must have observed that every one of the columns which surround it, was more or less broken and displaced, by the oxidation of the horizontal bars of the railing, each end of which was fixed under the pedestal of a column. Again, most persons who frequent that part of the town, must have seen that Bow Church steeple was lately obliged to be taken down and rebuilt, and they might have heard, that it was on account of certain iron cramps having so greatly dilated, through rust, as to lift up the entire fabric out of its perpendicular. I have seen the iron bars of a window exposed to the sea-air, and occasionally to the spray, dilate to twice their original diameter, and split, from top to bottom, blocks of marble and basalt, eighteen inches cube, in which they were inserted. I have seen an anchor inserted about ten feet below the summit of a pier, lift up and displace the superincumbent masonry of huge stones. And finally, to return home again, let any one examine the wrought iron railing in the older streets of London, and he will observe most striking instances of the process I am speaking of.

No species of oxidation of iron is so complete, or so rapid, as that which occurs to it when buried in the earth. And it appears also to be greatest, when placed at from three to twenty feet below the surface, and *in a gravelly soil*. In such situations, a kind of assimilating agglomeration of the surrounding gravel takes place, by which the metal is again converted into ponderous ore, radiating in spicular arrangement from the centre outwards. In compact clay, I have observed the oxidation to be of a slower and different kind,—a mere exfoliation, less considerable than what occurs in the common atmosphere. Owing to the great quantity of carbon (soot,) deposited on the streets of London, when iron pipes are only a few inches from the surface, oxidation is often checked by the formation of carburet of iron; as I have already remarked in my little work, called "Hints to Paviors."

In 1808, I found near Capua an antique sword, supposed to be Carthagenian, the blade of which had formed a hard tenacious agglomeration, with concentric radiations thicker than my arm, and weighing seventeen pounds; which I am inclined to think would, upon analysis, have yielded much more iron than had ever entered into its original composition. Amidst the pumice stone and puzzolana which cover Pompeii, large fragments of doors, &c. are occasionally found, with parts of hinges, locks, and nails. The iron has prodigiously diffused itself and agglomerated the surrounding earths, as well as penetrated the contiguous wood, which, in some cases, I have seen beautifully mineralized, while still preserving its ligneous appearance.

The upper stratum, in and about London, is chiefly gravel, consequently, as I have observed, the most liable to oxidize the innumerable gas and water pipes with which it is intersected. I have paid some attention to the state of these pipes, after different periods of interment; and I feel convinced, that it would be much to the interest of the parties *who pay for them*, were some means adopted to counteract the rapid deterioration they undergo.

Corporate bodies are not famed for economy; the interest of the managing parties being often, if not generally, at variance with that of the shareholders; and it is in the nature of things, as recent exposures have wofully demonstrated, that to *direct* the expenditure of ones own money, and that of other people, are very different things. Such among the labourers employed in laying down the pipes as I have happened to interrogate, have seemed to think that the pipes might be made to last much longer than would be consistent with *their* interest, or with that of the iron founders; and in other cases, we see such a continual chopping and changing of the pipes, either from changes in the water and gas companies, or from not having laid down sufficiently large ones in the first instance, as to put the oxidation I speak of, out of the question. There must, however, be many cases, in which the pipes are destined to remain a long time undisturbed, particularly, I should suppose, in what they call "the mains," some of which I have seen thirty inches in diameter.

To counteract the oxidation of iron pipes, I should propose to coat them outside with some substance impermeable to, and not easily decomposed by water. The best and most economical substance I have been able to devise, is made with two parts coal-tar, and one of lime, in powder. I have not ascertained whether the lime had better be slaked or not. It should be applied to the pipes before they are brought out to be laid; and to do it properly, they should be warmed, and suspended by a pole put through them.

Another effectual method of preventing oxidation, is to apply to the pipes while hot, a coating of sulphur, either pure, or with the addition of one-third part of lime. This will produce on the surface of the pipes a strong crust of sulphuret of iron, which will effectually intercept the access of oxygen. It is needless to observe, the inside of the pipes requires no protection.

It would be well if, instead of lead, with which the junctions of the pipes are at present sealed, some kind of hard mastic were substituted. Any how, the lead, or rather that part of the iron in junction with it, should be particularly guarded from the rust; seeing that the galvanic action of the two metals, must greatly promote the decomposition of the water which gets between them; and the accumulation of oxide in that situation, would inevitably burst the exterior pipe. In my merely fortuitous observations, I have seen this happen several times.

I have yet to point out a case of far more importance, than the preservation of water-pipes; the consumption of which is, after all, according to my Irish friends above alluded to, "good for trade," at the expense only of a tithe out of the great profits of the companies. The case I allude to, is, the rapid deterioration of the Southwark Bridge. This beautiful and stupendous structure, with an arch of 240 feet span, to behold which, several eminent foreign engineers have come purposely to this country, is suffering such decay from mere oxidation, as could never be imagined but for minute observation. With the exception of the balustrade, and exterior lateral members, which had *one* coat of paint, no kind of preservative, paint or tar, has ever been applied to it!

Cast iron is certainly not so liable to oxidize as wrought iron; *but it must be remembered, that the parts of a cast iron bridge, are held together by wrought iron bolts, screws, and nuts.* The oxidation which takes place between the nuts and the cast iron members, will at length force the former from off the end of the bolts,—just as I have seen it occur to gun carriages on a sea battery.

About two months ago, I witnessed a very remarkable proof of the shameful state of the bridge we are speaking of.—As I approached the centre arch in a boat, my attention was much excited by what seemed to be a thick shower of dead leaves or pieces of brown paper, just as if they had proceeded from several baskets full, thrown over from the top. Upon a nearer approach, and when under the bridge, I found that these apparent leaves were large flakes of rust, which some particular state, or change in the atmosphere, and a high wind blowing at the time, had caused to fall so abundantly, that before getting through the arch several of the flakes, larger than my hand, and about as thick as a shilling, fell into the boat. The shower continued unabated as long as my eye could distinguish it. The waterman informed me, that what I had seen was of frequent occurrence. For several years past, indeed from its first construction, I had witnessed with regret the shameful neglect of this magnificent edifice; and many a time I have both seen and felt the destructive drippings of water, or something else, which from some mismanagement perpetually falls from it; particularly from the exterior apex of the arches, and, I think, mostly from the centre one. I had also seen many large flakes of rust fall from time to time, but never before such an extraordinary shower as the one I have described.

It is easy to imagine, how such an abundant formation of rust must operate, when confined and accumulated between the two surfaces of the cast members, and forged bolts and nuts! No force will long withstand its vast dilating power, especially as the screws which have to resist it progressively deteriorate.

No dependence can be placed on the strength or durability of the most massive materials, when they are put together with a single false bearing, or unmechanical contrivance. How long, under the present circumstances, the bolts of the Southwark Bridge will perform their office, is not easy to determine; but as so many people are concerned in it, I suppose no body cares a straw about it. In a country, however, where the vast and advantageous application of iron far exceeds that of all the rest of Europe put together, some little attention to these homely hints might be turned to account, although I am aware, that engineers may deem them beneath their notice, and others regard them as injurious to "the trade." I could point out numerous other cases, to which these observations might apply.—It was only the other day, that on crossing Vauxhall Bridge I remarked, that hundreds of casks in a great vinegar yard are laid out in the open air; and with their iron hoops, are rotting and decomposing in the most wasteful manner, for want of a "*haporth*" of coal tar to protect them from the atmosphere. No doubt *Mr. Cooper*, like the silversmith of Ephesus, and other enemies to "innovations," can prove that he has a "vested right" in the existing order of things; and in due analogy he will persuade his employers, that their interests and his own, are one and the same,—identical—and essential to the maintenance of the "social order" of the cask's arrangement, as well as to insure the proper "workings of the spirit"—of the vinegar!

In my next communication, I will endeavour to intrude less upon your patience, and give you four or five hints, such as they are, in a smaller compass in one article.

I have the honour to be, &c.

F. M.

October 24, 1826.

WHY 120 GALLONS OF RUM AND WATER, WILL NOT FILL A 120 GALLON CASK.

Sir,—If the following answer will satisfy Lion as to the correctness of Mr. Dipstick's statement, I shall feel much pleasure.

Your's, &c.

TAPPER.

Devonshire.

It is a well-known chemical fact, that water added to strong rum will increase the temperature considerably. Now, from the quantity of heat evolved, the particles are brought into more immediate connexion, and the volume of the mass diminished; that is, if equal quantities of the two masses, rum and water, are mixed together, the bulk of the masses when mixed, will not be so great as when taken separately. In other words, the chemical affinity, by which these two bodies are combined, sets free a quantity of caloric, and the attraction of cohesion brings the particles of fluids closer together, and consequently the bulk is reduced. On the same principle, the bulk of fluids increases in the winter, and decreases in the summer; that is, 40 gallons in the summer, will measure more than 40 gallons in the winter. I hope this will satisfy Lion.

Another Answer.

Sir,—Permit me to furnish your intellectual Lion with some information which will satisfy him as to the truth of Mr. Dipstick's statement.

The particles of water are round, and of course the interstices among them are numerous; the particles of alcohol are much smaller than those of water, and, consequently, when the liquids are mixed, the latter occupies the interstices of the former.

From the same cause, a certain quantity of salt, and after that some sugar, may be mixed with water without the bulk of the mixture being greater than the previous bulk of the water.

A pretty accurate idea of such operations may be obtained, by introducing a quantity of shot among a number of bullets.

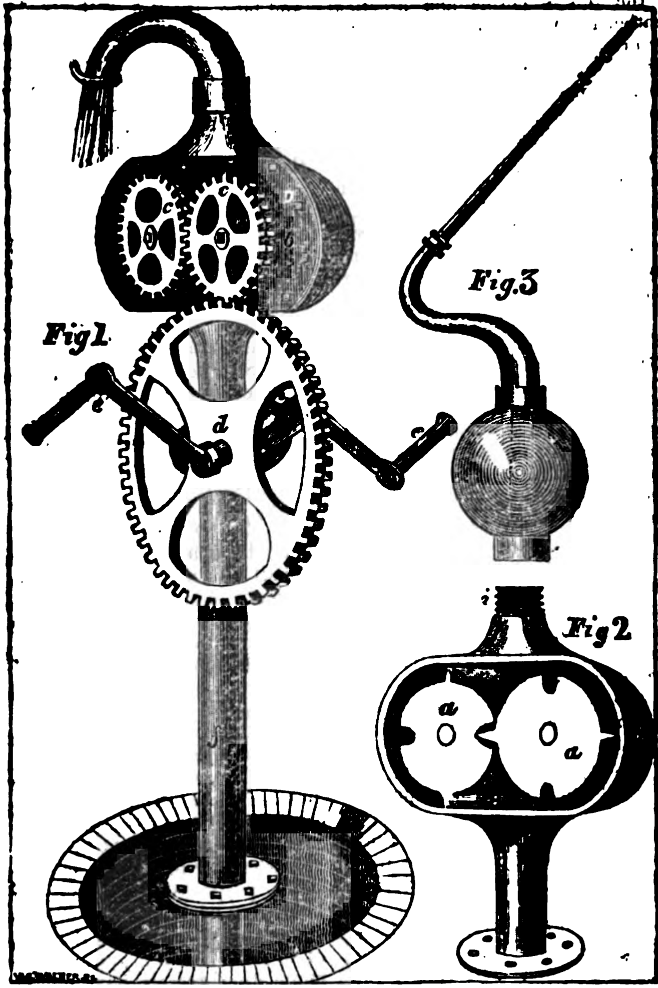
A JUVENILE PHILOSOPHER

[We apprehend that the former is the more correct solution. Our "Juvenile Philosopher" assumes, that "the particles of alcohol are much smaller than those of water:" were this the case, alcohol would of course be *heavier* than water, bulk for bulk; while the fact is precisely the reverse. There was an article in our last number on Specific Gravity, which we recommend to the Juvenile Philosopher's attention.—ED.]

MOTHER OF PEARL.

A subscriber to the Mechanics' Magazine, is desirous of being informed, through some of its correspondents, whether the various articles, now sold as mother of pearl, are manufactured from the pearl shell, or from any substance made in imitation of it.

It having been suggested, that an imitation is made from a preparation of rice, he would wish to ascertain if such is the fact, and if so, the process of making it?



Sir,

I have not seen in any of the scientific and periodical publications, more than an incidental notice of Mr. Eve's Rotary Pump, which has been exhibiting at the manufactory of Messrs. Taylor and Jones, 11, Jewin Cresent, Cripplegate, for a few weeks past, although the invention is certainly one of the most ingenious and valuable productions, which has been brought before the public in latter years. Mr. Eve obtained a patent for a rotary Steam Engine last winter, an account of which has been published in the Mechanics' Magazine, Nos. 161 and 162. In this patent, the before-mentioned pump is included; in fact, the principle and construction of this pump is the same as the Steam Engine.

I give you, prefixed, the necessary drawings, illustrative of the construction of this pump, and without commenting on its merit, I beg leave merely to state, that it is the opinion of the few scientific and practical gentleman, who have witnessed the performance of the machine in Jewin Cresent, that it must, in course of time, supersede the ordinary reciprocating pumps and fire extinguishing engines altogether. As a ship's pump this rotary machine is of incalculable value, because, being composed entirely of metal, it cannot get out of order, and the quantity of water to be raised, is as the force employed, and the velocity, which latter, as this motion is rotary, and having no valves to open and close, may be increased to almost an unlimited degree. The mode of working it by means of a crank handle on a winch, is the most advantageous and best adapted to a man's power. The pump constructed by Taylor and Jones, has two cylinders, of 3½ inches diameter, by 6 inches long, revolving on axes, and in contact with each other, in an outer case; through which the said axes protrude, and have outside cogwheels affixed to them, which regulate the equal motion of the cylinders.

Each cylinder has two wings of ¾ of an inch area, and 6 inches long, and two grooves; and in revolving, the wing of one cylinder falls alternately into the groove of the other, where the cylinders touch. The motion of the cylinders is in opposite directions.

The outer case, containing these cylinders, is fixed by a flanche to a pipe descending to the well, 21 feet deep.

By means of a multiplying wheel, which gears into one of the cogwheels, and trebles their speed, the pump is worked, and although the pump is of so inconsiderable a size, about 110 gallons, or half a ton, of water are discharged by two men in three minutes. This result is sufficient to shew the importance of this simple and beautiful machine, and I invite you and your numerous intelligent readers, to see the performance.

Fig. 1, exhibits a front elevation of the engine; fig. 2, a similar view of the pump-case, with the front plate and the gear, which gives motion to the cylinders removed; fig. 3, an air vessel, with branch pipe and bore attached, to be attached to fig. 2, by the screw, *i*, when employed as a garden or a fire-engine; *a*, *a*, are the two cylinders; *b*, *b*, the case; *c*, *c*, the cog-wheels; *d*, the multiplying wheel; *e*, *e*, the winches; *d*, the axis; *f*, the induction pipe; *g*, the eduction pipe.

Messrs. Taylor and Jones are authorized by the agents of the patentee, to execute orders for pumps and for engines.

I remain respectfully, Sir,
Your obedient Servant,
A Constant Reader.

October 27, 1826.

P. S. The end of the outer case is represented as taken off in the drawing.

HYDROSTATICS AND HYDRAULICS.

(Continued from p. 448.)

Of Capillary Attraction.

In this brief view of Hydrostatics, I shall not enter at large upon this subject; it would occupy too much room at present, but may, perhaps, furnish matter for a future paper; I shall therefore content myself with stating some of the leading facts and phenomena. We have already seen, when discussing the equilibrium of fluids, that when water or any other fluid is poured into a vessel, or any number of communicating vessels, its surface will be horizontal, or it will rise to the same height in each vessel, whatever be its form or position. This proposition, however, only holds true when the diameter of these vessels or tubes exceeds the fifteenth of an inch: for if a system of communicating vessels be composed of tubes of various diameters, the fluid will rise to a level surface in all the tubes which exceed one-fifteenth of an inch in diameter; but in the tubes of a smaller bore, it will rise above that level to altitudes inversely proportional to the diameters of the tubes. In the case of mercury, and probably of other melted metals, the fluid substance is depressed in these tubes, and the depression is subject to the same law, that is, it is inversely as the diameters of the bores. The power by which the fluid is raised above its natural level is called *capillary attraction*, and the glass tubes, which are employed to exhibit its phenomena, are called capillary tubes, The appellations derive their origin from the Latin word *capillus*, signifying a hair, either because the bores of these tubes have the fineness of a hair, or because that substance itself is supposed to be of a tubular structure.

The phenomena of capillary attraction take place under the exhausted receiver of an air pump, and the fluid will rise to the same height as if the experiments were performed in air. We may, therefore, conclude, that the ascent of water is not occasioned, as some have imagined, by the pressure of the atmosphere acting more freely upon the surface of the water in the vessel, than upon the column of fluid within the capillary tube.

It has been found, that when water is made to pass through a tube of such a bore, that the fluid is only discharged by successive drops; the tube, when electrified, will furnish a constant and accelerated stream. A similar effect may be produced by employing warm water; and a syphon, which discharges cold water only by drops, yields warm water in an invariable stream.

I shall conclude this subject by briefly adverting to the rise of fluids between two plates of glass. This acts upon the same principle as the rise of water in capillary tubes. Take two pieces of plate glass, three or four inches square, hold two of their edges close together, and keep the two opposite a little separated by a piece of cork, so that their interior surfaces may form a small angle at their intersection. When this is immersed in a vessel of water, the fluid will rise in the form of a curve, which will be more distinctly seen by colouring the water with a little red ink or indigo. By measuring the ordinates and abscissa of this curve, Mr. Hawksbee found it to be the common Apollonian hyperbola, having for its assymptotes the surface of the fluid and the common intersection of the two planes. Those who wish to enquire more minutely into this subject may consult the Philosophical Magazine for 1802, Philosophical Transactions 1805, and Nicholson's Journal, Nos. 57, 60, 61, and 62.

The equilibrium of floating bodies is the only remaining subject to be considered; but as it is more intimately connected with ship building and nautical affairs, and you have already devoted many pages to naval architecture, it would be superfluous for me to discuss it further.

I am, Sir,

Your's, &c.

J. M. N.

SUBSTANCE OF THE SPEECH DELIVERED AT THE FIRST ANNIVERSARY OF THE DEPTFORD MECHANICS' INSTITUTION, OCTOBER 19, 1826, BY DR. OLINTHUS GREGORY, PRESIDENT.

I never attend a meeting of any society, constituted for the improvement of intellect, or of morals, for the promotion of the arts and sciences, or for the diffusion of revealed truth, without appreciating more and more highly the felicity of being a Briton. I shall not, I trust, deviate widely from the objects of the present assembly, which is formed from the public at large, and not restricted to the members of the institution alone, if I attempt to develope, briefly, a few particulars on which this gratifying sentiment reposes.

With a view to this, let us first advert to the *physical advantages of Great Britain*. It is richly stored with every thing necessary to render its inhabitants happy. Meditate upon the benefits of its insular situation, the extent and figure of its coasts, the islands that lie in its vicinity; its springs, lakes, and navigable rivers; its fruits, herbs, corn, timber, and other productions of its luxuriant soil; its immense natural treasures of salts, minerals, fossils, stone, marble; its subterranean stores of lead, iron, tin, copper, *coals*, which, though last mentioned, are more valuable to us than the gold mines ever were to Spain, since without these the various metals could not be worked, and half our manufactories would be at a stand. Think of its thousands and myriads of animals, wild and tame; its flocks, herds, hives, dairies, dove-cotes, fisheries; all ministering, in their respective degrees, to the subsistence, the health, and the pleasure of its inhabitants Remember, too, that while we thus possess such a grouping of positive blessings, as probably no other nation enjoys, we have much fewer natural drawbacks, to deduct: for more than a century we have had no plague, no pestilence, and for nearly as long a period, no civil war: we have no such earthquakes as deal devastation around, no volcanoes, no avalanch, no tornado, no simoom. Such are the *natural* advantages of our native land; such the rich present which the bounty of Providence has bestowed upon us.

Observe, next, how *the art and industry of our countrymen assist nature.* Agriculture, manufactures, commerce, navigation, the arts, and sciences, useful and ornamental, in a copious and inexhaustible variety, enhance the conveniences and embellishments of this otherwise happy spot. Cities thronged with inhabitants, warehouses filled with stores, markets and fairs with busy rustics; fields, villages, roads, seaports, all contributing to the riches and glory of our land.

Besides this, recollect farther, that *every natural and every artificial advantage is susceptible of gradual progression,* and trace the yearly elevation to higher perfection. New societies for improvement (among which such societies as this must necessarily be classed), new machines to advance our arts and facilitate labour; waste lands enclosed, roads improved, bridges erected, canals cut, tunnels excavated, marshes drained and cultivated, docks formed, ports enlarged: these and a thousand kindred operations which present themselves spontaneously to the mind's eye, prove that we have not yet attained our zenith, and open an exquisite prospect of future stability and greatness.

Nor is this all; for all to which I have yet adverted is heightened by *the happy constitution of our government.* I am not going to deliver a political dissertation, for that would no more accord with my own inclination, than it would with the rules of your institution, were this an ordinary, instead of a public, meeting. But since nearly all the advantages which we enjoy as Britons, grow out of our constitutional blessings, I may be permitted to remark, that our mixed monarchy is proved, by the experience of centuries, to blend all the excellencies, while it provides, mainly, against the evils which would result from the single existence of either of the three kinds of government of which it is so happily compounded. And the beneficial existence of always at least *two* political parties, to conduct our parliamentary discussions, to investigate the causes of prosperity or of distress, and to subject every measure, proposed by whatever individual, to the severest scrutiny, tends to prevent any of the constituents of our threefold state, from unduly preponderating; and thus contributes to render us the glory of the civilized world.

Well may the incidents and events which have operated in the establishment and extension of our constitutional blessings, employ the pens of historians and poets, the chisel of the sculptor, and the pencil of the painter; well may they awaken and perpetuate the liveliest feelings of gratitude in us; for other nations universally meditate upon them, with astonishment, too often mixed with envy at the excellency which they can see, and partially appreciate, but do not attain!

> "Is it, then, fitting that *one* soul should pine
> For lack of culture in this favour'd land?
> That spirits of capacity divine
> Perish like seeds upon the desert sand?
> That needful knowledge, in this age of light,
> Should not, by birth, be every Briton's right?"
>
> SOUTHEY.

To impress our minds the more in reference to this class of advantages, even as they are connected with inventions and discoveries, let us consider how a free constitution, an intelligent and enterprising people, and a government of whom the arts and sciences never crave audience in vain, give scope and encouragement to genius and skill.

I may direct your attention to the case of Mr. *Kœnig,* a truly ingenious foreigner, and his invention of an improved printing press, in which, by duly blending the alternating and rotatory principles of motion, the apparatus is capable of working off 1100 sheets in an hour, with the superintendence of two boys. Tracing the history of his invention and of his difficulties, and of his want of encouragement through greater part of the continent of Europe, Mr. Kœnig says, "I need hardly add that scarcely ever is an invention brought to maturity under such circumstances. *The well-known fact* that almost every invention seeks, as it were, refuge in England, and is there brought to perfection, seems to indicate that the continent has yet to learn from her the best manner of encouraging the mechanical arts. I had my full share in the ordinary disappointments of continental projectors, and after having spent, in Germany and Russia, upwards of two years in fruitless applications, I proceeded to England."

What could not be accomplished by the encouragement of *princes* on the continent, was effected by the aid of private individuals in London. A few enterprizing printers, and their names cannot but be mentioned with honour on such an occasion, Mr. *Thomas Bensley*, Mr. *George Woodfall*, and Mr. *Richard Taylor*, liberally assisted this ingenious foreigner in bringing his invention to maturity. The machine was set to work in April, 1811, and 3000 copies of sheet (H) of the "New Annual Register for 1810," was printed by means of it. This was doubtless the first part of a book ever printed solely by a machine.

Messrs. *Bacon* and *Donkin* were, it is true, simultaneously at work upon analogous contrivances; and since then, other ingenious artists, especially *Applegath* and *Cowper*, have contributed greatly to the simplification of this class of machinery. The general inference is by no means unimportant: Kœnig found it necessary to come to England to mature his invention and carry it into advantageous operation: while *Donkin*, *Applegath*, &c. have felt no similar temptation to repair to the continent to perfect their labours, and seek the reward due to their talents.

For the reasons already suggested, and others which I shall not now have time to trace, without drawing too largely upon your patience, it happens that, notwithstanding the science and ingenuity of foreigners, they are usually far behind us in the practice of the mechanical arts. I have, I assure you, no invidious purpose to answer, in stating two facts which will enable you to make a comparison bearing upon this point. Two scientific Englishmen of considerable eminence, had recently conferred upon them a medal of, I think, 10*l*. value, by a learned society abroad, on account of some elaborate and very valuable researches. When the medal arrived, it was accompanied, as I am informed, by pieces of silver coin of more than a pound in value, that the medal, which was cast too small, might by this "make-weight," want nothing of its declared worth! This may be contrasted with the results of the operations of the British mint; in which I have been assured, that, on a recent examination, when *sovereigns* were put to the test as to their weight, it was found that out of 1000, 500 were quite correct, 200 varied only by half a grain, 100 more ¼ of a grain, and 100 more varied *altogether* a grain!

You wonder not at this accuracy in a country enriched and adorned by the inventions of *Boulton* and *Watt*, of *Mushett*, of *Barton*, &c. And if you wish duly to value *their* labours, and those of *Smeaton*, of *Brindley*, of *Arkwright*, of *Donkin*, of *Hornblower*, of *Trevithick*, of *Maudslay*, of *Bramah*, of *Telford*, of *Stephenson*, of *Palmer*, and of many others whom I cannot now enumerate, you need only *imagine* for a moment that Britain were altogether deprived of the results of their science and skill, and you would be able to appreciate the extent of their contributions to our national greatness, by the barbarism and desolation which would then reign around.

Were we attempting to trace the history of British intellect and invention, we should find that ever since the Reformation, still more since the Revolution of 1688, and still more since the accession of the house of Brunswick, there has been a growing love and attention to matters of knowledge. It is not now merely, but so far back as the recollection of the oldest man present will carry him, that the veriest peasants have declared with emphasis, that "*Learning is better than house or land;*" and many a peasant and man of humble life has experienced the truth of the adage.

Dr. Gregory then adduced various instances which had occurred within his own knowledge, and some among persons to whom it appeared he had been able to render assistance. Thus, he described the case of *a labourer* on the turnpike road, who had become an able Greek scholar;—of *a fifer* and *a private soldier* in a regiment of militia, both self-taught mathematicians, one of whom became a successful schoolmaster, the other a lecturer on natural philosophy;—of a journeyman *tin-plate worker* who invented rules for the solution of cubic equations;—of *a country sexton* who became a teacher of music, and who, by his love of the study of musical science, was transformed from a drunken sot to an exemplary husband and father;—of *a labourer in a coal* *mine*, a correspondent of the Doctor's, who writes ably on topics of the higher mathematics;—of another correspondent, a *labouring white-smith*, who is also well acquainted with the course of pure mathematics, as taught at Cambridge, Dublin, or the Military Colleges;—of *a tailor*, who was an exquisite geometrician, and discovered curves which had escaped the sagacity of *Newton*, with whom *Hutton, Horsley, Maskelyne, and Maseres* delighted to converse on mathematical subjects, and who laboured industriously and *contentedly* at his trade till nearly 60 years of age, when, by the recommendation of his scientific friends, he was first appointed *Master of Neal's Navigation School*, and afterwards *Nautical Examiner at the Trinity House*;—of *a ploughman* in Lincolnshire, who, without aid of men or books, discovered the rotation of the earth, the principles of spherical astronomy, and invented a planetary system akin to the Tychonic;—of a country *shoe-maker*, who has become distinguished as one of the ablest metaphysical writers in Britain; who has uniformly conducted himself so as to acquire the esteem of all who know him; and who, at more than 50 years of age, has been removed by the influence of his talents and his worth, from his native country to London, where he now edits some useful publications devoted to the diffusion of knowledge, and the best interests of mankind.

The writer of these notes regrets that he cannot give these instructive narrations with the fulness with which they were delivered; but he can present the inferences which Dr. Gregory made from them, as below:—

1. All these individuals were of exemplary conduct; and none of them evinced discontent, or were unduly anxious to thrust themselves out of the situations in which they moved, until the way was opened for them by means of their own celebrity.

2. What advantages might not these individuals have derived had such societies as that which I am now addressing existed in their respective vicinities? And how much depression, doubt, difficulty, and loss of time, might not they have saved?

3. What would have been lost to the arts of the fifer, the tailor, the shoemaker, if the individuals to whom I have alluded, had quitted those employments ten years earlier than they did? And what might not have been gained to the respective departments of knowledge to which they devoted themselves, had they been able so much earlier to get into the path for which the Creator evidently intended them?

Passing from individuals to associations, I may proceed to remark, that wherever societies for the diffusion of arts and sciences have been established among the middle and lower classes, by men of honest intention unmixed with sinister views, they have uniformly done good. *Nor is the experiment new.*

The *Mathematical Society*, in Spitalfields, has been established, I think, about 80 years, its members belonging principally to the middle classes of society. By their labours, their conversations, their lectures, their discussion and solution of interesting problems in pure and mixed mathematics, they have contributed greatly to the diffusion of a good mathematical taste among that valuable class of men, the London school-masters, *Bickford, Whiting, Hampshire, Davies, Downes*, that distinguished mathematician, *Mr. B. Gomperts*, and many others, have derived considerable advantage from this Institution. It has an excellent library, and a valuable collection of philosophical apparatus, by means of parts of which, as you are doubtless aware, some of the lectures delivered in this room have been admirably illustrated.

The Literary and Philosophical Society, at Newcastle upon Tyne, instituted as long back as 1793, has again contributed much to improve the intellectual character of that large and populous town; and has proved the nursery of many able classical scholars, mathematicians, and civil engineers, of established and growing fame. Other similar Societies, formed long ago, in *Manchester, Liverpool, Norwich, Sheffield, &c.* are known to have augmented the sphere of useful knowledge in those towns, and their respective vicinities. While book and reading societies, established during the last thirty years in many country towns, have awakened a spirit of enquiry, and diffused a portion of knowledge amongst tradesmen, and the active classes of mankind, which have powerfully contributed to our national greatness; and by slight modifications, such as the growth of knowledge, its facility of adaptation to circumstances, and the wonderful increase of British arts, manufactures, and machinery, might be *expected* to produce, has led to the association of *mechanics* by profession for that kind of instruction which is specifically suited to their case.

(To be concluded in our next.)

MEANS OF PREVENTING THE EXPLOSION OF STEAM BOILERS.

The recent explosion of the boiler of a steam packet in the Humber, by which several persons were killed, and others severely injured, has called forth a letter to the Editor of *The Times*, from which we make the following extract. We hope the excellent preventive which the writer points out, will be at once universally adopted; and that we shall not again have to lament, the loss of either life or limb, through the imperfections of steam machinery.

"Condensing engines (such as are generally employed in steam boats,) seldom work with a pressure of more than four pounds to the square inch. Take, then, a copper tube fourteen feet long, open at both ends; the diameter from three to six inches, according to the size of the boiler. Insert it at the boiler top, and let the lower end be immersed from three to four feet in the water of the boiler, whilst the upper end is open to the air. As a column of water, about two feet in height, is equal to one pound of pressure on the square inch, it is obvious that the water will rise in the tube to a height corresponding with the pressure in the boiler, in the same manner as mercury rises in the barometer. As soon as the pressure of the steam in the boiler exceeds five pounds per square inch, the water will be projected from the top of the tube; and at the same time that it relieves the boiler from its load, and prevents accidents, it gives notice to every person on board, that the safety valve has been fastened down, or overloaded. Bolton and Watt, the Butterley Company, and some others who make steam-packet engines, use tubes of this description, to keep the boilers supplied with water. There can be no reason why this method should not be used in all steam boats."

HIGH PRESSURE STEAM ENGINES.

Sir,—I shall be much obliged by the insertion of the following questions, which appear to me to have an important bearing on the improvement of locomotive Steam Engines.

How small a quantity of water is absolutely necessary to supply a high pressure engine with its consumption of steam of a certain pressure?

For instance, what quantity of water, will supply an engine with 50 cubic feet of steam per minute, at a pressure of 20lbs. per square inch; and what quantity of water will supply the same number of cube feet of steam at 40, and 60lbs. per square inch, respectively; also what difference would there be in the consumption of coals in the three cases?

Will the same quantity, that will raise one cubic foot of steam at 30lbs. to the inch, raise 30 cubic feet of steam at 1lb. to the inch?

An answer to the above, from any of your correspondents, will much gratify.

Your obedient Servant,

E.

GRATUITOUS LECTURING.

London, 6th November, 1826.

Sir,—I was somewhat surprised on reading T. M. B.'s letter, in defence of gratuitous lecturing, in your last number, as I had supposed that the question, so far as you had taken an interest in it, had been long since set at rest. I am not sorry that the subject has been again started, as I think there is now a better chance of its undergoing a calmer discussion; and of mechanics being convinced of the injurious tendency of the plan, than there was when it was formerly brought forward in your pages, on account of the various other matters which were then mixed up with it.

Why I am opposed to the plan is, that it is diametrically opposite to the principles on which mechanics' institutions are formed, and, consequently, injurious to their prosperity and real interests as *mechanics'* institutions; inasmuch as it destroys that sense of independence which ought to be most sedulously kept up amongst the members. Nor let this destruction of independent feeling be considered of minor or of little importance. It is of the *greates importance*; for, if that be destroyed, mechanics' institutions would degenerate from schools, and (if I may be allowed the term) *shops* of science and knowledge, into a kind of scientific poor-houses. In shops where we *buy* our articles of food and dress, we get them of the best description, and without any sacrifice of independence; but, in workhouses, where the idle and the base receive their support, the food is not only of an inferior description, but is eaten with shame, because it is received at the hand of charity.

Let not then the mechanics of England, descend so low as to receive that as a gift which they can afford to pay for. If they were so poor that they *could* not pay for their lectures, in that case there would be some excuse for them in their necessity, but we have not even that plea. If, then, having the means to pay for our instruction, we receive it gratuitously, merely that those means may be applied to some other more showy, but infinitely less useful purpose, (for instance, the building of a lecturing theatre) we put ourselves upon a level with those dishonest persons who, to cut a fine appearance, keep a carriage and handsome establishment, run themselves into debt with butchers and bakers, tailors and shoemakers.*

T. M. B. talks about "each being so obliging, that neither feels obliged." That may be very fair logic in some cases, but it does not apply here; for why should votes of thanks be passed to gratuitous lecturers if we are not obliged to them? Let T. M. B., or any other defender of the system, answer this plain question—*why should we receive lectures gratis which we have the means of paying for?*

Let us run no risk of putting ourselves under obligations, or of being obliged to put up with lectures of an inferior description; for whatever faults or omissions a gratuitous lecturer might make, we could not, with a good grace, call him to account or even find fault with him; for who "looks a gift horse in the mouth?"

But, again, let the intentions of those who offer their services be ever so disinterested and generous, we are not, on that account, to lay ourselves under obligations to them. If any man were to accept that as a gift which he could obtain by his own honest exertions, he acts a despicable part, and sacrifices that independence which ought to be dear to him as life.

Having made these few observations, which I trust will not be wholly thrown away, I hope, at least, that they will, in some measure, stir up the members of the London Mechanics' Institution, who are really *mechanics*, to a consideration of what they owe to themselves, and not suffer the management of that institution to go into other hands which ought to be justly and properly vested in theirs.

For proof of the ill management which the affairs of the London Mechanics' Institution receive, I need only refer to the very inferior kind of lecturing which now is, and for some time past has, been carried on there, and the consequent decrease in the attendance of the members thereof.

Believe me to be, Sir,

Your obedient Servant,

AURUM.

Also an ordinary member of the London Mechanics' Institution.

* I hope I shall not be *misconstrued* as putting scientific lecturers upon a par with a butcher or a baker.

PNEUMATIC GUN LOCK.

The principle of the pneumatic matches, lately invented by Mollet of Lyons, is proposed to be applied to the firing of guns. The pneumatic match, as our readers are probably aware, consists of a cylinder and air-tight piston; by the sudden pressure of which last, the included air gives out its heat so copiously, as to ignite tinder, or any other quickly-combustible substance. In the present adaptation of the experiment, the cylinder is concealed in the stock of the piece, and the piston is moved by a powerful helical spring.

PRACTICAL GEOMETRY OF THE CHINESE.

The learned Mr. Barrow, secretary to the Admiralty, in his description of China, in the supplement to the Encyclopedia Britannica, observes, that though the Chinese are marvellously ignorant of the nations around them, they have, by the aid of "practical geometry," acquired a tolerable knowledge of their own country. "Pere Mailla," says Mr. B., "asserts, that on comparing the ancient chart of China, said to be copied out of the *Shoo King*, with the actual survey made by his brother Jesuits and himself, and which took them ten years to complete, they found the limits and the positions of the provinces, the courses of the rivers, and the direction of the mountains, pretty nearly to accord, but the proportions of the objects to each other, and to the whole, were not in the least observed. He (Pere Mailla) further observes, that they saw, and gazed with astonishment and admiration at the chasms which the emperor *Yu* caused to be cut through solid mountains, to open new channels for the waters of the Yellow River. *Some, however, will be apt to conclude, that it was the water itself, and not the emperor Yu, which opened these channels.—Query.* Who but some of the sagacious folks concerned in ploughing down the Croker mountains would conclude any such thing?

CELLAR DRAINING.

Sir,—I would advise "Inquisitor," (page 405, vol. vi.) to have his well domed, to within three feet of the bottom, leaving an aperture at the top for a pipe, and to puddle the space between the dome and the level of the cellar, with pure yellow clay. I have no doubt of the spring being high enough for the water to be conveyed by a pipe, to a reservoir above the hall or passage. If the water do not rise to the height required, *at first*, he need not be disheartened. I know an instance where water was bored for, with the expectation of its rising six feet above the ground, as it had risen to that height in the immediate neighbourhood; but the party was disappointed at an insignificant trickling scarcely above the level, and yet, in a few weeks, it came stronger; three feet of piping were added, and, in a few days, it overflowed. Additional lengths of piping were afterwards added, and, in a few months, the proprietor of the brewery, where it was tried, was gratified in finding a constant, though not rapid flow, at a height above *twenty* feet from the ground. As to cementing, the bricklayer is *gamoning* him. Should Inquisitor be inclined to adopt the suggestion, and find his purpose thereby answered, perhaps he will acquaint you with his success.

R. W. D.

Albany Road, Oct. 30, 1826.

It might be as well to have a pipe of from four to six inches to a foot, above the level of the cellar, so that if the water should not be raised by this means, a pump might afterwards be added, and if the pipe were to burst, a stop-cock might be put at the level of the cellar; that is, supposing one to be at the other extremity, over the reservoir.

NOTICES TO CORRESPONDENTS.

We hope Amicus will not suppose that his communication is disregarded. Its insertion is delayed for a short period, solely from a motive of convenience.

Vindex, on Mr. Allan's Lectures, at Guy's Hospital, in our next. Anglicus and Philo-Birkbeck, came too late for insertion this week; but we shall, probably, find room for them next week.

Communications received from a Carpenter—A Constant Reader—H. W.—H. O.—W. J.—S. R.—J. C.—Barnardine—M. H. S.—Anglicus.

Erratum, page 432, col. 2, line 26, for *Mons. Aventinum*, read *Mons. Palatinus.*

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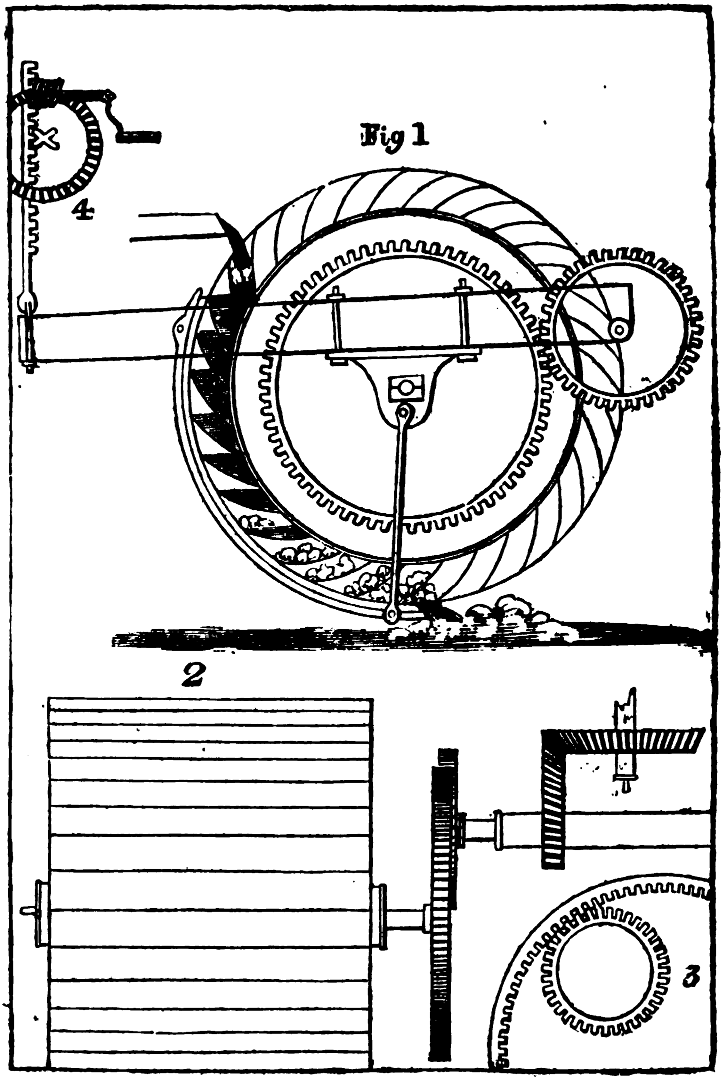
"He that has once accumulated learning, is next to consider, how he shall most widely diffuse and most agreeably impart it." DR. JOHNSON.

IMPROVEMENT IN THE WATER-WHEEL.



IMPROVEMENT IN THE WATER-WHEEL.

Sir,—There have been various contrivances for evading the obstruction occasioned by tail water, but all that have hitherto been in use, seem to be quite inadequate to the purpose; at least, the time and trouble spent in making the necessary alterations, quite overbalance any advantage to be derived from them.

Now, as the best method must certainly be that which will accomplish the object with the greatest ease and facility, without obstructing the work, it is proposed that the water-wheel shall be elevated above the tail water, and that may be done even while the wheel is at work.

A similar movement is performed in the best constructed wind-mills, as often as the wind changes, which, in some situations, is exceedingly frequent.

By the plan now proposed, it is intended to have what may be termed three pit-wheels, instead of one, and two horizontal shafts instead of one, as represented attached to the water-wheel at fig. 2. The two new spur pit-wheels being also in view at fig. 1, it will soon be seen, that as the smallest is stationary, the largest may still keep working into it, while rising or falling with the water-wheel.

The water-wheel is elevated or depressed by means of two levers, the fulcrum of which must be first exactly in a direct line with the small stationary spur-wheel before described, and there is room on each side of the water-wheel for them to be so placed, as in fig. 2.

There is also a moveable curb or bed to confine the water in the wheel, the upper part of which is hung by two pins that go through the levers, and the bottom of the curb is suspended from the levers by means of two strong iron rods, which have pins through them at each end.

To raise or lower the water-wheel, a man turns the winch at fig. 4, and the worm working into the face-wheel, turns the two pinions connected with the two racks at the ends of the levers; but should this be found too laborious, and take too much of the miller's time, while the work is going on, a strap might be applied, and driven by a drum fixed on some convenient shaft already in the mill, and if expense be not too much considered, the addition of a governer will make the thing very complete, particularly where the tide is continually altering the height of the tail water; it may also regulate the quantity of water admitted to the wheel.

Though not much regard has been had to proportions in the sketch given, it will appear that by having a wheel low enough for the water to enter it near the top, the most will be made of the water, and if surrounded by close buckets, instead of open floats, the weight of the water will actually hang in the wheel down to the bottom, while in floats, the weight of the water slides down the bed or trough which the wheel runs in; the buckets will also leave the tail-water better by being in a curved instead of an angular form.

When a flood occurs, and brings down a large quantity of water, it is high at the mill tail, and the water-wheel should be very wide, with buckets as capacious as is consistent with keeping the water at a proper distance from the centre of the wheel, in order to compensate for the fall being reduced, by admitting so much more water when the wheel is raised.

If the new water-wheel is to revolve in the same direction as the old one, the moveable pit-wheel must be toothed inside, and the small spur wheel that it drives, work within it, as at fig. 3.

It may not be quite superfluous to remark, that the shafts, arms, and rim of the water wheel, as well as the ribs and frame of the new moveable bed, or curb, that confines the water in the wheel, should be of cast iron, and sheets of wrought iron are preferable for the buckets and surface of the curb.

By the application of the new principle, many advantages will be derived, a smaller water wheel is required, and, by its going slower, all the power possible will be gained.

When there is a flood, an additional vent may be formed for the water, by raising the wheel without raising the curb, and letting it run all night, which will also have the effect of scouring and removing all impediments in the water-course at the mill tail.

Should any one of your readers, who may erect a wheel on this construction, transmit an account of his success, for insertion in the Mechanics' Magazine, he will oblige your correspondent, and may render some assistance to those mills that are incommoded by tail-water.

I am, respectfully,
SAMUEL RICHARDSON.

LONDON MECHANICS' INSTITUTION.

Sir,—I am surprised that any one who professes to be a member of the London Mechanics' Institution, and who feels so much for its true prosperity as Aurum affects to do, should be so bold, in the face of great professions of hearty good wishes for its success, to put forth statements which must very greatly injure it in the estimation of those who may happen to read his letter, and who, living far from the scene of action, will be apt to take for granted what is advanced so speciously. Under the cloak of friendship, he conceals the dagger of an enemy; from such friends as these, may the society ever be delivered.

The last paragraph in Aurum's letter, contains a very serious charge against the committee of this institution. He asserts, that through ill management the members have of late been obliged to put up with very inferior lectures. Now, I do not appear as the representative of the committee, having no connexion in any way whatever with them. In speaking of them, therefore, I do so quite impartially, and my letter shall contain a plain, unvarnished statement of matters of fact. Nor do I doubt, but I shall be supported by the whole of the members who attend the lectures, when I state that they are far from being dissatisfied with what they have of late been attending to, in that department of their institution which consists of lectures. During the last quarter, Dr. Birkbeck, Mr. Hodgskin, Mr. Cooper, Mr. Hogg, Mr. Preston, and Mr. Green, have been the lecturers, and, with the exception of the latter gentleman's course, the lectures have been such as to do honour to those who delivered them, and afford amusement and INSTRUCTION to those who enjoyed the privilege of listening to them. Indeed, the names of the gentlemen are a sufficient guarantee for the kind of lectures which might be expected from men who stand so deservedly high in the scientific world; for it is not to be supposed that they would risk their reputations by sending forth *that*, of which they might be ashamed. It is also to be hoped, that there are among the 1500 members of the institution, a number possessed of acumen sufficient to discover any errors or deficiency in what may be advanced before them; and of independence also, which would prompt them to give intimation thereof to the person who would so impose upon them; that this is the case, is a fact too well known to be refuted. The insinuation of Aurum is highly injurious to the good sense of the members; that this inference might be drawn, he seems aware, for he says that the members have in consequence of the bad lecturing, decreased in their attendance; unfortunately for him, the reverse is the case. I have been in the habit of attending the lectures during the whole of the time, since the establishment of the institution, and I am prepared to state, without fear of contradiction, that during the last and the preceding, and indeed every quarter, the attendance has rather increased than diminished. I, of course, except Mr. Green's four lectures on architecture. How Aurum, in the very face of these *facts*, could so err, is to me a matter of much wonder, as he *must* be well aware that the members of the institution are in full possession of these truths, and he could also not but feel, that his very unfair statement could not pass unnoticed. I do not hesitate to tell him, that he has no excuse whatever: his only way, will be to act the part of honour, and confess he was wrong. By doing otherwise, he will sacrifice his character (although an anonymous one,) for veracity; and it will appear, that his object was to calmly and deliberately do all that lay in his power to injure the institution for which he professes so great an attachment. I have now fully performed my task of clearing the committee from the charge of mismanagement, by proving that the lectures have not been, and are not inferior. I am sorry to be obliged to take up so much of your time, but the matter is one which calls for prompt interference, in order to prevent the contagion from spreading; I know well your anxiety to correct speedily any error or misstatement which may appear in your pages, and I think you will agree with me in the opinion, that this is one which calls for immediate correction. I therefore beg that you will not delay the insertion of this letter, as, in cases like the present, delay would be cruel.—I cannot help expressing my regret, that so able a correspondent as Aurum should thus so grossly err, as the object he has in view really appears to be that of calm calumniation, and will tend rather to weaken the cause he advocates. Trusting to your well-known candour and generosity in not delaying for a moment my communication,

I am, Sir, &c.

VIATOR.

We have three other communications of a similar purport from R. W. D.—D. Honor—and Veritas.—As much as there is new in these, we shall give in our next.—EDIT.

ARITHMETICAL QUESTION.

Sir,—I hope you will deem the following question worthy of insertion; it comprises simple addition, subtraction, and division. It is to be solved without the assistance of algebra, or the higher branches of arithmetic, and is chiefly intended for the amusement of beginners.

I remain, Sir, &c.

HERBERT D——.

Question.

£4987 was divided between A. B. and C; C.'s share was 29 times A.'s, and the sum of A and B.'s was 840l. Required each one's share.

INDIAN RICE-MILL.

The inhabitants of Pegu have a mode of cleaning rice which is quite peculiar to them. Two large baskets, of a conical shape, are joined together at their apexes, which are grooved; the apex of the lower rises inside that of the upper, and around this a space remains, sufficient to allow the grain to pass, after it has been divested of the husk, by the revolution of the upper on the lower basket.

DR. SULLY'S METHOD OF FEEDING HORSES.

Sir,—the public are much indebted to Dr. Sully, for relating so circumstantially his method of feeding horses.

I should be glad to know, from some of your correspondents, where cheap machines may be had for bruising oats, and cutting chaff. Having only one horse, it is a matter of importance to get these at a low price, and yet to be sufficient for my purpose.

I am, Sir,
Your obedient servant,
A CONSTANT READER.

Nov. 7, 1826.

THE BARNARDINE FIRE-STOVE.

Sir,—I herewith send you a description of the Barnardine stove, for the benefit of those who may have the wisdom to estimate its qualities, and to put it into practical use. A few shillings laid out upon any stove in use, will prove what is herein said of it.

At the distance of 3½ inches from the clear of the front bars, (inwards,) have two grooves on each side the grate, with one at top half an inch long, and one at bottom. Insert in these grooves a thin iron partition-plate, with close bars, lengthways; this will divide the stove into two separate parts; the front one I denominate the coal-fire, and the back the furnace. The front part only is to be fed with coals, and the furnace with cinders, rubbish, litter, &c. The furnace will soon cake any and every thing thrown into it, and will continue to emit a strong heat the whole day, without further alteration than throwing some more litter, &c. upon it.

With this Barnardine, not half the usual quantity of coals will be consumed—four times the heat will be thrown into the room—no sifting of cinders will be necessary—cleanliness under the grate will be unavoidable—and no waste can possibly occur; while a bold, cheerful fire, will be uniformly maintained in front.

A new Barnardine stove might be rendered handsome, by having the furnace part made a little in the cupula form, with a sufficient opening at top.

I remain, Sir,
Your humble servant,
BARNARDINE.

N.B. At first lighting the fire in the morning, a piece of wood may be thrown into the furnace, to assist its lighting. Even the large kitchen grates, in the houses of the rich, might be transformed into Barnadines, by removing the partition-plate during culinary purposes.

MESSRS. DUPIN AND BIRKBECK'S GEOMETRY OF THE ARTS.

Sir,—I perused with much satisfaction your vindication of our men of science, from the imputations of Dr. Birkbeck and M. Dupin. A proneness to prefer whatever is of foreign growth, is a weakness of old standing, and has already done much injury to the scientific reputation of England. The doctrine of increments we owe to Brooke Taylor; a knowledge of the limitation of the irregularities of the orbits of the planets, to Simpson; the calculus of derivations, to Waring; the method of resolution by fluctions, to Maclaurin; and yet, strange to say, the honour of these important discoveries (amongst many others that might be mentioned,) has been generally conceded to foreign mathematicians, merely because they were first duly appreciated by foreigners, and imported in foreign works for the benefit of the country which gave them birth. Is it not then enough, that the honour of some of the proudest achievements in mathematics should have been transferred from our own countrymen to foreigners? Must we to foreigners also, yield the humbler honour of explaining the *a*, *b*, *c*, of the science to our mechanics and artizans? Thanks to your patriotic criticism, there is no fear of any such result. Thanks also to the indiscretion of the publishers of this adaptation of M. Dupin, more is asked for the whistle than many poor folks are able to pay. I have heard much of M. Dupin's liberality, and I do believe, that in most things he is extremely liberal; but it must be confessed, that, for a liberal man, he has an unfortunate knack of appropriating to himself much that does not belong to him. For this, be it known, is not the first or even the second time that M. Dupin has appeared in a questionable shape amongst us.

You have noticed his journey into Scotland in 1817, and how his visit to the Andersonian Institution of Glasgow first impressed him with the advantages of courses of popular instruction, in the principles of the arts and sciences. But you have omitted mentioning (not being perhaps aware of the fact,) that besides introducing institutions on the same plan in his own country, M. Dupin claims the merit of having first introduced them on this side of the Tweed.—"Les observations," says M. Dupin, "que j'ai faites à ce sujet, dès 1817, ont été traduites en anglais, et reproduites dans beaucoup de journaux; *elles ont fait connaitre en Angleterre* le mérite de l' institution Andersonienne de Glasgow, et de son enseignement populaire."—*Introduction d'un nouveau cours de Géométrie et de Méchanique appliquées aux Arts.* How much M. Dupin has deceived himself in this particular, it is scarcely necessary to say. The Royal Institution of Great Britain, which was avowedly planned on the model of the Andersonian, was established many years before the name of M. Dupin was heard of; and the numerous other Mechanics' Institutions that have recently started up in England, must all date their origin from the establishment of the Mechanics' Magazine, which, without any reference I believe, to M. Dupin's "observations," "traduites," et "reproduites," first roused the attention of the English public to a sense of their importance. When again it was resolved to erect a monument to our illustrious countryman, Watt, we were told that it was owing to an appeal of M. Dupin's on the subject, that the English people were induced to do this justice to his memory; whereas, according to the testimony of Mr. Turner, who took so active a part in that proceeding, (see Mechanics' Magazine, vol. ii. p. 306,) the work of M. Dupin, containing the appeal alluded to, was, at the time the measure was agitated, and even at the moment when the public meeting took place, "altogether unknown to most, if not to all," the gentlemen concerned in the business.

So much, a regard to truth and to national character has called from me; but I must at the same time express my perfect conviction, that it has been from misinformation alone, and not wilfully or invidiously, that M. Dupin has ever claimed more than was his due. He possesses merit, and has performed services of too sterling a kind, to stand in need of any of the factitious aids so necessary to the profession of the pretender and charlatan.

I am, Sir,
Your's respectfully,
ANGLICUS.

Walworth, Nov. 12, 1826.

[There are one or two mistakes in this communication, which we think it our duty at once to correct. Anglicus alludes to the imputations on our men of science, as proceeding from "Dr. Birkbeck *and* M. Dupin," and speaks afterwards of M. Dupin's appearing again "in a questionable shape" amongst us, as if this new appearance were an act of his own choice. M. Dupin, however, has *not joined* in these imputations, and though he must, doubtless, be gratified to see his lectures translated into a foreign tongue, and adapted to the wants of a foreign people, this is an affair of other parties, over whom, it is to be presumed, M. Dupin has no control. In regard to Watt's monument, Anglicus blames M. Dupin still more unjustly. M. Dupin, himself, *never* claimed the merit of stimulating the English people to this testimony of national gratitude. He merely stated, what was the fact, that at the time he wrote, no such testimony existed, (see Mechanics' Magazine, vol. ii. p. 242.) The party who erroneously claimed this merit for him, was the Editor of the Mechanics' Magazine; who feels that, in doing this justice to M. Dupin, he makes but scanty reparation for the prejudice which his indiscreet encomium seems to have excited.—EDIT.]

ELECTRICAL EXPERIMENT.

Mr. Editor,—Permit me to call the attention of the readers of your valuable miscellany, to the following experiment, by which two kinds of electricity, or the direction of the fluid, may be ascertained. Insulate two wires, furnished at each end *with a metal ball, three-fourths of an inch in diameter;* connect one with the *positive*, and the other with the *negative* conductor of the machine; the balls should be four inches asunder, and between them, at equal distances from each place, a lighted candle, with the *centre* of its flame nearly on a level with the centres of the balls. If the machine be put into motion, the flame will waver very much, and seem to incline rather more to the negative ball, than to the positive one; after about fifty revolutions, the negative ball will grow warm, and the positive will remain cold. If the revolution be continued to about 202, the negative ball will be too hot for the hand to touch, while the other remains as cold as at the beginning.

I am, Mr. Editor,

AMICUS.

PILE DRIVING.

Sir,—I shall feel obliged to any of your correspondents, who will demonstrate with what power an iron ram, of six hundred weight, will fall, on being disengaged at the height of twenty feet above the pile? It is a matter on which practical men are much in want of information.

I am, Sir, &c.

A CARPENTER.

October 28, 1826.

P.S. I should like also to know, what difference it would make, if the engine declined 11 feet from a perpendicular on its height: viz. 20 feet?

QUESTION IN HYDRAULICS.

What quantity of water per hour will be requisite to keep in motion an overshot water-wheel, of light construction, eighteen feet in diameter, having the work of two horses to perform at a speed of three miles per hour, the fall of the water being 23 feet?

The mode by which the calculation is made to be explained.

M. N.

CHEAP AND DURABLE FISH OIL PAINT.

Pilchard oil, which possesses more greasy matter than any other fish-oil, has been used, in Cornwall, for the last 50 years, to the greatest advantage, in coarse painting. The preparation is made in the following manner. Put the oil into a clean iron pot, and place it over a slow fire (wood is best); to prevent it from burning, when it begins to heat, skim it well; let it remain on the fire till it singes a feather put therein. For every gallon of oil, add a small table spoonful of red litharge. Stir them together well for about three minutes; then take the pot off the fire, and let the mixture cool in the open air, after which it is fit for use. It will quickly dry, and become a solid body, in any coloured paint, on wood or iron. It is very durable, and has all the appearance of varnish.

J. C.

IMPROVED HAMMER FOR BREAKING STONES.

Sir,—I have had some hammers made for breaking pebbles and other stones for the use of roads, different from any I ever saw or heard of, and I think I may say, better too. They are circular, and steeled round the edge; or, which is preferable, made entirely of steel. I have them of different sizes, according to the nature of the stones they are to break. I find for breaking gravel, one of 2¼ inches diameter, weighing rather more than one pound, very suitable; the handle, ¾ of an inch in diameter, or not quite so thick, two feet four inches long, and straight: ash is the wood I use. The socket for the handle is in the *centre* of the circular hammer-piece, which is, of course, affixed to it *endwise*. With the assistance of this description, any blacksmith who can give a proper temper to the edge can make them; or if any of your readers please to write to me, paying the postage, I can refer them to hammer-makers who will supply them with good articles, and cheaper than they can be made by country smiths; probably, as cheap as any where in England.

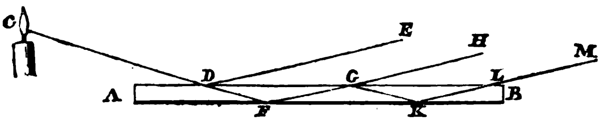
I am, Sir, your's,

JOHN GREAVES.

Barford, near Warwick.

REFLECTION OF LUMINOUS OBJECTS.

Looking over your third volume, I observed a query by a correspondent, signing himself "*Obednego*," respecting the cause of a number of images of a single candle being observed in a single plane mirror. Now if Obednego is still a reader of your Magazine, perhaps the following explanation may satisfy him.



Let A B represent the looking-glass, C the candle or other luminous object, F K the silvered side of the looking glass. The rays issuing from C, will first strike the glass at D, from whence part of them will be reflected in the direction, D E, and form a faint image of C; the remainder of the rays will pass on till they reach the silvered side, at F, from whence they will be reflected in the direction, F G H, and form a strong image of the candle C.—A small portion of them will, however, be reflected back from the upper surface, at G, to K, and from thence will be reflected towards M, and form another much fainter image of C. A part again of these will be intercepted at I, and form other images fainter and fainter, till the eighth or ninth, when they will be so faint as to be no longer perceptible. Thus it is plain, that the first image is very faint, as it is reflected from the surface of the glass; the second is the strongest of all, as it is reflected from the silvered side, and that, after the second, they will all grow fainter and fainter, each one than its antecedent, till they disappear entirely. It is also plain, that a metallic speculum cannot exhibit more than one image of a luminous object, since it presents only one surface. Trusting that Obednego will find this answer intelligible,

I remain, Sir,
Your obedient servant,
H. C—LL.

MR. ALLEN'S LECTURES AT GUY'S HOSPITAL.

Sir,—Nothing can give greater uneasiness to the philosopher, than to see the discoveries which his researches have brought to light, and the knowledge of facts, which, without him, would never have existed, subverted to serve the purposes of impiety, and to bring into discredit, the doctrines of religion. In your 161st number, a correspondent, under the signature of F. M. animadverts upon a lecture delivered by Mr. W. Allen, at Guy's Hospital, as tending to overthrow the doctrine of the resurrection of the dead. F. M.'s letter is a mass of confusion and contradicsion throughout; yet I cannot but regret, that any thing relating to such subjects should have found a place in the Mechanics' Magazine; though, as they have been touched upon, I trust you will allow an explanation of this question to appear in answer, that all possibility of error on this important subject may be prevented for the future.

First, then, I shall prove that Mr. Allen is perfectly right, in what he asserts concerning the changes of the elemental particles; and afterwards, that this assertion does not, in any way, tend, as your correspondent affirms, to overturn the doctrine of the resurrection.

The absurdities and contradictory statements dispersed throughout this letter, are too palpable to escape the observation of any one. F. M., after proposing his ridiculous question, ends by saying, "the answer will give us a complete refutation of Mr. Allen's chemical philosophy, according to which, a body once decomposed, is dispersed throughout the universe, and never brought together again;" while, as if to display, in as open a manner as possible, the falsity of this, his own assertion, concerning Mr. Allen's philosophy, F. M. has actually printed, in Italics, the very words of Mr. Allen's lecture, which disprove his own account of the matter, viz. "thus the body is decomposed, and furnishes elements or materials for a new generation. It is like pulling down a house and building another with the same materials;" hence it is not Mr. Allen's philosophy, that a body once decomposed, is dispersed throughout the universe, and never brought together again.

In a paragraph preceding that I have quoted, your correspondent, after deducing some results from this theory, sneeringly inquires, whether the self-same particles, which to-day form a human being, might not, in some time hence, be united in exactly the same proportion, to form another human being; and if this took place, would it not be the resurrection of the body? Upon this passage I have to observe, that such a thing, stretching probability to the utmost, might happen; yet, that these particles would form the same man that they did before, I positively deny; why they would not, I shall now explain. Every organized being, endowed with a soul, is perpetually in a state of change as to its physical body; what forms a part of my frame today, may, in a month, belong to any one else; it is the mental part, the soul, the spirit, not the physical part of the body, which undergoes no change; all the elemental particles, viz. carbon, hydrogen, &c. which now make up my *whole* body, may, a year hence, make up the *whole* body of some other person; but still that person will be neither what I am, nor what I was; my soul is the same as it was, and this it is, that makes the essential difference between man and man. Besides, if such a change of particles could be considered as a resurrection, it would lead to the absurdity of supposing, that a man might exist at one and the same time in several forms; for in the course of twelve years, the human frame probably undergoes a complete change, and if the particles thrown off from any one's body in this space of time, should happen in the end to form another human being, this being, according to F. M., would be the same as the person whose body they were in before, or that this person existed in two forms at once.

I now proceed to show, that all organized bodies are perpetually changing, that every part of us is for ever being pulled down and built up again, and that decomposition and recomposition, is the established routine of nature.

In a note on combustion, in Parke's Chemical Catechism, it is said—"of the effects of combustion it may be remarked, that animal and vegetable substances are converted into water and carbonic acid during the process, by the union of their hydrogen and carbon with the oxygen of the atmosphere, and that, in time, the same water and the same carbonic acid, are absorbed by vegetables, and again decomposed, in order to set the oxygen at liberty to produce fresh combustions, while the vegetating organs appropriate the hydrogen and carbon to promote their growth and nourishment. A regular series of compositions and decompositions, is thus perpetually going on, and all organized beings are made to surrender, in due time, to the general mass, those elementary substances, which were kindly lent them for the preservation of their existence." And in another note to the same book, "all organized beings, whether vegetable or animal, possess the materials of which they are composed, only for a limited time. At the proper period, oxygen, or some other powerful agent, effects the decomposition of the curious fabric, and sets all the elementary particles at liberty to form other equally perfect and complicated existences."

"Link after link the vital chain extends,
And the long line of being never ends."

When a person undergoes a profuse perspiration, must not the exhaustion, thus occasioned to the body, be somehow replenished; do not the nails and hair grow; and when these parts are cut, whence, I would ask F. M. is a fresh supply of them to be obtained? Is it not evident that the food is the medium by which these perpetual wastes are renewed? All the food that is swallowed is not voided again; what becomes, then, of the unvoided part? Surely a conviction of the truth must strike every observer, viz. that this part supplies the exhaustions that are continually going on, or, in other words, that the particles of food enter into the constitution of our frames. These facts have been long known and acknowledged in the scientific world; proofs, sufficient to convince every unprejudiced mind, might easily be adduced; and to hesitate in assenting to their truth, is to disbelieve the evidence of our senses, to call in question the science of a Davy, and to doubt the abilities of a Home. That these facts do not militate against the doctrine of the resurrection it is not difficult to establish. Concerning the way in which this event will take place, and with what bodies we shall be raised, the scriptures only give us some general information. Christ, in answer to the Sadducees, (Luke, ch. xx.) who, disbelieving the resurrection, questioned him concerning it, says, that the good shall be incapable of death, and similar unto the angels; and St. Paul, (1st of Corin. ch. xv.) in reply to those who asked, "with what bodies the dead should come," declares that at the resurrection, we shall not have such bodies as we have now, for "flesh and blood" are not adapted to taste the spiritual pleasures of heaven. Abp. Secker has some excellent observations on this passage in St. Paul, very apposite to my present purpose. "On the inquiry that follows, 'with what bodies do they come?' we are taught, they shall be so far the same bodies, that every one shall have properly his own, and be truly the same person he was before; but so far different, that those of good persons will be subject to none of the sufferings, none of the infirmities of this life. But the particular nature of spiritual bodies, or the distinction that shall be made in them, between the more eminent in goodness and their inferiors, these things we are not qualified, in our present state, to understand." Hence we may be certain, that our bodies, at the resurrection, will not be as they are now, made up of particles of carbon, hydrogen, &c. combinations of such substances being subject to corruption; consequently, the discoveries which we may make concerning the forms and modifications which these particles assume, have nothing at all to do with the resurrection. St. Paul may be supposed to say, without any perversion of his meaning, "bodies made of carbon, hydrogen, &c. are not suited to enjoy the pleasures of heaven." I hope the foregoing argument will satisfy your correspondent, that Mr. Allen's philosophy has no tendency to overturn the doctrines of Christianity; that he will subscribe to its truth, in place of attempting to turn it into ridicule; and be assured that,

"Organic forms with chemic changes strive,
Live but to die, and die but to revive;
Immortal matter braves the transient storm,
Mounts from the wreck, unchanging but in form."—DARWIN.

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[Another reply by C. I. to F. M. in our next.]

SINGULAR MAGNETIC EFFECT.

Sir,—One of the most interesting subjects for investigation in the science of electricity, at its present state of advancement, is that of discovering the connexion between it and magnetism. That they stand in close affinity to each other, is obvious;—what that relation is, whether of cause and effect, or whether magnetism is, in fact, a state of the electric fluid, *per se*, is a query not very easily solved, but which affords an ample field for the investigations of experimenters. In a late experiment, I rendered a bodkin sufficiently magnetic to raise a small needle, by merely employing a small jar. I will state the experiment and add a query, which I shall thank any of your readers to solve.

I made a coil of small flexible iron wire, and into it I introduced a bodkin, just the length of the coil; I then discharged several shocks of a jar, by no means strong, through it, and the bodkin became magnetic.*—How was the coil effectual in producing magnetism?

Your's,
INQUISITOR.

CONDUCTING POWERS OF SALT AND PURE WATER.

Sir,—I have always understood it to be an acknowledged fact amongst electricians, that salt water is a readier conductor of the electric-fluid, than pure water:—This I am much inclined to doubt. Salt is an inferior conductor to water; therefore, when the electric-fluid passes through a solution of it in water, the resistance which the saline particles offer to the passage of the electric-fluid should be greater than that which the water, in a separate state, would oppose, and, consequently, its progress should be retarded.

Your's, &c.
LECTOR.

SELF-ACTING VENTILATOR FOR GARDEN FRAMES.

Sir,—Every person having a garden must, with the writer of this, regret that we have no contrivance for ventilating garden frames, besides the awkward wedges used to raise the windows or lights; which, by neglect or ignorance, remain frequently so long open, that the plants perish; nor can this mode determine the requisite degree of heat. For hot-houses, self-acting ventilators have been invented, by Mr. Mugliston, and John Williams, Esq. It has occurred to the writer's mind, whether a funnel, fixed in one of the lights, would not, in some degree, answer the purpose; the large end to reach deep in the frame, to receive the heated and impure air; and the pipe to discharge it; this is all I can invent. How to add a valve, to regulate the heat, I must look to some of your ingenious correspondents to devise and explain.

W. I.

ELECTRICAL TELEGRAPH.

A correspondent of the Register of Arts proposes to effect an instant communication between distant places, by means of sound produced by the collision of bodies in opposite states of electricity; and illustrates his scheme by the following example. "Let a metallic wire, coated with a non-conducting substance, be extended under ground between any two given places, which, for the sake of experiment, may be two separate apartments in the same house: one of which may be denominated A, and the other B. In the apartment A place an electrical machine, and to the extremity of the wire in B a little ball, suspended by means of a very slender chain, within whose sphere of action there is a common bell. Now, by connecting the wire in A, with the conductor of the machine, the electric fluid will pass instantaneously along it, and charge the ball in B through the medium of its little chain, which flies off immediately to the uninsulated bell, to discharge its surplus of electric matter, and recover its equilibrium. The force by which it is attracted or impelled towards the bell is quite sufficient to produce the sound required; it is an experiment which I have often made, and with invariable success. Let this bell be numbered 1, and have a series of them up to 10, with separate and distinct metallic conductors, it is evident to a demonstration that, by a combination and the successive excitement of these simple numbers, the whole of those at present made use of in our most improved telegraph and signal books, together with their corresponding meanings, may be conveyed from the apartment A to B with the greatest accuracy, and with the speed of thought." "Thus," he adds, "by this simple and inexpensive means, (by two electrical machines and a double series of wires with their

* The same effect did not follow from passing shocks through a bodkin *without* the coil.

appendage,) say between Portsmouth or Plymouth and London,—news of the greatest political importance may be conveyed in a few minutes, by a gentleman connected with the apparatus at either of these places; he has only to excite the wires which correspond to each individual number of the telegraph made to him by the common flag signal, which will, in almost the same instant of time, affect their corresponding bells in London, and give the necessary intelligence in a series of numbers, whose symbols will be found by referring to the signal books now in use."

The idea of employing electricity as a means of communication between distant places, is not new. It was broached more than a year ago, by one correspondent of the Mechanics' Magazine, and, afterwards, well supported by another. (See vol. iv. pp. 148-178.) The only novelty in the present proposition is, the application of the electrical shock to the ringing of bells. The first of our correspondents proposed to take note of the strength and number of the shocks only; the second suggested, that six wires (corresponding with the six shifting boards of our present telegraph), should terminate in a dark room, and be brought in contact with six figures, 1, 2, 3, 4, 5, 6, affixed to one of the walls and prepared in tinfoil, according to the method practised by electricians in forming what are called *luminous modes and figures*. The last method appears to us the best; light being a more certain indicator than either sound or touch.

PURIFICATION OF THE ATMOSPHERE OF LONDON.

Sir,—I perfectly agree with what is stated in No. 163, page 361, article, Miscellaneous Hints, as to the necessity of endeavouring to render the atmosphere of London more pure, for the sake of the buildings, the health of its inhabitants, and comfort of occasional visitors. Mr. M. A. Taylor's Act, to which your correspondent refers, was passed, I believe, before any means were discovered to enable brewers, soap-boilers, &c.; to consume the smoke of their furnaces—nor do I know that there is any simple and effectual means of doing so, yet discovered.

The requisites are simplicity, economy in fuel, and machinery not expensive in erection or application. The revolving grate is but in few instances applicable, and very expensive. I have seen several where the fresh atmosphere is admitted, but which are not now used, as much more fuel is required. If F. M., or any of your correspondents, will take the trouble of drawing the attention of the public to the most approved methods of effecting so desirable an object, many would be glad to adopt them, and the obstinate might have the assistance of M. A. Taylor's Act to compel them.

I am, Sir,
Your obedient Servant,
J. G.

DRYERS IN PAINTING.

Sir,—Allow me to ask, through the medium of your Magazine, what is the difference between sugar of lead, and white copperas, when used as dryers in paint?

In what are they to be preferred?

What quantity is to be used, to a given quantity of colour?

If some of your correspondents would furnish some hints upon the principles of drying, (which are but imperfectly known among house painters,) they would oblige generally, and particularly,

A Young Country Painter.

October 19th, 1826.

BOILING TAR.

Sir,—I have somewhere seen it stated, that it is possible to put the hand into boiling tar without any disagreeable effect; and, that tar at 220°, does not affect the feeling so much as water at 140°. Perhaps some of your readers may have made the experiment—I should be glad to see it explained.

G. W.

SUBSTANCE OF A SPEECH DELIVERED BY DR. O. GREGORY, AT THE FIRST ANNIVERSARY OF THE DEPTFORD MECHANICS' INSTITUTION.

(Concluded from page 462.)

Your Institution has now existed and *flourished*, beyond your anticipations, more than a year.

Now, let me ask, and I ask without doubt or hesitation, have any of the evils, which were predicted by some, grown out of your association? Can any one, who has had an opportunity of witnessing the course of action of your members, affirm, that he finds you less correct in your morals or your language, less temperate in your habits, less industrious, less contented in your respective stations, than you were before? or, do any of you *feel* this to be the case? No: I am persuaded you do not; for that is not the legitimate effect of even mere intellectual application, which, so far as it operates, may be expected to check the grosser sensual propensities; and there is no reason in the world, because you have evinced an anxiety to acquire human knowledge, that you should be regardless of knowledge of a higher order, knowledge which, while it illuminates the understanding, impresses the heart, and effectually regulates the conduct.

From your fourth quarterly report, I learn, that, besides the instruction in your schools of rudimental knowledge, from which several of the Dock-yard apprentices and others have derived so much advantage, there have been delivered to the Institution, generally, *forty* lectures, of which, it is gratifying to remark that *fifteen* have been given by some of your own members.

Dr. Gregory here presented a recapitulation of the subjects of the lectures, enlarging most upon those which seemed more immediately connected with mechanical pursuits. Thus, in reference to the science of *mechanics*, he dilated upon the properties of the mechanical powers, the nature and application of the principles of the centre of gravity, the parallelogram of forces, the strength and stress of timber, and other materials, the nature and correlation of thrust and pressure, the equilibration of structures, the principles of roofing and centering, the application of the diagonal truss to ship building, the vibrations of pendulums, the laws of falling bodies, and the fixed relation between the length of a seconds pendulum and the space descended in one second by a body falling freely in any latitude, shewing that the latter is, universally, nearly five times, or *accurately*, 4·9348 times the former. In developing the laws of hydrostatics, he explained the equality of the perpendicular pressure of a liquid upon any surface, vertical, horizontal, or oblique, with the weight of a prism whose base is the surface pressed, and altitude the vertical distance of the centre of gravity of the surface pressed from the upper surface of the liquid. He marked the application of this proposition to the pressure on sluice gates, &c.; and gave, as a simple measure of the pressure of water, *thirteen* pounds avoirdupois on a square inch, at the depth of *thirty* feet, a measure easily remembered, the first syllable of each word being the same, and easily applied to other depths by taking the pressures in proportion to the depths. In speaking of *specific gravities* he pointed out the advantages which result from the striking fact, that *a cubic foot of pure rain water weighs a thousand ounces avoirdupois;* a remarkable peculiarity, in consequence of which, the numbers in our tables of specific gravity, become accurate measures, in ounces, of the weight of a cubic foot of the substances to which these numbers respectively belong. This beneficial result appertains to the English foot *alone*.

Dr. Gregory then briefly recapitulated the principles of Hydrodynamics and Pneumatics; the velocity of effluent water, the pressure and elasticity of the air, the variations of atmospheric pressure of different altitudes, the principles of the steam engine, and some of the more interesting experiments with the air pump.

He next explained the principles of astronomy, the nature of the Copernican system, and the beauty and harmony manifest in the planetary motions; and suggested an argument for the twofold motion of the earth, which is simply this:—It is evident from astronomical observations, that the sun *appears* to move entirely through the circumference of a circle, in the plane of the *ecliptic*, once in a year: it is equally evident, from observations, that the sun *appears* to describe a complete circle, every day, in a circle parallel to the *equator*, or in the *equator* itself: it is quite impossible, in the nature of things, that the same body can move at the same time in two different paths, and with two different velocities; but it is possible that a body, while it moves in the circumference of a circle, may turn upon its own axis: the latter, therefore, contradicting no principle of sound philosophy, and being adequate to the solution of the phenomena, must be assumed as true,—there being no intermediate hypothesis.

The Doctor next adverted, in the same recapitulating manner, to the properties, the probable mutual relations and dependencies of heat, cold, electricity, &c., and the variations of expansion and contraction, resulting from changes of temperature. He then remarked that the most powerful agents in nature, as fire, light, air, electricity, magnetism, gravity, were all invisible, except as some of them, fire and light for example, were exhibited to the senses by ignition, and other processes and combinations: and the knowledge of so singular a fact, he observed, cannot be dangerous, because it leads to the obvious inference, that, since the most powerful and universal agents in nature operate *unseen*, there may be a God of nature, infinitely powerful, as well as infinite in all his attributes, though neither He nor they are fully discernible but by the eye of faith.

Dr. Gregory then proceeded thus: 'Allow me to recommend to you two more classes of lectures. One of them should be on popular anatomy, the structure of the human frame, the nature, mechanism, and uses of bones, joints, ligaments, muscles, membranes, nerves, blood-vessels, &c.: the circulation of the blood, the extraordinary provision for keeping up that circulation after amputation, digestion, the symmetry of the human frame, the system of compensations, and that of prospective contrivances in the structure of man and animals. The same course might comprehend the general characteristics of health and disease, and the operation with reference to either of air, exercise, different kinds of employment, clothing, cleanliness, food, different modes of cooking, &c., the danger of quackery, and the nature, value, and efficacy of some of the simpler remedies.

'Here, again, if you should not be so fortunate as to obtain the aid of a gentleman of competent anatomical knowledge, and of popular talents, as a lecturer, you may, with perfect safety become your own instructors, according to the plan which I ventured to suggest to you twelve months ago. There might be read, select portions of *Paley's Natural Theology*, and the whole elucidated by enlarged drawings from Mr. Paxton's *Elegant Illustrations* of Dr. Paley's work, lately published. With regard to the medical department of this course, I think, too, that you might safely avail yourselves of selections from *Jennings's Family Cyclopedia, and Parkinson's Medical Admonitions*. If, however, some medical friend would kindly undertake to make the selections from the latter mentioned works, your progress would be more safe, and therefore more beneficial.

'The remaining class of lectures to which I would earnestly invite your attention, should relate to *Biography*, especially the biography of men who have become eminent as artists, anatomists, mechanics, manufacturers, engineers, &c. It has been remarked, by an eloquent friend, that the "moral history of *a beggar*, which faithfully revealed the interior movements of his mind, and laid open the secret causes which contributed to form and determine his *character*, might enlarge and enlighten the views of a philosopher; and that whatever tends to render our acquaintance with any portion of our species more accurate and profound, is an accession to the most valuable part of our knowledge." The degree of interest and instruction will always bear a proportion to the resemblance in circumstances, profession, and incident, between the individual delineated, and the reader or auditor; yet, in *all* cases, a faithful and minute record, including, if possible, all the local and other circumstances, which contributed to the developement of genius, the formation of character, or gave scope to the powers of invention, cannot fail to be productive of good.

'Should you distribute the task among yourselves, you might, with regard to Englishmen, adopt the topographical order of the counties. And, if you were to commence with our own county, Kent, there occur to me, among the names of natives, those of Lord Chancellor *Hardwick*, and Sir *Francis Walsingham*, statesmen; and General *Wolfe*, a renowned hero, a native of Westerham; *John Evelyn*, a native of Deptford: *Woollett*, an eminent engraver, born at Maidstone; Dr. *William Harvey*, the discoverer of the circulation of the blood, born at Folkstone; Dr. *Linacre*, an eminent physician, born at Canterbury; Dr. *Goddard*, one of the founders of the Royal Society, born at Greenwich; and Dr. *Monro*, another eminent physician and anatomist, born also at Greenwich. The train of incidents through which such men have passed, suggest to those who become acquainted with them, a variety of analogies and comparisons, highly conducive to intellectual decision and progress.

'Perhaps I ought not to conclude without hinting at remaining opposition, and the good which may result from it. Consider, then, what that was useful, curious, or new, has not been questioned or opposed? The Copernican system, the spots on the sun, telescopic discoveries, microscopic discoveries, the seven colours into which a ray of solar light is resolvable, the change of "style" in the calendar, the practise of inoculation, that of vaccination, the enclosure of waste lands, the cutting of a new canal, indeed, every intended benefit to mankind, and *most of all opposed, the greatest of all blessings*. All this, though it is sometimes productive of lamentable effects, grows out of a wise and happy constitution of our nature, in virtue of which, every thing new is subjected to the severest scrutiny; its supposed or real advantages and disadvantages are weighed in the balance of the most deliberate and extensive judgment; that which is sound, manly, liberal, and useful, succeeds; that which is fallacious, frivolous, or puerile, shrinks from the test, or crumbles away under it; the bounds of practical, scientific, or moral truth, become enlarged, and real good is secured and perpetuated.

Bear these deductions in mind, and recollect, also, this fact, with regard to institutions for the diffusion of knowledge, that every meditative man, of good common sense, gives his own children the best education in his power to furnish or procure: for if every individual is persuaded this is his duty, with regard to his own children, there is an end of the question, unless the preposterous idea be tolerated, that every man may better know what another ought to do with his children, than he can himself;—or, the equally preposterous idea that it is not the duty of a man, of mature age, to supply the deficiencies of his early education. Call to mind, also, the universally attested fact, by persons engaged in tuition, whether in private or in public seminaries, in schools for boys, or in colleges for men, that the most studious are the most exemplary; and then banish all fear that you should be made worse by becoming wiser.

'You do not profess that mechanics' institutions will effect pure unmixed good; for even religious societies, notwithstanding the excellency of their tendency, and usually the excellency of their management, do not accomplish that; but you expect that they will do *much* more good than harm.

'Nor do you profess to instruct the *whole* population, as is often objected, but to instruct those who have a desire for improvement, and to whom the knowledge imparted by the institution may really be beneficial. If "ignorance be bliss," you have, so far as *your* labours are concerned, left 49-50ths of its inhabitants to enjoy quite as much of that felicity as they had before. Nor do you profess to make every carpenter, wheelwright, or smith, a philosopher, as again is often objected; but where one or more, engaged in such employments, evinces by his conduct and by his solicitude, that God has given him a capacity for scientific pursuits, or for any department of beneficial enquiry, you invite him to the aid of your institution, to facilitate his course.

'In conclusion, then, I would simply exhort you to steady perseverance in the path which you have so laudably commenced; and to such a course of action as shall ensure the esteem of your neighbours, and excite them to imitation. Tell them that you now find, what you only believed before, that *as the worn key becomes brighter*, so the mental as well as the bodily faculties strengthen by exercise—that by studying the principles of the arts, which you daily practice, you have learnt something of the nature of the operations which you perform; that you hence feel yourselves elevated in the scale of rational beings, and are animated by a growing desire to be useful; that man is in his nature an *improveable* being, and that each of you is anxious to furnish in himself a confirmation of it;—that man is also a *social* being, and that you will, with God's blessing, apply your knowledge of every kind, not merely to selfish advantage, but to a more conscientious discharge of all the social relations, whether private or public; and thus contribute, so far as in you lies, to the augmentation of the national stock of happiness, prosperity, and peace, as well as to its stock of mechanical knowledge, of b[illegible] of practical skill[illegible]

ON INCREASING THE FLAME OF FUEL AS APPLIED TO STEAM BOILERS.

Sir,—I should think, that from analogy, we may regard the steam, or elastic fluid engine, as being yet in the infancy of its construction and application. We may therefore expect, very soon, to see the huge furnaces and boilers, now used for the generation of steam, at so great an expense of fuel and of room, superseded by a more economical and compact contrivance.

As, however, most of the engines, at present in use, are worked with such great boilers and furnaces, I will trouble you with an idea of mine on the subject, on the mere chance of its possibly having some practical utility in it, of which, most of your readers will be better able to judge than myself.

I am told, that the most efficacious mode in which heat can be applied to the boiler, is that of *flame*. That fuel, therefore, is the best, which, in a given weight and bulk, will produce most *flame*.

In the steam-engines I have had an opportunity of inspecting, part of the incandescent coal or coke is raked out of the furnace as soon as it ceases to give out *flame*. This suggested to me the idea, whether oil, fat, or coal-tar, might not, under particular circumstances, be injected into the fire-place, so as to keep up an abundant *flame*, to which the glowing coke would serve as a kind of wick? The injection might be performed by the engine itself, through several little beaks in the sides of the furnace, subject to the complete control of the engineer.

Would not one cubic foot of oil, or tallow, or tar, produce more flame than a cubic foot of coal? Might not a steam vessel, on certain occasions, economize her coals by some such substitute?—Might not such a vessel, upon falling short of coals, be, per[illegible]il, fat, or tar, to eke them out, and complete her voyage?—May not fat, oil, or tar be met with in many situations where coal is not to be had?—Even at sea a whale ship might supply oil enough for a long voyage, or a steam-vessel might even catch some of these fat cetaceous tribe herself. Might not wood, which is to be had on every coast, with the timely application of any of the above combustible fluids, be made to furnish more *flame* than an equal bulk of coal?—I mean, whether a cubic foot of wood, and another of fat, would not produce more *flame* than two cubic feet of coal?

I am, Sir,

Your obedient,

F. M.

NOTICES TO CORRESPONDENTS.

The letter of Philo-Birkbeck, promised in our last, is withdrawn at the request of the writer.

The continuation of "Practical Perspective" has, through the delay of the Engraver, been unavoidably deferred, but will be resumed in our next.

If H. H. will favour us with the remainder of his paper on the doctrine of Proportion, it shall have an early place in such weekly portions as we can find room for.

Mr. G. Smith's paper has been received, and is intended for insertion.

J. A. A. will do a service, by forwarding the information he possesses.

Communications received from Nathan Short—G. M. J.—F. M.—X. X. Miss S. P.—W. B., Jun.—Verax—Mercator, (who shall have an answer soon,)—M. H. S.—W.—C. K.

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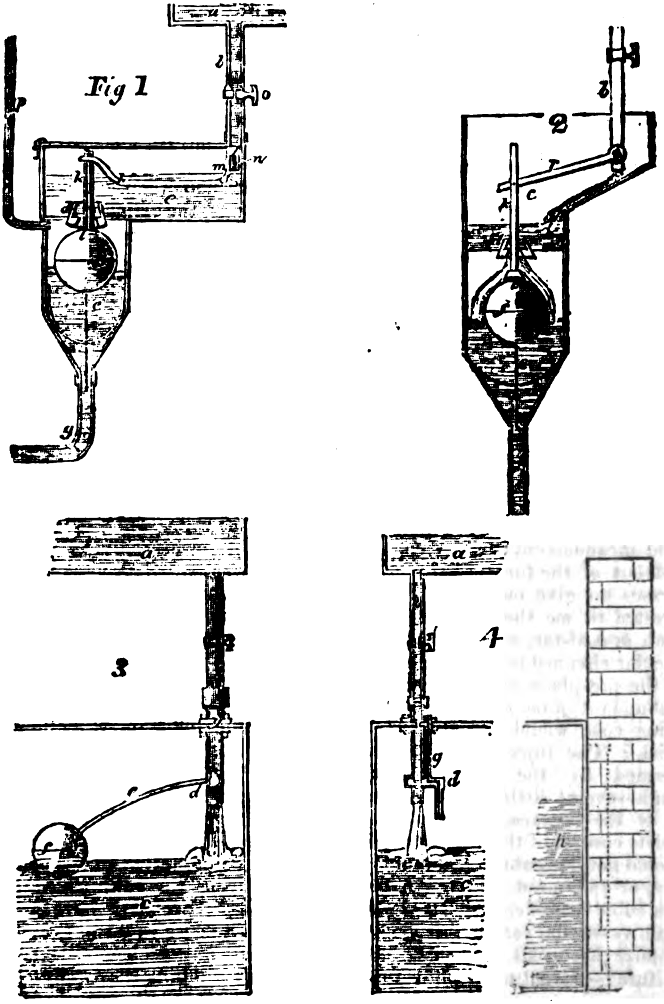
"A genius and great abilities are often wanting, sometimes only opportunities. Some deserve praise for what they have done, and others for what they would have done."

BRUYERE.

JEAKS'S APPARATUS FOR REGULATING STEAM BOILERS.



JEAKS'S APPARATUS FOR REGULATING THE SUPPLY OF WATER IN STEAM BOILERS.

The usual mode of regulating the supply of water admitted into tanks, cisterns, boilers, or other vessels, and of shutting it off as the vessels become full, has been by attaching a hollow metal ball as a float to the cock of the supply-pipe, by means of an arm or lever, which rising with the float, closes the cock of the supply-pipe as the water ascends to the top of the vessel. When this sort of hollow ball is introduced as a float into a steam-boiler, for the purpose of regulating the supply of water, the very considerable heat of the steam expands the air within the hollow ball, and frequently rends it open, under which circumstances the water gains access to the interior of the ball, and thereby destroying its buoyancy, renders the apparatus of no use.

To remedy this defect, the present invention of Mr. Jeaks, of Great Russell-street, Bloomsbury, is proposed, and consists first of a hollow arm or rod, carrying the float-ball, by which means as the temperature becomes raised, the rarified air within the ball finds vent through the hollow arm into the atmosphere, and as the temperature lowers, the surrounding atmosphere finds its way into the ball.

Fig. 1, represents a section of the improved apparatus, consisting of a supply-cistern, with its pipes, float, lever, and other appendages as connected to the boiler of a cooking apparatus. *a* is a reservoir of water placed in any convenient situation; *b* is the supply-pipe from which the water flows into the supply-cistern *c*, and thence through a valve *d*, into the cylinder *e*, where the ball *f*, floats. At the bottom of this cylinder a pipe *g*, is attached which conveys the water into the boiler *h*. To the stem of the float *f*, the disc *i*, is affixed, and by its rising and falling the valve *d*, is shut or opened. As the water flows in the cylinder *e*, to the same height as in the boiler *h*, it follows that whenever the water is low in the boiler *h*, the float *f* will descend and the valve *d* be opened, so as to permit the water to flow through the valve into the cylinder, and thence through the pipe *g*, to the boiler. By there means the water will soon rise to its proper level in the boiler, and the float at the same time rising also in the cylinder, will close the valve and prevent any further accession of water.

To *k*, the upper part of the stem of the float, a long lever *l*, is connected, which moves upon a fulcrum-pin in the arm *m*; the shorter end of this lever acts against a pin with a conical top *n*, and as the float-ball descends opening the valve *d*, the longer arm of the lever *l*, descends also, and causes its shorter arm to lift the valve *n*, and permit the water to flow from the pipe *b*, into the supply-cistern *c*, and thence through the valve *d*, to the cylinder *e*, and ultimately to the boiler; but when the float rises, the cone *n* is permitted to fall and close the valve. There is a stop-cock at *o*, for shutting off the water in the pipe *b*, whenever the apparatus requires to be removed for repairs or from any other cause.

The pressure of the steam within the boiler acting upon the surface of the water, will sometimes, by its force, cause the water to return through the pipe *g*, and fill the cylinder *e*; the valve *d*, however, being closed, the water will rise in the pipe *p*, until the weight of the column of water exactly balances the pressure of the steam. Supposing the boiler to be heated so that the steam shall exert a pressure of 1 lb. on every superficial inch, then the column of water *p*, will rise to the altitude of 36 inches. Under these circumstances the hollow metal ball or float *f*, will be enveloped in boiling water, by the heat of which, the air within will be expanded; the ball however having an opening through the hollow stem *k*, to the atmosphere, the air will be permitted to escape without injuring the ball, which if confined might probably have burst it open. In order to guard against the water by any accidental leakage of the valve *n*, filling the supply-cistern *c*, a small waste-pipe is introduced into the cistern, the top opening of which is a little above the proper level of the water.

Fig. 2, shews a similar cylindrical cistern *e*, float-ball *f*, and valve *d*, to those represented in fig. 1, the supply-cistern *c*, varying slightly in form from that in the former figure. This is to exhibit a different mode of regulating the flow of water from the supply-pipe *b*, to that adopted in fig. 1. Here the water passes from the pipe *b*, through an ordinary cock, upon the square end of which the lever *r*, is affixed, and passing through a slit in the stem *k*, rises and falls with the float-ball, by which means when the level of the water in the cylinder rises sufficiently high, the valve *d*, is closed by the disc *i*; and also the cock of the pipe *b*, shut by the rising of the lever *r*.

Fig. 3, represents one of the improved ball-cocks when placed within a boiler; and fig. 4, is a section of the pipes and cock as in the preceding figure, shewing their internal passages, the same letters referring to the same parts respectively in these two figures.—*a* the reservoir of water which supplies the boiler; this should be of such height that the column of water contained therein will at all times overcome the force of the steam; *b* the supply-pipe, *c* the boiler, *d* the cock, *e* the arm or lever which turns the cock, *f* the hollow metallic ball-float. The rising of the surface of the water in the boiler causes the float *f* to lift the arm *e*, and shut the cock *d*, as in ordinary ball-cocks; but as the air within the ball will expand by the heat of the steam surrounding it, there would be a tendency of the ball to burst, as before mentioned. This, however, is prevented by the hollow arm *e*, through which the rarified air escapes from the ball and passes, by means of a longitudinal passage in the cock *d*, to the vent-pipe *g*, placed by the side of the supply-pipe *b*, and opening into the atmosphere.

PALLADIUM.

On the discovery of this metal, some doubts were entertained as to the reality of its existence, and a paper was read before the Royal Society, entitled, "Some Account of a pretended New Metal, offered for sale and examined, by Richard Chenevix, esq." In this paper, Mr. C. questions its existence as a simple metal, and endeavours to prove the validity of his doubts. This metal had been offered for sale, by some unknown person, through the medium of a Mrs. Foster, of Gerard Street, and, on the publication of the above-mentioned doubts, a challenge was given, and a reward of 50l. offered to any one who would make only 20 grains of real palladium, before any three gentlemen chemists. In consequence of this, a committee was appointed, consisting of Mr. Nicholson, Mr. Hatchett, and Mr. E. Howard. Subsequently, Dr. Wollaston acknowledged himself to be the author of the challenge.

CONDUCTORS OF ELECTRICITY.

Sir,—In your last No. you have inserted a letter in which I expressed a doubt respecting salt-water, as a conductor of electricity; I would now enter a little on the increase of capability which electrical conductors receive from heat. Every experimenter must have observed that a jar, when warmed, is capable of containing a much greater quantity of the electric-fluid than when cold.—This may be accounted for thus, I think:—The air contained in the jar becomes rarified by the heat, and the electric fluid, not only is retained by the metallic coating, but, also, fills the jar with an electrical atmosphere, supplying the place of the partial vacuum; whereas, when the jar is cold, the electric-fluid meets with an opposition from the atmospheric air, and can only be retained in the metallic coating. Breathing in a jar is found efficacious in increasing its capability for receiving and holding a charge of the electric-fluid; this is obviously from the particles of moisture which are breathed into the jar, and form a conducting medium which retains the electric fluid, thereby accumulating a greater quantity.

The addition of caloric acts in the same manner upon water as it does on the atmospheric air, in expanding it, which expansion in the air, is termed rarefaction. Now, if I may use the expression in this case, I would say, that it swells and rarifies the particles of water likewise, and thus diminishes the resistance to the electric-fluid.

The resistance in water, to the progress of the electric-fluid, is offered, I imagine, by the oxygen it contains, while the hydrogen, having a great capacity for electricity, readily admits its progress. How far I may be correct in this idea, I will not presume to say, and I would only further observe, that as, by the expansion of bodies, the opposition which the electric-fluid meets with in its progress, is diminished, so, in hard solid substances, as the metals, the resistance derived from heat, is proportionably less.

I am, Sir,
Your's, &c.
LECTOR.

CALCULATION OF MINUTE PARTICLES OF MATTER.

Mr. Editor,—I take an early opportunity of thanking your Correspondent, F. M., for his very ingenious and scientific paper, in the 323rd page of your miscellany; as well as of expressing my readiness to assist him in the intricate question he proposes: and I do this the more willingly, as the subject of his enquiry perfectly coincides with my own idea of one design of your publication, which is, in the improvements of science, to furnish the surest arms against scepticism or infidelity. And as the dangerous lecture, to which your correspondent alludes, seems calculated to bring into doubt the soul's immortality, from the presumed principle of its materialism, my object will be to prove, that the same reasoning which induces that philosopher to doubt, should establish in every reflecting mind complete conviction. And I am glad that an investigation of this kind gives me an opportunity of remarking, that the wisdom which shines in your pages, is, if properly modified, of a more exalted nature, and more nearly allied to the divine, than may at first be supposed. For, I can undertake to say, that the humblest person, when endeavouring to illuminate others by some discovery in mechanical science, is engaged in a duty by no means unnoticed by the Divine Beneficence, nor uncongenial with the designs of his providence. For we are assured in the pages of sacred truth, that the *natural*, as well as the *moral* laws, by which the Supreme Being governs the world, are proposed as objects of our research and imitation. And thus, to use the words of an excellent writer * of the last century, "a happy alliance is formed between Religion and Philosophy,—between the kingdoms of nature and that of grace."

Referring to the question proposed by F. M., it would, I own, require numbers, almost themselves, reaching in extent from one extremity of the Copernican system to the other, to calculate the changes through which the constituent parts of different organized bodies may have to pass. But why should that infer the impossibility of their re-union? Even *without* philosophy, my reason would still tell me, that this and much more was possible to Him who had the work to do. But *with* philosophy, the possibility even of this, brings along with it irresistible conviction. For it is not, I am sure, unknown, Sir, to yourself, to your Correspondent, or to the gentleman on whose principles he so properly animadverts, that the principal agents, by which the Divine Intelligence governs the universe, are, in their original or component parts, generally invisible. As an instance, we know the astonishing effects of light. We know, for the fact has been made too evident to admit of doubt, that it emanates from its fountain, the Sun, with a rapidity which allows it to

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* See Bp. Hallifax's Introduction to Butler's Analogy, page 35.

reach the orbit of the earth in eight minutes of time.—We know also, by experiments, that the light of a candle, of the smallest size, can be seen at the distance of two miles; or, in more philosophical language, can fill with particles of light a sphere of four miles in diameter. How inconceivably small then must these particles be! yet every one of them appears to listen to the Creator's voice, issues from its centre in the prescribed direction,—travels with the prescribed velocity, and, without any confusion or hindrance from millions of other particles crossing the line of its course, regularly performs its required duty! Examine the atmosphere we breath. No microscope, however powerful, could ever bring into view its component particles, or explain the causes of their mutual attraction or repulsion; yet their effects we know, as well in the storms that hurry to destruction the works of man, as in the gentlest breeze of the summer's evening. Or, if your Correspondent should prefer a reasoning deduced from *visible* substances, we may take any of those works of nature, which we can, in part, follow with optical instruments. We may take as an instance, the wing of a moth or butterfly. It is known that every particle of its dust, which on the touch adheres to the finger, is, in fact, a feather fitted most exactly to its socket, and contributing to that vast diversity of shade and colouring, which gives so much interest to the insect-tribe. Viewing then, our meadows, on a summer's day, or extending our thoughts through the whole compass of animated nature, how astonishingly great must be the number of these feathers. Yet every one of these is furnished with its *quill*, as well as its *vanes*,—is balanced, polished, and adapted to the uses of the insect, with a degree of care, as if that single instance demanded the whole attention of the Creator!

And, can any numbers calculate all these? Or, on the failure of such calculation, can any doubt be reasonably formed of their existence or reality? Well, then, may philosophy stand amazed, if her calculating powers fall short in enumerating,

Through what varieties of untried Being,
Through what new scenes and changes we must pass! *

And if, in *natural* causes, neither the number nor the minuteness of the particles which compose the universe, can excite a doubt of their existence, but are easily referred to the inexhaustible power of the Creator; so, in his moral government, we have no reason but to think the same, and to suppose that, even *there*, His power is equally unlimited, especially as it has in view, the "best and most exalted interests" of man.

I am, Sir,
Your most obedient Servant,
C. I.

Brotherton, Nov. 15th, 1826.

SPORTSMAN'S CANOE.

A gentleman in the neighbourhood of Southampton (C. Warde, Esq.) has in his possession a most ingenious canoe and large gun, for the purpose of shooting wild fowl. The canoe is about 24 feet long, narrow, quite flat at the bottom, and, to use a sea phrase, is very stiff, so that a person may easily stand on her gunwale without upsetting her; she is completely decked fore and aft, and open sufficiently at midships to admit the gun and shooter only, with streaks to let up and down in case of a swell. The bow or nose, and likewise the stern, terminate in a very sharp point, firmly cased with copper. The gun is well finished, with a first-rate cocking-piece, and a beautiful stub twist barrel and a flint lock (the preference being given by the wild-fowl shooters to the flint over the percussion, because, the birds suddenly rising at the flash, present a better mark for the range of the shot), and is shot

* Addison's Cato.

from a swivel, to which is attached a strong spring to receive the recoil that naturally arises from the discharge of so large a gun, the barrel being eight feet long, and weighing nearly 70lb. So ingeniously is the canoe built, that she is scarcely perceptible at a short distance, from being painted white, and scarcely eight inches above the surface of the sea; and, together with the gun, oars, and man, it draws only three inches of water.

PRACTICAL APPLICATION OF AEROSTATION BY THE FRENCH ARMIES.

A writer in a recent number of a continental publication, recals the public attention to the subject of balloons, and expresses a persuasion that that invention will, on some future day, be considered as of much greater importance than it has hitherto been. He subjoins a description of the use which was made of balloons in the earlier periods of the revolution, contributed by an old officer, of the name of Coutelle, who at that time was appointed captain-commandant of the balloon corps; and a transcript of a manuscript memoir on the same subject by M. Meunier, an officer of engineers, and a member of the Academy of Sciences. Some of the most remarkable details are as follow:—

A proposal having been made to the Committee of Public Safety, to employ balloons with the armies, for the purpose of observation, it was accepted on condition that sulphuric acid should not be employed in their inflation, sulphur being scarce and necessary for the fabrication of powder. The means resorted to, were to obtain the gas by the decomposition of water on hot iron. A large apparatus for that purpose, and a balloon 27 feet in diameter, were constructed by M. Coutelle, whose experiments on the subject completely succeeded. He was sent to the French army under General Jourdan, at Maubeuge, and ascended repeatedly to the height of 270 fathoms, (the length of the cords by which he was retained) which gave him an opportunity of observing all the movements of the enemy. On several of these occasions he experienced great danger from the violence of the wind; and, in one instance, was fired at three times during his ascent, the balls passing so near to the balloon, as to induce him to fear that they had perforated it. The victory of Fleurus was, in a great degree, attributable to the advantage which the French derived from the communications made to them by M. Coutelle, from his aerial station, of the manœuvres of the hostile army. From what reasons does not appear, but the use of balloons in military operations was soon after discontinued.

M. Meunier's memoir is curious. Proposing to himself nothing less than the power of making very long voyages, he had, of course, to consider the means of sustaining the shocks of strong and adverse currents of air, of stopping and anchoring, of raising himself, and remaining at a convenient elevation, of moving in a calm, and of modifying the direction and speed of his progress. Again, as none of the materials of which air-balloons are composed are absolutely impermeable by the hydrogen, it was indispensable to discover how to retain the gas, or to repair its loss. It remained to determine the size and shape of a balloon, that should be capable of transporting the apparatus, the observers and their instruments, and a quantity of provisions necessary for the longest voyage they might be required to undertake. This skilful mechanic conquered a number of the above difficulties by putting a second cover on his balloon. This outer cover was of linen, not permeable by the atmospheric air. Between the two covers there was a considerable space. A pipe, of the same fabric as the outer cover, communicated between that space and a forcing pump fixed in the car. By means of this pump, the air between the two covers could be condensed, the volume of the hydrogen diminished, and thereby the mean specific gravity of the fluid contained in the balloon increased. As the cover was scarcely extendible, and as the cords on its outside would not allow it to change its shape, the volume of the balloon varied very little, while its weight increased or diminished according to the mean specific gravity of the two gases which it contained. Thus, when the aeronauts were at a great elevation, all that it was necessary to do in order to descend, was to work the forcing-pump, by which the weight of the atmospheric air between the covers was increased, so that the balloon would not remain suspended except in denser, that is to say, in lower air. Ballast was thereby rendered unnecessary. When it was required to ascend, the opening of a valve allowed the compressed atmospheric air to escape. By this ingenious contrivance, the aeronauts were enabled to regulate their distance from the earth; and, as the currents of air at different degrees of elevation frequently run in opposite directions, to get into that current most favourable to the object they had in view. In calms, they made use of oars, by which, however, they could not advance themselves above a league in an hour. The writer seems to think that it would be possible, with such a machine, to reconnoitre the interior of Africa, without being exposed to any of the evils which have hitherto proved so fatal to travellers in that country!

WINTER FOOD FOR COWS.

M. Chabert, the director of the veterinary school of Alfort, had a number of Cows which yielded 12 gallons of milk every day. In his publications on the subject, he observes that cows fed in the winter upon dry substances give less milk than those which are kept upon a green diet, and also that their milk loses much of its quality. He published the following receipt, by the use of which his cows afforded him an equal quantity and quality of milk during the winter as during the summer,—Take a bushel of potatoes, break them whilst raw, place them in a barrel standing up, putting in successively a layer of potatoes and a layer of bran, and a small quantity of yeast in the middle of the mass, which is to be left thus to ferment during a whole week, and when the vinous taste has pervaded the whole mixture, it is then given to the cows, who eat it greedily.

DRAINING LAND—LARCH BARK.

Sir,—In your number of 11th of February last, there is a letter containing enquiries on the subject of draining land, that I should have thought of sufficient consequence to attract the attention of some of your intelligent contributors. Being a native of the west, where the system of draining, there adopted, corresponds precisely with that described by your correspondent, I felt a personal interest in the answers which might have been expected; but the total silence of your work on the subject, evinces an incapability, (for I will not impute to your correspondents an indifference towards so important a subject) to afford any solution to them.

In the following number for 18th of February, there are several enquiries by the same correspondent regarding the qualities and value of larch bark. This is a subject of great and increasing consequence, both to the possessors of larch plantations and the community. Doubtless many of the contributors to your useful publication can say something on it that would be satisfactory to that writer, to myself, and your readers in general; and urging its great importance as my only apology for calling the attention of your contributors to it,

I am, Sir,
Your's obediently,

Temple, 8th November, 1826. W.

PRACTICAL PERSPECTIVE.

(Continued from p. 442.)

To draw the elevation and plan of a cylinder, first ascertain its position; if its axis be perpendicular to the horizontal line, (as fig. 13,) the plan will be a circle, (as fig. 14,) and its elevation, if the cylinders can be enclosed in a quadrangular prism, (fig. 17,) will be a rectangle, (fig. 18;) or if in a cube, a square, (fig. 18;) but should the axis be parallel to the horizon, the plan will be a rectangle or square, and the elevation a circle, the height of which will be equal to its diameter, (as A. B. fig. 17.)

Fig. 14, Plane.

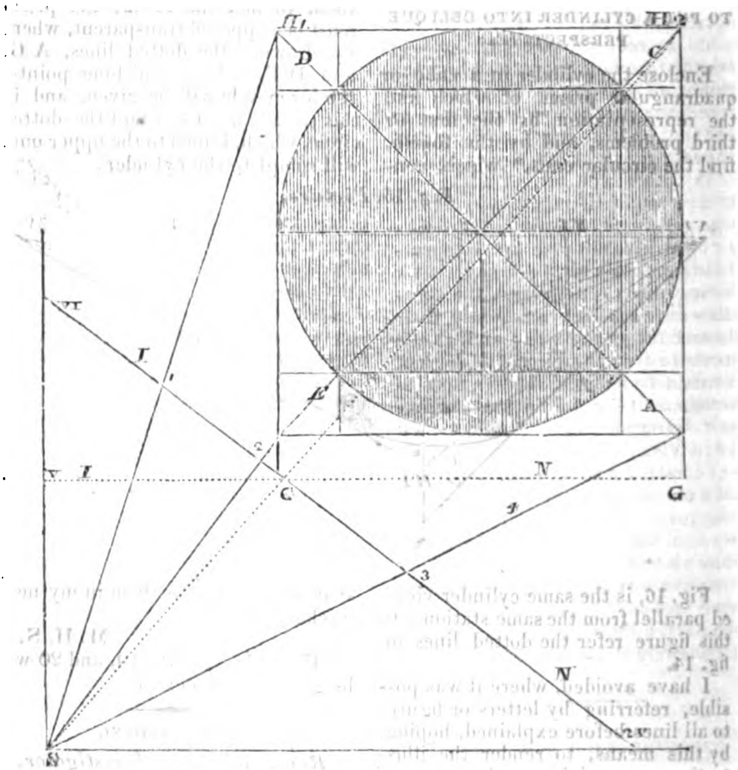


Fig. 13, Elevation.

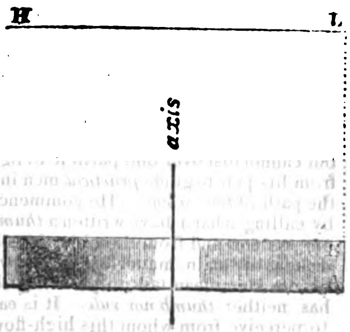
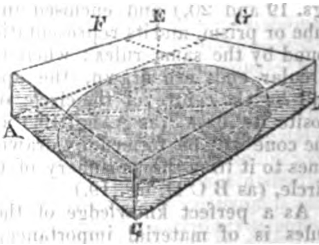


Fig. 15*, Picture.



The cube or prism, when enclosing a cylinder must, as well as the cylinder itself, be always supposed transparent, showing, if necessary, all its sides, &c. (as represented by the dotted lines in fig. 17.)

Problem 5.

TO PUT A CYLINDER INTO OBLIQUE PERSPECTIVE.

Enclose the cylinder in a cube or quadrangular prism, of which find the representation by the first or third problems, and by the fourth, find the circular ends,* which, connected together and shaded, will give the object required.

Example.

Let figs. 13 and 14 be the plan and elevation of a quadrangular prism, and A C D E, fig. 15, its oblique representation, and let the upper circle be found by problem 4; then, to find the lower, the prism must be supposed transparent, when, by drawing the dotted lines, A G, and D F, to their vanishing points, the lower side will be given, and in this (as see fig. 15*,) find the dotted circle, which, joined to the upper one, will complete the cylinder.

Fig. 15, *Picture.*

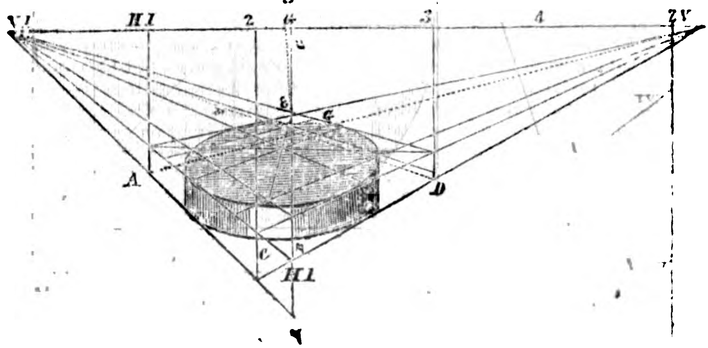


Fig. 16, is the same cylinder viewed parallel from the same station; to this figure refer the dotted lines on fig. 14.

I have avoided, where it was possible, referring by letters or figures to all lines before explained, hoping, by this means, to render the illustrations as plain as their limited size would admit of.

In conical perspective, the cone must be supposed a cylinder, (as figs. 19 and 20,) and enclosed in a cube or prism, and its representation found by the same rules; when the circular ends are drawn, the apex will be the centre of the circle opposite its base, (as A, fig. 19,) and the cone will be formed by drawing lines to it from the periphery of the circle, (as B C D, fig. 19.)

As a perfect knowledge of these rules is of material importance, I shall refer again to them in my next week's letter.

M. H. S.

[Figs, 16, 17, 18, 19, and 20 will be given in our next.]

* I say circular, though in perspective they appear elliptic.

SHIP-BUILDING.

Reply of Noah to Investigator.

Sir,—In No. 143 of your valuable work, a correspondent calling himself Investigator, has introduced himself to the public, assuming the character of a censor; but he appears to want the two great requisites, knowledge and experience. He informs us he writes for the information of *practical* men; I have read what he has written with attention, but cannot discover one particle of light from his pen to guide *practical* men into the path of *true science*. He commences by calling what I have written a *thumbing* system, and from the objections he makes to plain matter of fact, it will be no Herculean task to prove that he has neither *thumb nor rule*. It is easy to perceive from whom this high-flown nothingness' proceeds, and had I not touched on the fallacy of a certain institution of above 15 years standing, which, like many other abortions, has disappointed our best hopes, all my false principles and thumbing system might have crossed the *Atlantic* without one objection. Nay, Investigator would have condescended to give me credit for writing to the best of my *judgment*. Many remarks on ship-building have appeared in the columns of the Mechanics' Magazine, some of which have been very fallacious, yet they have gone over *Europe* without correction from the pen of this learned gentleman. Seeing, however, something like truth, free from varnish or glossary, he is afraid of his craft; the profits from the shrine is in danger. Investigator shall know that it was not a *mad fit for scribbling* that induced me to write, but a wish to introduce a few general and useful remarks on ship-building, in a plain unlettered strain, to meet the capacity of plain practical men. In reply to what he calls my "thumbing system," at another my "glaring errors," at a third my "*specious arguments*," and again, my "*false principles*," let us see how far those glaring errors, which are unworthy of my namesake, agree with a work recently published. It is a treatise on ship-building, by a foreigner, translated into English by a gentleman at the head of a naval institution in this country, which I have just had an opportunity of seeing. The translator, in his notes on the best method of construction, makes the following *thumbing* observation; (I crave his pardon, it is the language of one of his own pupils,) page 271. "Before a construction can be made, it is necessary to know the cubic feet she will displace, or their weight in tons." Noah says she is to carry 1-4th or 2-7ths above her register tonnage. Again, "it is advantageous to give the projected ship the required stability with as little ballast as possible, by reducing the displacement of the body under water." This, Investigator says, can only be done by a hollow bottom. Noah says, construct your vessel that she may be as fine under water, forward and aft, as possible. Page 273. "Nothing can enable a constructor to give the most advantageous breadth, but a careful observation of other ships of known good qualities; a straight of breadth extending as far as possible fore and aft, above and below the load water line is, no doubt, the most advantageous to a ship's stability," Noah says, after you have passed the round of your bilge, you commence your straight in midship, increasing on each line till you get to your load mark, which should be nearly straight 2-3rds of her length, for on this line is required her greatest capacity, &c. Page 275. Similar remarks are used respecting the best form for the after body and the easy passage of the water to the rudder. He says "now by carrying the greatest transverse section, (dead flat) something before the middle, the fore body becomes fuller than the after body, which gives a fine run, which is favourable both to sailing and effect of the rudder." (In this you are wholly left in uncertainty.) Noah says, the best station for dead flat is between 3-7ths and 4-9ths from the foremost perpendicular. Page 281. To sum up the whole, and leave all to conjecture, he says, "there is an infinite number of ways in which the main transverse section is drawn according to the taste and skill of the constructor." And a little further on he throws aside the *trammels of science*, and comes to the following conclusion: "Indeed, it may be questioned how far such methods are consistent with that freedom with which constructors should be able to draw, and if necessary, to alter and retouch the different curves in a draught." I have thus glanced at the analogy between those notes and Noah's directions to construct a ship. They are plain remarks, written in a style which shows that practice and observation must yet be the ultimatum in constructing of ships. (I would recommend these notes as worthy of the attention of the learner; if they were published in a cheap edition they would add to the general stock of knowledge.) Will the translator permit me to observe, that he teaches his pupils to establish every thing on fixed principles, and tolerates them in reprobating plain practical methods, let him be careful that his house is not divided against himself; for he candidly acknowledges throughout the whole of his notes, that the principal point in constructing is, that the judgment must be exercised; that every thing must give way to practice, and the known qualifications of other ships, and those ships constructed by men whom his pupils would set at naught. I have reviewed my former observations and can see nothing to correct; they are plain practical facts, written before I saw those notes, to which I would refer for their correctness. Your limits will not permit me to comment on the high-flown language of Investigator, but he shall find, if he enters further on the subject, (which by the by he has promised to do,) that I scorn not the trammels of *true science*. My wish is, that men professing themselves shipwrights, would first be practical, by which means they would be divested of that littleness of pride, which causes those just fledged from an academy to look with scorn on their superiors in useful knowledge, for this only reason, that they are operatives. I introduced myself to you, Mr. Editor, by answering a few plain questions, put by Philo-Naut, and I enlarged on the abilities and correctness of those men who built by eye. I come now to answer Investigator's theory. He laughs at my observations on the present method of casting tonnage, by stating that the depth is altogether neglected, (when prejudice preponderates some men do not mind a small slip of the tongue,) it being well known that half the breadth, whatever it may be, is the prescribed depth, that is, if a vessel, from the aft part of the keel to the perpendicular of the stem is 100 feet, her breadth 30 feet, the depth for tonnage would be 15 feet in the hold, her register tonnage 392 52-94 tons. What I contended for was, that by constructing the vessel with care and attention on those principles, keeping in view that her real burthen was to be her register tonnage only, then we should have perfect models with every qualification, and shipwreck would be little known, &c. I reprobated with Investigator the present disgraceful method of building merchant vessels. He must be a fresh-water sailor, indeed, whose last resort in a gale of wind is to batten down the hatches, and trust to the mercy of the pitiless storm. Investigator disapproves of the term "a vessel coming round in stays on a pivot," which he refines by calling it, arcs passing through the centre of gravity. Permit me to draw a simile of the action of a vessel in stays by that plain mechanical method of making an oval with two pegs and a line, that is, the centre of action passes from forward to aft through the centre of gravity till it rests at the extremity of the keel; the vessel is then about on the opposite tack. Noah *practically* knows the difference between winging the ballast and placing it level with the line of floatation. The first is to ease the rolling of the ship occasioned by the ballast being necessarily placed too low down; the latter to give the vessel all the stability possible, to enable her to carry a greater press of canvas, which Investigator says will not require much theory or argument to refute. But instead of giving either the theory or argument, he goes on to establish the fact by saying, "I agree with Noah that row-boats, gigs, and galleys, lose nothing of their stability;" (by having 4-5ths of their ballast *above* the line of floatation,) to obviate which, he says, "they are *peculiarly constructed*." Now the fact is well known, that of all floating bodies those row-boats, gigs, and galleys, have the least qualifications for such a contrast. Investigator would confer a greater benefit on science by communicating those peculiar qualifications, than he ever will by his futile remarks on plain matter of fact, because they are not written in an unknown tongue. Again, he has looked, it seems, with admiration on our old three deckers with four tiers of guns, but he doubts if they would be the stiffest and best sea-boats in the world, but for the effect of many hundred tons of iron, water, &c. stowed as low as possible. Does Investigator know that in those ships the height out of the water is much greater than that immersed; that the weight in ammunition and stores above the water, independent of the ship's own weight, *exceeds eight hundred tons*, the centre of gravity of which *is more than sixteen feet above the line of floatation?* From these facts can any practical man doubt for a moment that the best place for the ballast is on a level with the ship's immersion?

I proceed to Investigator's remarks on what he calls a fundamental error,— an assertion unsupported by theory or practice,—that all vessels which lean forward require their masts well aft. I know the reverse is a dogma laid down at the academy, but it does not follow that it is a matter of fact. I should pause before I acted on such a principle, seeing how many times the mast of the Orestes was removed during her trial with the Champion. Neither is it a fact that in sharp vessels the main direction of the water is forward; for sharp-bowed vessels, if well proportioned, scarce ever ship a sea over the bow, but in general take in the water a little before midship section, (if the mast is in the proper station.) It is full bowed vessels that always bury themselves forward where the main direction of the water acts. What says *practice* if a vessel is sharp forward? Is it not necessary to carry the mast well aft that it may receive that due support necessary to prevent her violent pitching in a sea and, under sail, qualify her working to windward? It will be recollected that the observations I made were on cutters, but they will hold good as to all vessels. What gives all those superior qualities in sailing to the Pearl, Sabrina, Iris, and many other yatchs, but their masts steeped near the middle of the keel? These are all very sharp vessels forward. Let Investigator go over to the Isle of Wight, and view the vessels belonging to the Yacht club. He will soon learn that practice is against him as to the station of the mast and main direction of the water. He will be informed that the dryest place in those sharp vessels is before the mast. I could, if your limits would allow, prove, in more than fifty instances, that by removing the mast forward in full-bowed vessels, they have answered every expectation, when before they were barely manageable. If Investigator's theory holds good, that full-bowed vessels require their masts aft, and the reverse if sharp, how is it that all the Irish lockers which have all very full bows will not sail without their masts being steeped within a few feet of the keel of the stem, with considerable rake forward?

Investigator may know by theory, that form of body of least resistance on a sheet of water; he may, as far as books have taught him, be able to define the centres of gravity, meta, and displacement; he may, by information, know the action or pressure of the wind on a piece of canvass of a given size, and many other things, useful, no doubt, if subservient to practice. But the truth is, the little he has been taught, has given him a degree of self-importance, which causes him to look with indifference, if not with scorn, on the well-informed practical, but humble, operative, who could give him in one hour more useful information than he could procure in one year at the academy. For instance, let me ask Investigator, where is the centre of gravity, the metacentre, and centre of displacement, in those vessels whose draught of water aft is as 12 is to 6 (in some instances more), and in what proportion do they alter their position, from her swimming upright, and different degrees of heeling under canvass? Will he account for their qualifications when they produce from their set by the stern, a nominal transverse section, 2-3ds from the stem, without a particle of ballast on the fore-side of the mast? Practice daily proves, that the further aft you can carry this nominal transverse section, the faster the vessel will sail. This is a problem wherein the modern theory feels her impotency, and must remain silent.

I now come to the most useful part of the controversy, that of *modelling*. Let not the young practitioner be discouraged at Investigator's talk of weeks and hours. Modelling is the perfection of the art; without a knowledge of modelling, theory will ever be imperfect. By blocking your drawing, and cutting it in sections and parts, you are enabled to see the good and bad qualities the vessel you are about to construct will possess. It is here you can make the necessary alterations, both in the wood and on the paper, till it becomes perfect. The young beginner, by modelling, adds to his theory practice of the best kind. Every part of a ship becomes familiar, through which he is enabled to define to his advantage and improvement. If the question rested as to time, it would be nothing when placed in the scale of advantage. You have your vessel in miniature, all her parts are presented at one view, the form of the body becomes familiar, and you get through your conversions with ease; I cannot for a moment give place to Investigator, that it takes up more time after a little practice. Could I descend to a challenge with all the advantage Investigator possesses, I would produce in less time a drawing and model, with every calculation of centres, displacement, and tonnage, the mast correctly placed, of any given-size merchant ship he would name.

Permit me, as a practical man, to give a word of advice to Investigator. First, take nothing on trust, prove your present theory by practice, get a qualified person to instruct you in the art of modelling; you will soon find it turn to account, by proving your theory; you would get just views of the art of ship-building, and it would always be to you a source of amusement and information; if self importance should cause you to spurn this humble advice, I shall be happy to learn that some of your readers have derived some useful information from this controversy.

I remain, Sir,

Your very humble Servant,

NOAH.

[Our correspondent has omitted in his manuscript to denote, by the usual quotation marks, the different passages he has quoted from the treatise, which is the subject of his criticism; and, as we have not that treatise before us, the marks have been supplied as the sense seemed to point out. It is possible, therefore, that there may be some inaccuracies in this respect.—ED.]

ARTIFICIAL MOTHER-OF-PEARL.

SIR,—In reply to the enquiry of a correspondent in your last number, I beg to state that that elegant preparation, Japanese cement or rice paste, is made by intimately mixing fine rice-flour with cold water, and then gently boiling it. This paste admits of the most unlimited application; and whether we consider its great strength, or neatness of appearance, for fancy articles it is unrivalled. This composition, made about the consistence of plastic clay, (by diminishing the original quantity of water,) may be formed into vases, basso-relievos, busts, &c. &c. which, when dry, admit of a high polish, and possess great durability. Great quantities of grotesque figures are continually imported into this country from China, made of the above composition; some of which are white like fine marble or alabaster, others are tinged of a deep brown, and their composition is a riddle of no small difficulty to those who are unacquainted with this application of its basis. The Japanese are very skilful in this manufacture, and they make quadrille fish of this substance so *nearly resembling mother-of-pearl*, that the officers of our Indiamen are frequently duped in this traffic by the cunning natives. Most of the mother-of-pearl, however, is manufactured from the shell, but the process is a secret to,

Your's, respectfully,
W. B. JUN.

10, George Yard, Lombard Street,
Nov. 20th, 1826.

LONDON MECHANICS' INSTITUTION. GRATUITOUS LECTURING.

Agreeably to the promise made in our last, we now extract from the other letters which we have received in favour of gratuitous lecturing, such arguments as have either not been anticipated by its principal advocate, T. M. B., or furnish pertinent illustrations of those advanced by him.—We also insert a letter from an auxiliary, on the other side of the question, which may help to keep the judgment of our readers suspended in the balance till the principal combatants again make their appearance on the stage. The question is one well worthy of the most full and deliberate discussion.

(*Extract.*)

SIR,—The objections of Aurum to gratuitous lecturing are, in fact, objections to the encouragement of latent and rising talent. Would he consider the committee justified if they were to *hire* a person to deliver lectures, without being sufficiently acquainted with his ability? And yet how many persons, admirably qualified to become lecturers, may never have had an opportunity of evincing their qualifications! Might not the committee, in refusing such a man permission to deliver a course of lectures gratuitously, be driving from them one who might rise to equal even Sir Isaac Newton? And would not an institution, taking such an individual by the hand, be sure for ever after to enjoy his countenance and support? The answers to these questions may easily be anticipated. It is, besides, a well-known and acknowledged fact, that those persons who have risen to the height of their ambition, will certainly give rather *tame* essays than pleasing lectures; whereas, we find those *aspiring* to fame, deliver their lectures with the greatest enthusiasm. I may here quote, as an appropriate example, that able lecturer on Astronomy, Mr. Wallis. Can any one, moreover, suppose that a young and able lecturer, offering his services gratuitously, does not consider the popularity which he gains a sufficient recompense for all his toil?

Your's, &c.
R. W. D.

Albany Road, Nov. 18, 1826.

(*Extract.*)

SIR,—Aurum says that why he is opposed to the plan of gratuitous lecturing, is because "it is diametrically opposite to the principles on which mechanics' institutions are formed." Now here he is mistaken, for it is one of the rules of the London Mechanics'

Institution, which is the first of all the institutions for mechanics, that any person giving ten gratuitous lectures, shall be an honorary member for life. Aurum further says, "if, having the means to pay for our instruction, we receive it gratuitously merely that those means may be applied to some other more showy, but infinitely less useful purpose; for instance, the building of a lecturing theatre; we put ourselves upon a level with those dishonest persons who, to cut a fine appearance, keep a carriage and handsome establishment, run themselves into debt with butchers and bakers, tailors and shoemakers." In answer to this, I would say that the theatre is not less useful than the lectures; for what would be the use of the lectures unless there were room for as many members as attended? There would be nothing but discontent and mischief; and what with the crammed and miserable state in which the members must be, if in a too small place, and the disturbances hence arising, the lectures would not be half heard, or if they were, the whole would be heard so confusedly that but little benefit would be derived therefrom. I feel persuaded, therefore, that it would turn out *more economical in the end* to have a theatre than not; and besides, the persons with whom we run in debt, know the liability they incur by allowing us so to do; but if they are not paid,* the fault is their own. We, therefore, are not like "*those dishonest persons.*"

I will now answer the plain question proposed by Aurum to any defender of the system of gratuitous lecturing—"why should we receive lectures gratis, which we have the means of paying for?" Because by so doing we not only please ourselves, but others, and also have the money for other equally useful purposes, (for instance, paying the masters employed in teaching the arts and sciences, buying books, &c. &c.)

One object of my writing is to defend the conduct of the committee of the London Mechanics' Institution from the charge of ill-management, as a proof of which, Aurum says, "he need only refer to the very *inferior* kind of lecturing which now is and has been for some time past carried on there." If Dr. Birkbeck's, and many other eminently clever lecturers' lectures are inferior, then he is in the right; but it is evident to any person that is capable of judging between good and bad, that the lectures which now are and for some time past have been delivered at the London Mechanics' Institution, (excepting only Mr. Green's,) are not, neither were they inferior, nor even approaching to inferior. As to the decrease in the attendance of members, of which Aurum speaks, there is no such thing, saving only the few evenings on which Mr. G. lectured.

The whole matter of Aurum's letter centres in this point—do the mechanics, by having gratuitous lecturing, surrender their independence? For my part, I decidedly think that they do not.

That you will keep open your columns to all parties and be influenced by none, (which I have little doubt you will,) is the sincere wish of your obedient humble servant,

David Honor.

Sir,—To prove that the members of the Mechanics' Institution can shew their disapprobation of poor lectures, with propriety or with a good grace, which Aurum says they cannot do, I would point him to Mr. Green's lectures on architecture, in which case they shewed their disapprobation, by not attending, and by withholding the usual applause which is given every good lecturer, whether he lectures gratuitously or ungratuitously.

Veritas.

Sir,—The attack which "Aurum" has made on gratuitous lecturing having drawn such a crowd of assailants upon him, I hope you will permit one who owns with pride *Aurum* for his chieftain, and who is, by right of birth, as well as (with due humility be it spoken) by weight of talent, second only, in station to his excellency, to break a lance in his behalf. I cannot say, Sir, that either *Aurum* or myself are *disinterested* champions in the affair; for it is certain that if we gain the day, the members of mechanics' institutions will never after be able to do without us.—I can promise this, however, that you will find us not only *men of metal*, but such absolute salamanders, that the hottest fire of our opponents shall neither hurt nor consume us. I flatter myself, also, that should victory crown our efforts, no person will be able to

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* It is almost impossible, however, but that they should be, there being so many liable for the debts incurred by the institution.

any of us (whatever else they may say,) that we were beholden in the least either to a *brazen face* or a *leaden pate*.—I confess that I (the Pro-Generalissimo) am rather a *light* fellow, and possess even less *gravity* than many *mercurial* folks, whose spirits rise and fall with every change of the weather; but I feel sustained by the reflection, that any deficiency of mine in this respect will be more than made amends for by my illustrious chieftain, who (exaggeration apart,) has more *weight* in the world than all the rest of the people in it. In short, Sir, we are two *sterling* fellows, and nothing less.

But to drop metaphor, and come to the simple matter in hand—I must beg your readers to recollect, the plain issue to which the question was brought by Aurum's letter. "Let T.M.B. or any other defender of the system, answer this plain question,—*Why should we receive lectures gratis, which we have the means of paying for?*"—p. 463. Now, to this plain question, I can find no answer whatever, in T. M. B.'s last epistle. He talks in a very high-sounding strain, of the injustice of saying that the London Mechanics' Institution has been injured by the gratuitous system, and of the excellence of the lectures which have been delivered there; but not a whisper does he breathe as to the justice or expediency of the mechanics of London (who are abler, perhaps, to pay for value received, than any other mechanics in the kingdom,) enjoying such prime lectures for nothing. It is evident, however, that the excellence of gratuitous instruction furnishes of itself no reason for accepting it gratuitously; but that, on the contrary, it makes the shame of those who receive it, *unnecessarily*, only so much the greater. The instruction given at a charity school may be of the first order, and yet a father be greatly to blame who, possessing the means of giving his child an independent education, should send him to share the portion of the fatherless and destitute.

"Aurum," it is true, stated it to be *one* of the evil consequences of gratuitous lecturing, that it obliged the members of Mechanics' Institutions "to put up with lectures of an inferior description;" and he particularly referred to the "inferior kind of lecturing which now, and for some time past," has been witnessed at the London Mechanics' Institution, as an example of his position. But though we were to allow that T. M. B. had shewn this charge against the London Mechanics' Institution to be unfounded, what would be gained to his side of the question by the admission? Would it follow that because the particular example cited is erroneous, the position which it was intended to illustrate is erroneous also? Would it be less true than before, in a general sense, that persons going with money in their hands into the market of talent, (as into other markets,) must command a far readier and a better supply, than such as go a begging for mere charity's sake?

Let us see, however, whether it be really the case, that the London mechanics have suffered nothing by the gratuitous system pursued at their institution.—T. M. B. says, that the lecturers have been Dr. Birkbeck, Mr. Hodgkin, Mr. Cooper, Mr. Hogg, (Ogg I presume,) Mr. Preston, and Mr. Green, and that "the names of the gentlemen, are a sufficient guarantee for the kind of lectures which might be expected from men who stand so deservedly high in the scientific world." Now, without meaning any offence to these gentlemen, I must be allowed to say of them all, (with the exception perhaps of Dr. Birkbeck,) that their "high" station in the scientific world, is a matter of NEWS to me, and I should suppose not less so to themselves. Be their talents and acquirements what they may, they have certainly still the steeps of science to climb. Be their hopes of renown what they may, it is certain that *as yet*, their names alone do *not* furnish "a sufficient guarantee" that their lectures have been all that might have been desired. Aurum says they have been of an "inferior kind;" T. M. B. denies that they have. Assertion for assertion, the one as much entitled (to say the least,) to respect as the other.

I think the question is one which had better be discussed, without any reference to individuals at all; for though lecturers may be eminent, it does not exactly follow that they must deliver only the most suitable lectures. Sir Walter Scott shall lecture to mechanics on Heraldry, Mr. Campbell on the Greek Tragedy, Mr. Brougham on Chancery Abuses, Mr. Spurzheim on Noodleology; and yet, celebrated as the names of these gentlemen are, and unquestionable their peculiar fitness for the subjects assigned to them, there shall be nothing in their respective courses of instruction, of the least use to their hearers.

The gratuitous practice, besides, affects the character of the lectures delivered, in a way with which *names* have nothing to do. Where lecturers are employed as they happen to offer themselves, there can, of course, be nothing like a regular and consecutive plan of instruction pursued. The managers cannot say to themselves for example,—"It is proper that the members should be taught arithmetic and geometry, before they are introduced into the higher departments of mechanics and astronomy, and therefore we shall first of all, get them good instructors in these elementary branches." No.—Each branch of knowledge must be taught just in the order that a lecturer for it happens to turn up; and members may be qualified or not qualified, just as chance may determine, to understand and profit by the sort of lectures delivered to them. Matters only fit for the comprehension of minds the most intelligent and well prepared, and matters adapted to the meanest capacities—subjects appropriate and subjects outrè—things trivial and things unimportant, come all jumbled together in the strangest sort of sequence and juxtaposition. Now it is of the heavens, and now of coal-pits—now of the longitude, and now of short-hand—now of two and two, and now of the national debt—now of the Newtonian system, and now of the Scotch and Quaker rag-system; that the members are lectured to, and all within less than the short space of a *lunar* month. What is this, in fact, but a pretty exact description of the sort of lecturing which has been exhibited at the London Mechanics' Institution? And who can seriously deny that, viewed in this light, the gratuitous system has been productive of great and serious injury to its members?

Add to this vital objection, to the gratuitous practice—an objection which alone should banish it from every system of management—the other strong objections which have been brought against it; and it must seem a wonder that any person, (far less one possessed of the good sense and good feeling which T. M. B. usually displays,) should be found to stand forth its advocate. The length to which I have already gone, warns me to confine myself at present, to a mere recapitulation of these objections; but should T. M. B. and his adherents still persist in their heresy, I shall perhaps trouble you again on the subject.

First, then, the gratuitous practice is, (as I have just shown) productive of a system of instruction unmethodical, irregular, and imperfect.

Second, It is a mean and a truculent practice, to solicit and accept services for nothing, which you are able, and which it would be well worth your while, to pay for.

And third, It is an unjust practice; for though the members of the London Mechanics' Institution pay nothing, (I speak generally,) for their lectures, it is not because they do not make as large termly payments, as the members of the Glasgow or any other Institution, who pay for every thing, but because they choose to apply the money which they injudiciously, meanly, and unjustly, withhold from their lecturers, to other purposes.

I am, Sir,
Your most obedient servant,
ARGENS.

NOTICES TO CORRESPONDENTS.

Mr. Saul's design shall have an early place.

The patentee of the revolving masts has omitted to send us a particular description of his drawings.

Communications received from H. H. — J. S.—W. H W.—M. K.—A Yorkshire Miller—A. Z.—rules in addition from H. S.—H. O.—S. H.—A. M. C.—J. P.—A Juvenile Philosopher—H. H. —Clyde — Amicus — Mr. Moss—G.—Galvanus—Alpha Beta.

Some "friends at Chelmsford" are in want of a good set of electrical apparatus; and not being willing to go to the expense of purchasing it new, they want to obtain it second-hand. Any person desirous of disposing of such apparatus, may direct to A. Z. Chelmsford.

Communications (post paid) to be addressed to the Editor, at the Publishers', KNIGHT and LACEY, 55, Paternoster Row, London.

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Mechanics' Magazine,

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"The soul that sees Him, or receives sublim'd
New faculties, or learns at least t' employ
More worthily the powers she own'd before,
Discerns in all things, what, with stupid gaze
Of ignorance, till then she overlooked,
A ray of heavenly light, gilding all forms
Terrestrial, in the vast and the minute;
The unambiguous footsteps of the God,
Who gives its lustre to an insect's wing,
And wheels his throne upon the rolling worlds."—COWPER.

HORIZONTAL DRUM-VANED WIND-MILL.

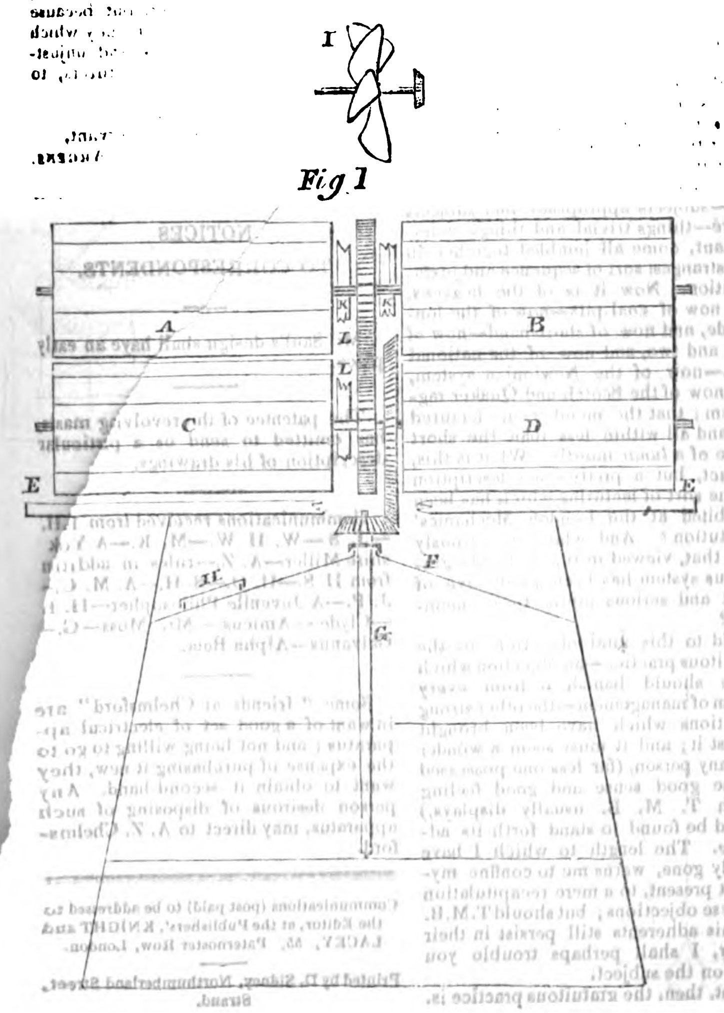


Fig. 1

HORIZONTAL DRUM-VANED WIND-MILL.

Sir,—I am at a loss what name to give to the inclosed sketch; however, for the sake of distinction, I shall call it a Horizontal Drum-Vaned Windmill.

A B, and C D, fig. 1, represent a front view of four wind drums; on the middle of the shafts, at E L, two tooth wheels unite their power.

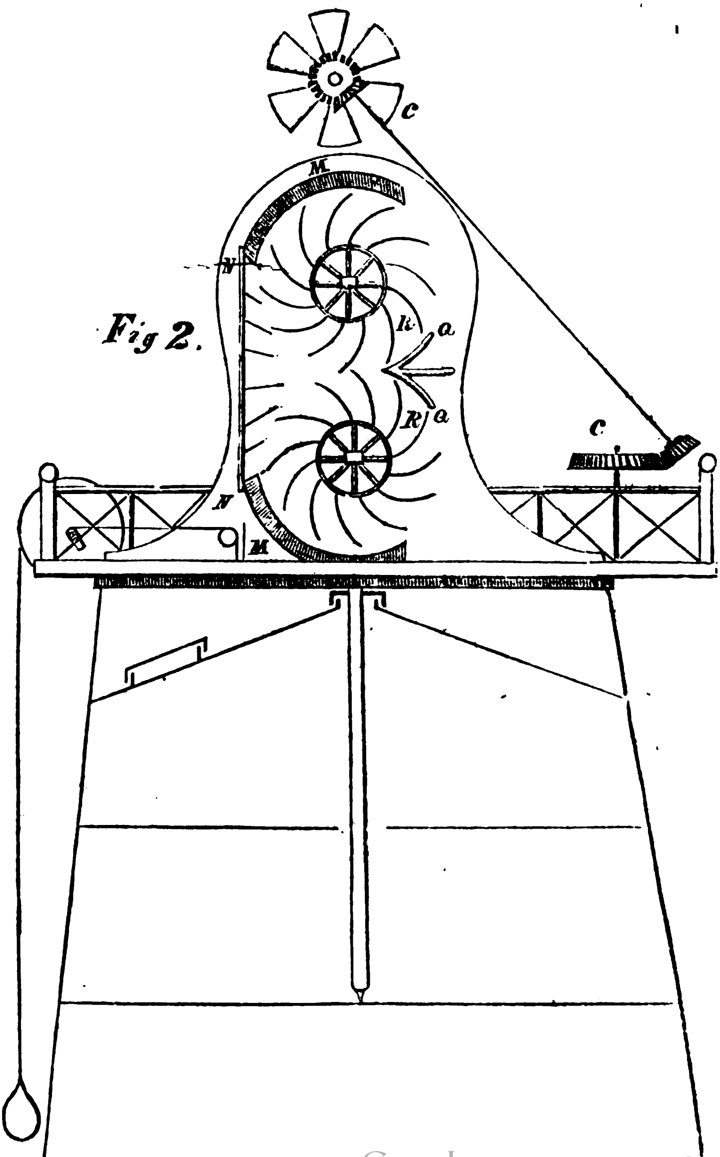
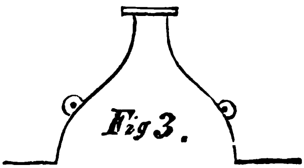


Fig 2.

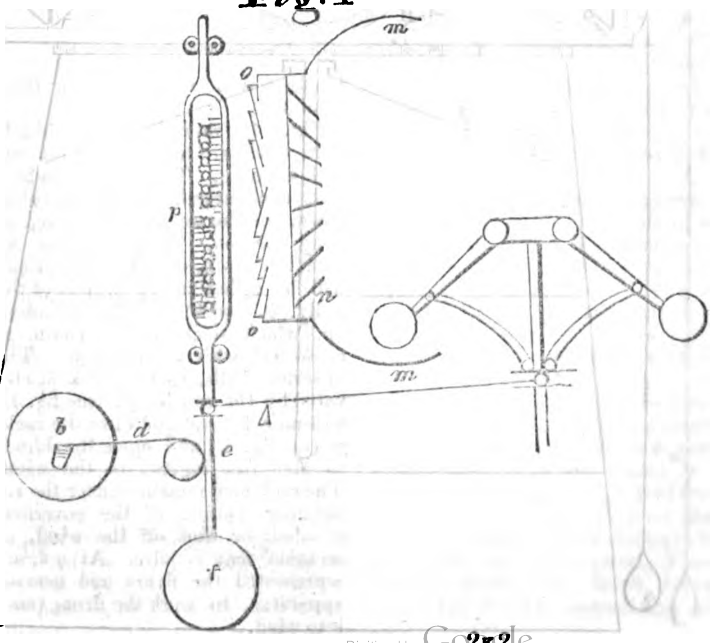
The bevil wheel in the lower shaft works into the crown wheel on the vertical shaft, A, which passes through the fixed roof, at F, to convey motion to the working apparatus in the mills. Upon this shaft, at F, is a running bow, to prevent wet entering the mill. At H is a hatchway, to ascend outside the roof. The flyers, at I, are supported by two metal bridges, fig. 3, which are



bolted down upon the two head-stocks, K K, of the upper drum shaft. The frame work, E E, which supports the wind drums, is screwed down upon the moving part, which is constructed the same as other turret-built mills which are wrought into wind by flyers. Fig. 2 is an end view of the drum vanes; the diameter of each is ten feet, which will admit the breadth of the vanes, on each drum, to be four feet; their length may be extended at pleasure, by making provision in the building, &c. The vanes are curved that they may quit the wind backwards with more ease by their centrifugal force; at M M, the vanes are screened from the wind. The space from N to N, in front of the mill drums, contains an opening, the partitions of which are so adjusted, as to direct the wind to strike square upon the vane. These partitions I shall call the *directors*. In front of and close against these directors, are the blinds, *o o*, (see fig. 4,) which are opened or shut by the motion of the rack, *p p*, whose teeth lath into small pinions fixed upon the axis of the blind; the rack being moved by the motion of the governor. The rack and blinds in the drawing are placed alongside each other, I could not shew them connected.

One half of the blinds at *o o*, shut upwards, and the other half shut downwards. This requires the rack to be toothed half way on one side, and the other half on the contrary

Fig. 4.



side, which opens the blinds parallel with the directors, and facilitates the entrance o fthe wind. The intent of the directors is, that whether the blinds are more or less opened by the regulating motion of the governor, the wind may continue to strike upon the vanes in the same direction.

At Q Q, fig. 2, is the intercepting part curved to the periphery of both drum vanes, which prevents the wind escaping the passing vanes, R R, till the succeeding ones come in contact; thus obtaining its whole force on the wind drum. Without this precaution the wind would escape in a current stream betwixt the vanes as they were approaching to and

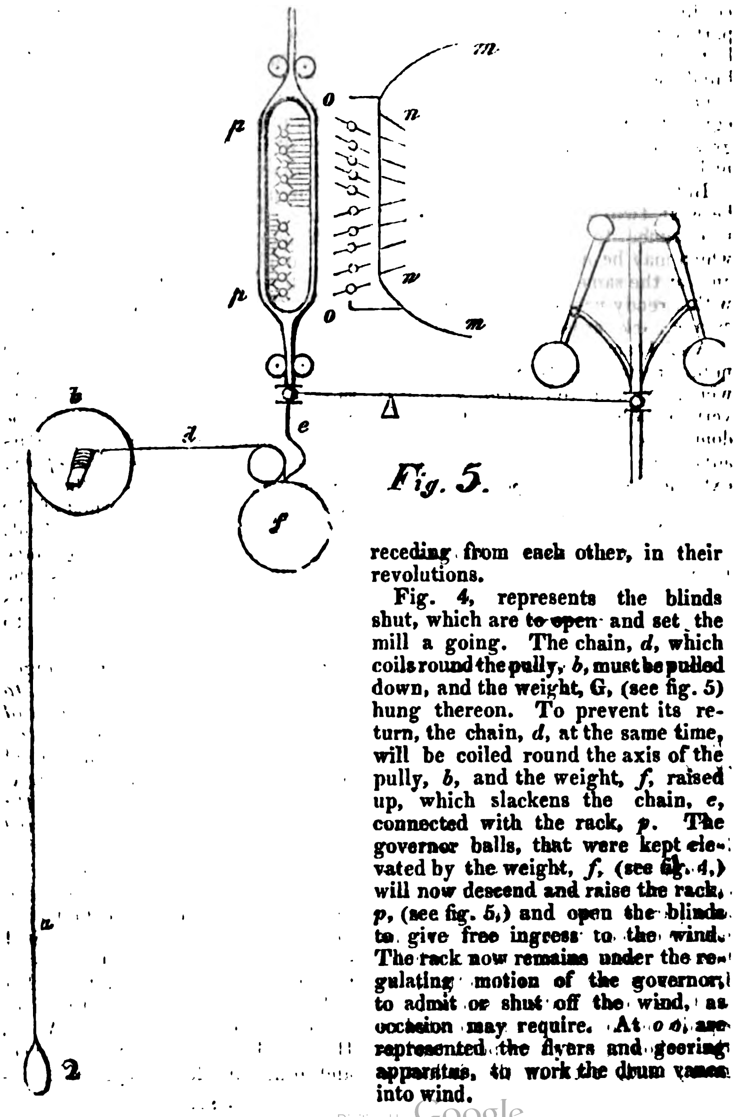


Fig. 5.

receding from each other, in their revolutions.

Fig. 4, represents the blinds shut, which are to open and set the mill a going. The chain, *d*, which coils round the pully, *b*, must be pulled down, and the weight, G, (see fig. 5) hung thereon. To prevent its return, the chain, *d*, at the same time, will be coiled round the axis of the pully, *b*, and the weight, *f*, raised up, which slackens the chain, *e*, connected with the rack, *p*. The governor balls, that were kept elevated by the weight, *f*, (see fig. 4,) will now descend and raise the rack, *p*, (see fig. 5,) and open the blinds to give free ingress to the wind. The rack now remains under the regulating motion of the governor, to admit or shut off the wind, as occasion may require. At *o o*, are represented the flyers and geering apparatus, to work the drum vanes into wind.

I am of opinion, that horizontal mills, with one mill drum only, labour under great disadvantages. In the first place, a broad vane is useless; the drum being cased round with blinds, they are all opened to the same angle to admit the wind, and it cannot be directed to cover the surface of a broad vane, as the wind will be continually screened from a great part next the drum by each succeeding vane. Secondly, a great part of the force of the wind will be lost, by being exerted against the blinds while passing round with the vanes. Thirdly, the want of a ready egress for the wind backwards, will greatly retard the speed, and diminish the power of the third drum.

But, by causing the wind to pass betwixt two drums, its whole force is confined to act upon the vanes, which may be of any desired breadth, and, at the same time, accommodated with a ready passage for the wind to escape backwards.

And I am bold to assert, that a mill, erected upon this principle, would be able to compete with any vertical sailed wind-mill in the kingdom; allowing the drum vanes an advantage in their area, equal to the extra leverage of the others.

I am, Sir,
Your humble Servant,
A Yorkshire Miller.

Barnsley.

DOCTRINE OF PROPORTION, OR RULE OF THREE.

Si proportionis doctrinam e Mathesi abstuleris, nihil fere præclarum aut egregium relinques.

Whiston's Tacquet's Euclid.

Sir,—The observation of the above learned author, upholds the doctrine of proportion as a subject of no inconsiderable consequence; and that, as a part of the mathematics, it is not a mere constituent, but forms the basis or substructure of the whole. Its importance in arithmetical, as well as mathematical science, is equally obvious: it is incarcerated in the reckonings of every petty tradesman; and, even in the inductive drudgery of the young tyro's first attempt at calculation, are its theoremic properties unconsciously submitted to his crude demonstration.

The consideration which your present correspondent wishes to propose to the attention of your readers is, the doctrine of proportion so far only as may be connected with what is commonly termed the rule of three. This rule is now elucidated by two different methods, both, perhaps, supported by good authorities. I allude to the arrangement of the terms, consisting of four proportionals.

The bias to tread an old beaten track, disinclines all, in a great degree, to explore an unknown though less circuitous route; and the enterprising discoverer may find the world quick to admit his theory, but slow to observe his practice. Whether to this prevailing fatuity may be ascribed the writer's adherence to the old method of treating the above rule, your readers may judge and reply. Though certainly, on the other hand, the fatuity is reversed, by its advocates travelling the road blindfolded, knowing perhaps *whither*, but uninformed *wherefore*; for the tenacity with which the theory of the new-fangled method of the modern authors has been withheld, is like a navigator describing some newly-discovered course across the trackless seas, without informing us in what latitude and longitude to sail.

The old classification or arrangement of the terms in this rule is, *to place the first like the third, and the second to be like the fourth*; that is, in the same denomination of the same kind. The new classification or arrangement is, *to place the first like the second, and the third to be like the fourth.*

The propriety of the original method, has been decidedly sanctioned by mathematicians of the first eminence; and, if in advocating it I should be found in error, I shall sustain no greater dishonour, than that of being classed with the distinguished names of Walkingame, Vyse, Hutton, Bonnycastle, Keith, Joyce, and other no less respectable authus. Should it appear that any of these authorities in the later editions of their works, have adopted a new method, they have, doubtless, offered reasons for such as satisfactory as those which they advanced in support of their former plan.*

In the following investigation, a direct mathematical demonstration of the doctrine of proportion, is not intended; a course of reasoning is pursued applicable to the ordinary enquiries of arithmetical calculation: valuing goods, estimating quantities, &c. &c.

Hence, by the original method, the stating of the following question will stand thus:—

Question. If 1lb. of tea costs 8s. what will 2lb. cost at the same rate?

As 1lb. : 8s. : : 2lb. : 16s.

By the new method:—

As 1lb. : 2lb. : : 8s. : 16s.

A celebrated author and mathematician, of considerable eminence, in treating upon this rule by the first of the above methods, observes:— "It is founded on this obvious principle, that the magnitude or quantity of any effect, varies constantly in proportion to the varying part of the cause; thus the quantity of goods bought, is in proportion to the money laid out; the space gone over by a uniform motion, is in proportion to the time."

To dispute this evident principle, that *the magnitude or quantity of any effect varies constantly in proportion to the varying part of the cause*, would require the most subtile reasoning. Moreover, the explication of this principle is as obvious as it is incontrovertible; namely, that *the quantity of goods bought, is in proportion to the money laid out*.

That this rule is founded upon so obvious a principle as the above, will appear by considering the object of the rule. Hence, in the example already given, the tea bought is in proportion to the money laid out.

Observation 1. Here the object is to find the cost of a quantity in a given proportion to its magnitude; that is, the cost of a given quantity in the same proportion to that quantity, that a given cost was to a quantity before.

Whence the stating:—

As 1lb. : 8s. : : 2lb. : 16s.

Observation 2. Or, *vice versa*, to find the magnitude of a quantity in a given proportion to its price; that is, the magnitude of a quantity in the same proportion to its cost, that a quantity of a given magnitude was to a cost before.

Whence the stating:—

As 8s. : 1lb. : : 16s. : 2lb.

Observation 3. Here the effect produced, is in proportion to the varying part of the cause; that is, the term found, is in a given proportion to the varying term, according to whose magnitude a greater or less effect is produced. Which varying cause is there evidently the third term.

An objection has been urged against the propriety of stating ques-

* I am aware, that one of the above-mentioned authors has, in his subsequent editions, departed from his former plan of stating this rule. To shew how strongly the original plan of this rule is fixed upon the mind, this same author, and in the same edition which contains his proposed amendment of the rule of three, has inserted a note under the head of exchange, in which he directs foreign money to be put in the *first* place, and the same in the *third*; sterling money to be put in the *second* place, and the same will be in the *fourth*. His words are:—" Any kind of foreign money is reduced to English, by saying, As the given rate of exchange is to 1l. sterling, so is any given sum foreign, to the sterling sought; and sterling money is reduced to foreign by reversing the operation." However, the stating of the two following examples stands according to the new method, while the rule is rather inaptly given for the old. Another no less manifest contradiction in the same author's work, may be found under the rule of *partnership*, where he not only gives his rule in direct opposition to his new doctrine, but immediately confirms the variance by an example, in which he has unwittingly placed *oxen* in the *first* and *third* places, and *money* in the *second* and *fourth*. Thus it is evident, that long established usage only, can render theory and practice uniform, where the former is doubtful. —*See the Scholar's Guide to Arithmetic*, edition 12.

tions in proportion, as given above, The strongest argument deduced for this purpose, the following question will convey. What proportion can a *quantity of tea* bear to a *sum of money*, or a *sum of money* to a *quantity of tea?*

Whence the stating:—

As 1lb. : 2lb. : : 8s. : 16s.

Though it is palpable to common sense, that a quantity of *tea* cannot possibly exhibit a rational or relative proportion in *magnitude or bulk* to a magnitude or bulk of *money*, or other thing, commodity, &c. of disproportionate value, magnitude, or bulk; yet the reasoning of a child will inform him, that the purchase of the tea is regulated by its weight, cheap or dear, according to which a certain ratio was given; or, in other words, that the money paid is in proportion to the quantity of tea bought, by a ratio proposed.

(To be continued.)

SIMPLE ELECTRICAL INSTRUMENT, WITHOUT RUBBERS OR RIBBON.

Sir,—As some of your readers appear to have found difficulty in preparing a varnished ribbon for the pocket electrical apparatus, the following account of a simple instrument for the same purpose by the celebrated Cavallo, which renders the rubbers and ribbon unnecessary, will, no doubt, prove acceptable, (if you deem it worthy of a place in your instructive and useful Magazine,) especially as I think it is not generally known. Take a glass tube, about eighteen inches in length, and an inch, or an inch and a half in diameter. It is immaterial whether one of its ends be closed or not. Coat the inside of it with tin-foil, from one open extremity of it to about its middle; the other part, which remains uncoated, we shall call the naked part of the instrument. Put a cork to the aperture of the coated end, and let a knobbed wire pass through the cork, and come in contact with the coating. The instrument being thus prepared, hold it in one hand by the naked part, and with the other hand, clean and dry, rub the outside of the coated part of the tube; but after every three or four strokes, remove the rubbing hand, and touch the knob of the wire; in so doing, a little spark will be drawn from it. By these means, the coated end of the tube will gradually acquire a charge, which may be increased to a considerable degree. If, then, you touch the outside of the coated end of the tube with one hand, and the knob of the wire with the other hand, you obtain the shock.

In this instrument, the coated part of the tube answers the double purpose of electrical machine and Leyden phial, the naked part being only a sort of handle to hold the instrument by. The friction on the outside of the tube, accumulates a quantity of positive electricity upon it, and, by virtue of its sphere of action, forces out on the inside, a quantity of electricity also positive. Then, by taking the spark from the knob, the inside electricity is removed; consequently, the inside remains undercharged or negative. By further rubbing, and taking the spark, the tube receives a charge.

Instead of a tube, this instrument may be constructed with a pane of glass, but it cannot be managed so easily; nor, of course, can it be charged so high as the tube. A piece of tin-foil must be pasted in the middle only of one surface of the pane, leaving about 2½ or 3 inches of uncoated glass all round. This done, hold the glass by a corner with the coated side from you, and with the other hand rub its uncoated side; and take the spark from the tin-foil alternately, until you think that the glass may be sufficiently charged; then lay the glass, with its uncoated side flat upon one open hand, and on touching the tin-foil with the other, you receive the shock.

With my best wishes for the prosperity of your entertaining Journal,

I remain,

Your obedient servant,

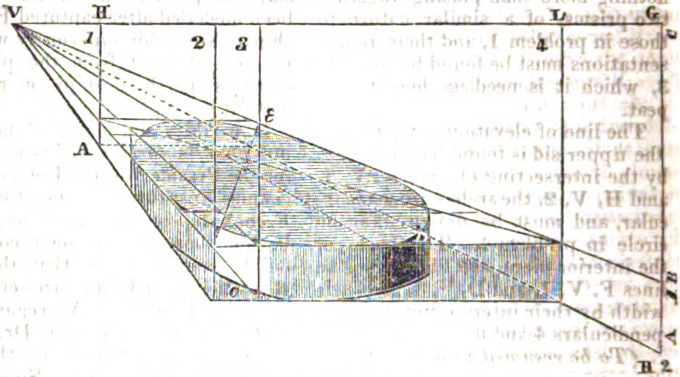
GALVANUS.

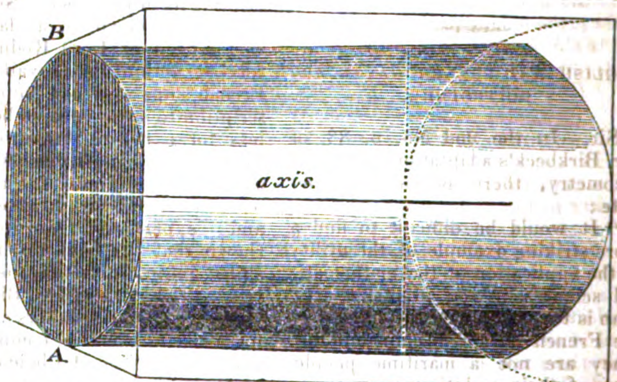
Great Missenden.

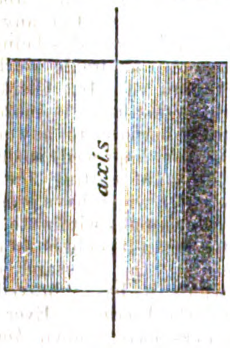
PRACTICAL PERSPECTIVE.

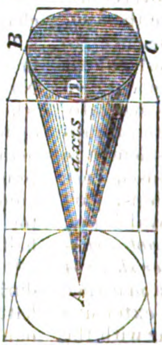
(Continued from p. 489.)

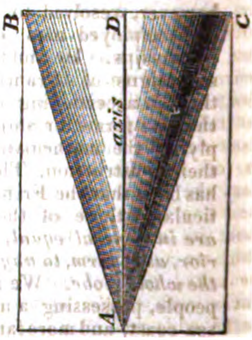
Figures 16, 17, 18, 19, and 20, as referred to in our last, and here placed in their numerical order of succession.











Problem 6.

To depict a bridge in oblique perspective.

(see the engravings and space.

figs. 23 and 24, present only half the plan and elevation; but if the lines, O, O, O, and the rays, 1, 2, and 4, were continued, and perpendiculars raised at their intersections, the remainder would be drawn.

A few brief observations will explain this figure, which, though in appearance complicated, is in reality, nothing more than placing together two prisms, of a similar nature to those in problem 1, and their representations must be found by problem 3, which it is needless here to repeat.

The line of elevation is G, H, and the upper sid is found, as in fig. 12, by the intersecting of lines K, V, 1, and H, V, 2, the arches are semicircular, and must be drawn like the circle in problem 4. The bases of the interior piers, are shown by the lines F, V, 1, and D, V, 1, and their width by their intersecting the perpendiculars 4 and 6.

(To be resumed in our next.)

ENGLISH AND FRENCH NAVAL ARCHITECTURE.

Sir,—In the 2nd No. p. 33, of Dr. Birkbeck's adaptation of Dupin's Geometry, there is the following note:

"It would be difficult to find a more striking example of the utility of the application of the mathematical sciences to the practical arts, than is to be found in the success of the French nation in ship-building. They are not a maritime people. One of their ambitious sovereigns, however, resolved to make them so, and employed men of science to build ships. He and the subsequent sovereigns of France encouraged them in ascertaining mathematically the best forms for ships, and in applying the mathematical sciences to their construction. The consequence has been that the French ships, particularly those of the Royal Navy, *are in general equal, if not superior, as to form, to any other ships of the whole globe*. We are a maritime people, possessing a more extensive sea-coast, and more familiar with the ocean, than any other nation. In the practical and merely manual part of building ships, as well as in managing them, we are superior to our neighbours. That we in general overtook and captured the finer-formed vessels of the French, was in consequence of the superior skill of our sailors; but the superiority of those vessels as to form was so great that most of the ships at present in our navy have been modelled after captured French ships. Now, this superiority was altogether derived from the plan of constructing these ships on mathematical principles."

It would seem, sir, as if nothing but what is *foreign* had any charms for the President of the London Mechanics' Institution; and that the French ship-builders are to be lauded beyond those of our own country, on the same principle that the mathematicians of France are set above those of England. As regards *the matter of fact*, however, Dr. Birkbeck is as unfortunate in the one instance as in the other. Some fifty years ago—down to as late a period, indeed, as Lord Rodney's victory—a notion did prevail that the French ships were of a superior description to ours; people being at a loss for a better reason to account for the fact, that a French ship could always when it chose get away from one of ours. Subsequent investigation and experience, however, have shewn that the fault was not in our ships, but in our tactics, the "superior skill" for which Dr. Birkbeck is pleased to give our sailors credit, being an acquirement of comparatively very recent date. I allude of course to their skill in war only, and in chasing particularly. Let any person who has a doubt of this being the fact, read the admirable work on Naval Tactics of Mr. Clerk, to whom the English navy is more indebted than perhaps to any other man, for those improved modes of practice (that of cutting the line among others,) which have procured for it more triumphs within the last half century than it could boast of in all the rest of "the thousand years" during which it has "braved the battle and the breeze." Ever since our mariners have known *how* to chase an enemy scientifically, it has been found, in nine instances out of ten, that British-built ships are far quicker sailers than those of France or any other country. Whether single or in fleets, we have almost always been able to overtake the foe, and *compel* him to stand to his guns, as his only chance of safety.

Dr. Birkbeck says that "most of the ships at present in our navy have been modelled after captured French ships." The Doctor may rest assured that he has been grossly misinformed. The English ship-builders have never had, and never followed, any better models than their own. The captured French ships in our navy are not at all remarkable for their sailing qualities; generally speaking, I should say they are rather among the worst sailers we have.

But Dr. Birkbeck is not even consistent with himself; for though he has just told us that it was science and theory alone which made the French all at once such capital ship-builders, he has afterwards (p. 82,) another note to this effect: "The reader should perhaps be reminded that THEORY *will not give precision in execution*. There can be no doubt, judging from the admirable elementary works which have been published in France and Germany, both on the sciences and arts, that the theory of them is, and has long been, as well if not better known in those countries than in this." But "*our* superiority in manufactures arises chiefly from the practical skill of our workmen, &c." Yes, it is the practical skill of our workmen; of our ship-builders and ship-wrights; which, with but little help from science, has so long enabled them, and still enables them, to turn out such ships as neither Frenchman, nor Spaniard, nor even American can excel.

I am, Sir, your's, &c.

TOM BOWLING.

GRATUITOUS LECTURING.

Sir,—The very powerful communication of "Argens," in your last number, on gratuitous lecturing, seems to render any further remarks from me, (at least for the present,) almost unnecessary; but I feel it incumbent on me to make a few observations, chiefly by way of explanation, on those letters which have appeared in reply to my first communication on this subject.

First, then, Viator, in his intemperate and unseemly letter, has proved nothing excepting that his opinion differs from mine; and, not contented with stating this in a moderate and becoming manner, he has altogether deserted the question in order to give vent to his spleen, in the expression of the grossest personalities; in doing which, he has thought proper to impute to me the unworthiest of motives, to denounce me as a perfidious friend, who, while affecting to have at heart the interests of the institution, do my uttermost to injure it, as a forger and utterer of the grossest and most deliberate falsehoods, and an unblushing calumniator.

I confess, Sir, such language as this has excited in me no inconsiderable degree of warmth of feeling, to which I am only restrained from giving a correspondent expression, by the saying of the wise man, "Answer not a fool according to his folly lest thou be like unto him:" and, from the conviction that in so doing, I should only be aiding him in making your pages rather a vehicle for personal abuse than for deliberate discussion. By way *of reply* to these most ungenerous remarks, I can only say, that I have no more connexion with the institution than he professes to have, and that my motives (of which I take myself to be a better judge than *any mortal*) are wholly disinterested, so far as personal considerations go, having no other aim than the good of mechanics. And by way of conclusion to these remarks, (which however irrelevant to the question, I feel it necessary to make) I leave him to make application of the following quotation from Cowper.

"'Tis *senseless arrogance* t' accuse
Another of sinister views,
Our own as much distorted."

I now come to those who have not wandered quite so much from the question as Viator; in replying to whom I shall be as brief as possible. First, I will meet R. W. D.'s question, by agreeing with him, that the committee would *not* be justified in "*hiring*" a lecturer with whose ability they were not fully satisfied; but, at the same time, their conduct would be equally unjustifiable if they were to permit any one to lecture without knowing him to be every way qualified for the office, *merely because he offered to do so gratuitously;* and because, *possibly*, it might elicit latent talent; thus sacrificing the positive instruction of the whole body of members to the most vague and paltry considerations! Out upon such reasoning!

Again, if his other position be correct, we are to prefer young "*aspirants*" to fame, before lecturers of tried, sterling, and acknowledged ability, because, forsooth, their delivery is enthusiastic; so to do, would be sacrificing matter to manner with a vengeance. Besides, it is by no means such an acknowledged fact, as he assumes it to be, that those who have established their fame, (forgetful it would seem that those talents the display of which first *acquired* them their fame, must be employed to *preserve* it from falling away) deliver *mere tame essays*; to illustrate which remark, I would ask him whether the lectures of *Birkbeck, Millington, and Cooper*, are *tame essays*, and whether *Mister* Green's are *pleasing lectures?*—His quotation of Wallis is not quite apposite, for, although he is not a very old *man*, he is an old and experienced *lecturer*, and his reputation deservedly great.

David Honor must either be a very young member, or have paid very little attention to the proceedings of the Institution, or have forgotten himself when he states the law relating to the admission of honoring members to be one of the *principles* on which the Institution was founded. Now, so far from this being the case, it is, on the contrary, a law of comparatively recent date, and, indeed, is such an one, that had those firm, sound, and manly principles, on which the Institution set out, been adhered to, and acted upon, would never have been *thought* of, much less have been *passed*. However, amongst all who have written on the subject, David is the only one who has thought proper to put in an answer to the simple question propounded in my first letter; but, I put it to any one of your readers, whether it is a satisfactory one; is not the first sapient reason rather a libel on the members, viz.—that, "by so doing, they please themselves." This is only "a woman's reason."

The other part of his reason, viz. that by having gratuitous lectures they are enabled to buy books, &c. &c., only goes to show that, in *his opinion*, (he does not shew the *fact*) they would not be able to possess books, &c., if they paid their lecturers; but does not give even the shadow of a good and sufficient argument in favour of the "justice or the expediency" of receiving gratuitous lectures.

Next comes Veritas, who only states that the members have shewn their disapprobation of Mr. Green's lectures; but, I must say, and will maintain, that such disapprobation must come from them with a very bad grace indeed, inasmuch, as in so doing, they committed an action which to a proverb is an ungracious one, and, therefore, ought not to be done, viz.—looking a gift horse in the mouth; (this latter is a hackneyed phrase, but when a better is found it shall be dismissed.)—And I can easily imagine Mr. Green's cogitations on the occasion, to have been something like the following in sentiment, if not in words, "Here I have been making these people a present of a course of *valuable* lectures on architecture; and the only thanks I get is disapprobation; if I had been paid for them, it would have been different, but, to say the least, it is very ungracious behaviour."

In conclusion, I have only to express the pleasure which the appearance of Argens' letter gave me; for, as appearances then were, I stood a chance of being overwhelmed with numbers; and further, how cordially I agree with him in his three propositions, which bring the question into a small circle, from which, I trust, no disputant will, for the future, wander. I yield, with pleasure, my rank in the debate to Argens, (to whom I feel myself superior only in name) under whose auspices, I will, to the extent of my limited ability, maintain his propositions.

I am, Sir,
Your most obedient Servant,
AURUM.

PAINTER'S COLIC.

The colic known by this name, and which is produced by the absorption of the white lead mixed with paint, and sometimes with wines and spirits, has hitherto been generally treated by vomits, aperients, and opiates. Dr. Palais, a French physician, has published a treatise, in which he shews, that the application of leeches to the abdomen, and the exhibition of soothing medicines, have a much more beneficial effect.

BANK NOTE ENGRAVING.

Every person is, by this time, familiar with the new species of engraving, introduced into this country by Messrs. Perkins and Fairman, and applied, under the direction of Sir W. Congreve, to the prevention of the forgery of country bank notes. It appears, from the following article, which we extract from the Franklin Journal and American Mechanics' Magazine, for August, 1826, that the merit of the invention belongs neither to Mr. Perkins nor Mr. Fairman, but to another countryman of theirs, Mr. Asa Spencer, of Connecticut.

"The whole of the process, excepting the words, is performed in the lathe, and is therefore purely mechanical. The instrument by which it is accomplished, is denominated the *Geometric Lathe*, which was invented by Mr. Asa Spencer, of Connecticut, but now of this city. An opinion, altogether erroneous, has been prevalent, that it was the product of the genius of Mr. Jacob Perkins; an intelligent gentleman in Connecticut, first suggested to Mr. Perkins its application to Bank notes, as a security against counterfeiting, and he in consequence, engaged Mr. Spencer to carry this suggestion into operation. Mr. Spencer accompanied Mr. Perkins to this city in the year 1816, when the lathe-work was first applied to the notes of the bank of the United States, by Messrs. Murray, Draper, Fairman, & Co. When Messrs. Perkins & Fairman went to London in the year 1819, Mr. Spencer was induced to join them. The work was there put to the severest test, which the combined talent of that great metropolis could invent, and after having passed this trial in the most satisfactory manner, it was very generally adopted, and continues to be used by the banks and bankers of the United Kingdom.

"The Geometric Lathe differs very materially from every other turning engine, hitherto invented. The only one, the work of which has any apparent similarity, is the Rose engine, by which the beautiful ornamental work on the metallic dial plates, and cases of French and other watches, is performed. This instrument is only capable of *copying* patterns, previously formed upon "*guides*;" whilst the Geometric lathe, forms its own patterns, which are all *original*, and are as various, and as unlimited in number, as those produced by the kaleidescope.

"In the rose engine, the pattern is produced by a great number of distinct lines, separate from each other, whilst the figures formed by the Geometric lathe, result from one continued line, which returns into itself. When a die is to be formed, or an article to be ornamented, the tool (a single point) is at rest during the operation, whilst the lathe is made to revolve, and carries the article to be turned, in all the various circumvolutions, requisite to form the complete figure. Those who are acquainted with Suardi's Geometric pen, can form some idea how this may be accomplished. We have compared the lathe, in the multifarious patterns which it is capable of producing, to the kaleidoscope; the justness of this comparison will be obvious from the fact, that the inventor of the lathe, is unable to re-produce a particular pattern, unless he has kept an exact register of the arrangement by which it was originally produced; and that under any new arrangement, the resulting pattern is known from trial only.

"On carefully inspecting a specimen of Mr. Spencer's engraving, it will be seen that on some of the figures, the lines are white, and the ground black, whilst on others, the reverse is the case: this is attained by what is called *transferring*; which bears some resemblance to the taking of an impression from a seal. When a steel die is made, the lines are cut in, like an engraving upon copper; this die is then hardened, and it is forced upon another piece of steel, with a power sufficient to produce a complete impression, so as to make a reversed die. By this means the effects produced, combine those of wood, and of copper-plate engraving, whilst the whole may be said to be mathematically correct, and defies the effort of the most skilful hand, to produce any thing like an exact imitation.

"It has been said that what has been done by man, man may do again; to a certain extent this is true, but it is not absolutely so; who can reproduce a complicated form, which was the result of accident? the work of which we are now speaking, defies imitation as truly as that which is purely accidental. It is true that patterns may be produced which shall deceive unskilful observers; but this difficulty exists in the very nature of things; it is one thing to make an article which cannot be imitated, and another to create the power of discrimination, where nature has denied it, or where it has not been formed by habits of observation. We think that all that can be accomplished, in the prevention of counterfeiting, is to produce work requiring consummate skill, and expensive apparatus, so that a tolerable imitation, shall be equally difficult and unprofitable, whilst, to the discriminating, it may be absolutely inimitable. Is not this the case with the plan pursued by Messrs. Fairman, Draper, Underwood, & Co.? We think that this question may be answered in the affirmative. We have mentioned the subject of transferring, as applied to the lathe-work, but to this it is by no means confined. Every kind of engraving, but more particularly the vignettes, may be transferred by means of steel dies made in the form of rollers. The engravings are at first made upon cast-steel, which is afterwards hardened; an impression in relief is then taken upon cast-steel rollers, which are also hardened; from these the whole may be transferred to plates of copper, or of steel, so that the impressions precisely similar, in every dot and line, may be made upon any number of plates, and these impressions, when worn, may be renewed by the same tool, with a precision which is otherwise unattainable. A degree of labour, may consequently be given to a single figure, which could not otherwise be afforded, and the first talents may be employed, at almost any price. The copper-plates, like the impressions upon paper, may be said to be printed."

SQUARING THE CIRCLE.

An Italian geometrician, of the name of Malacarne, has published at Paris a treatise, entitled, "A Geometrical and Accurate Solution of the celebrated Problem of the Squaring of the Circle," and he has deposited in the hands of his bookseller the sum of 300 francs, to be given to any one who can prove that he is in error!

BURSTALL'S STEAM-COACH.

Mr. Burstall has now so far succeeded with his steam-carriage, (described in a former number,) that he made a trial of it lately along the Ferry Road, near Edinburgh, when it went at the rate of between five and six miles an hour. A greater velocity might have been given to it, had not a slow motion been necessary to observe the working of the machinery.

PAINTING ON PORCELAIN AND EARTHENWARE.

The colours employed in the painting of porcelain and earthenware are produced by means of the different metallic oxides, each of which affords a different colour, and these colours are again multiplied by such mixtures of two or more of the oxidized metals, as experience has shown to be useful.

In employing these colours, the ground oxide is first mixed with a prepared flux, which is also reduced to an impalpable powder, and then this mixture is well incorporated with gum water, the acid of tar, oil of turpentine, or some other essential oil. The fluids are used merely to lay on the colour, for it is necessary that whatever oil is employed, it should evaporate immediately and entirely.

The preparations which are commonly used, are the metallic oxides, and their combinations with acids. Thus, cobalt yields a blue; antimony and silver give yellows and orange; platinum a silver colour; gold, violet and purple; copper, the greens; while the reds, the browns, and the blacks, are derived from iron.

The oxide of cobalt employed in pottery is usually prepared from zaffre; which is an expensive article imported from Saxony, though a few years ago it was procured from Cornwall. For preparing antimonial yellows, the crude antimony is first calcined with four times its weight of nitre, and then mixed with a certain portion of vitrified lead. Oxide of gold, precipitated by copper, makes the finest purple. A small portion of copper mixed with oxide of iron, greatly increases the intensity of the blacks on earthenware. It is here necessary to remark, that in *painting* on the *biscuit** no oil is used; the colours are mixed with water only. For certain purposes, the painting is performed on the glaze, as some colours would be injured, and others destroyed, by the heat of the gloss oven. Thus, when iron is employed to produce black or brown, the painting is always done upon the glaze, the ware is then finished in an enamelling oven, at about six degrees of Wedgwood's Pyrometer.

Lustre ware is produced by being covered entirely on the exterior, as is the case when the sulphuret of antimony is employed for producing a common kind of yellow ware.

Gold lustre is effected by means of gold, and silver lustre by the oxide of platinum.

For preparing the lustre ware, the oxide, of whatever kind it may be, is mixed with one of the essential oils, and in that state is brushed upon the surface after the ware is glazed. For gold lustre the ware is made of red clay, which, when burnt and glazed, shows so much of its colour through the covering of gold, as is sufficient to give the goods that peculiar brown tint, which is always observable on this singular kind of pottery. When the metallic oxide has been applied to the surface of the goods, they are carried to an enamelling oven, where the heat dissipates the oxygen, and restores those precious metals to their metallic state, though not quite to their primitive brilliancy, because this is often injured by the fluid menstruum employed in the operation. The great difference which there is in the appearance of this ware, especially that which is covered with platinum, can only be thus accounted for. Some of it looks like silver, while from other manufactories, the article looks like steel.

For *gilding* porcelain the metal is used in its metallic state. To procure it in a pulverized form, it is first dissolved in aqua regia, and then the acid is driven off by heat, and the gold remains; this is then mixed with borax and gum water, and applied in that state to the goods; after this it is baked, and finished by burnishing.

Blue painting. The potters of England have derived great advantage from the introduction of the printing-press. The use of this valuable machine, which is comparative-

* Biscuit is a term used in potteries to denote the ware after it is once baked and is unglazed.

ly of late date, has enabled these manufacturers to produce a greater variety of patterns, and of neater execution than could possibly have been done, at the same expense, by the pencil. As this is a curious branch of the business, it will be proper to describe it minutely.

The intended pattern is first printed with some metallic colour, chiefly oxide of cobalt, on what is called silver paper, and the colour is transferred from the paper to the surface of the porcelain.

This style of ware is a very successful imitation of the old blue porcelain of China, and of late years has been the means of extending the consumption of British pottery throughout Europe. The potters of China are totally unacquainted with the printing press, and consequently all their designs are produced by the pencil alone.

This mode of imparting designs to the surface of porcelain, and which is known in the trade by the appellation of *Fine Painting*, is managed in the following manner.

One man attends the press, which is similar to the common copper-plate printing press; and as soon as he has applied the colour, which is laid on the copper-plate in the same manner which the copper-plate printers apply the ink—he lays it upon a hot iron to thin the oil with which the colour is mixed.

The oil is a peculiar preparation of boiled linseed oil for this purpose. When the colour upon the plate is thus reduced to a proper consistence, a sheet of silver paper is laid over it, and passed through the press.

The oxide of cobalt is the only mineral employed for the blue, and is largely prepared in the Staffordshire Potteries. It sells from 40s. to 60s. the pound, according to its intensity and goodness. Indeed, such improvements have been made in the manufacture of this colour, that the Chinese potters are now supplied from England with all the cobalt they consume.

When the paper comes from the printing press, stamped with the required pattern, it is delivered, while wet with the colour, to a girl, who cuts off the superfluous paper with a pair of scissors, and passes it to another girl who immediately applies it to a piece of biscuit ware, and then hands it to a third, who fixes it more firmly by rubbing it hard with a piece of flannel tightly rolled up in the form of a short cylinder. The design of this hard rubbing is to force the colour into the pores of the ware. When the papers thus applied have lain on for about an hour, the colour is generally found to be sufficiently fixed to admit of their being detached. This is effected by putting the articles into a tub of water, where the paper soon becomes soft enough to allow of its being rubbed off, leaving the full impression of the pattern upon the biscuit. The paper having been removed, the ware is suffered to stand dry, after which it is put into an oven at a low heat, for the purpose of dissipating the oil, and preparing it to receive the glaze. It is obvious that a transparent glaze is necessary to give full effect to the brilliant colour of the cobalt. A little of the oxide is put in the glaze to subdue any lurking yellow tint which might impair its lustre.

The possibility of printing two or three colours at once does not appear to have yet occurred to the porcelain and earthenware manufacturers, but as the Lancashire calico printers employ a machine which imparts two or three distinct colours by one impression, the application of the same principle to earthen ware and porcelain can scarcely be a matter of any difficulty.

PORTABLE CALCULATOR FOR SEAMEN.

The teacher of the high school of Leinekilns, (near Edinburgh,) has invented an instrument which he proposes to call the "Seaman's Portable Correct Calculator." It is said, that by one operation, it shews both the difference of latitude and departure, and with more correctness and expedition, than any instrument or table yet published. It is so constructed too, that every distance, difference of latitude and departure, is ascertained from one hundredth part of a mile, to one thousand miles, *ad infinitum*.

OAT BRUISING AND CUTTING CHAFF MACHINES.

Sir,—In your 170th number I observe a correspondent enquires where he can have a machine for bruising oats and cutting chaff constructed on moderate terms. Visiting lately the manufactory of Messrs. Taylor and Jones, in the Crescent, Jewin Street, (where, as is mentioned in your magazine two weeks ago, is constructing Eve's Rotary Pump,) I observed machines constructing for the various purposes of grinding and bruising grain of various kinds, and likewise others for cutting chaff, all which appears to me to be very superior, both in point of construction and workmanship.—If your correspondent finds this notice of any service it will satisfy

Your's, &c.

AMICUS.

AROMATIC VINEGAR.

Macerate during four days two ounces of rosemary and two ounces of sage, with one ounce of lavender and one drachm of cloves, in four pounds (all apothecaries' weight,) of wine vinegar, then filter the expressed liquor through paper. It is considered an antiseptic, and an improvement of what is called *Thieves' Vinegar*.

This preparation may have its use; but in contagion I would advise your readers not to rely upon this, nor on camphor, &c. but have recourse to fumigations with chlorine gas. Perfumes serve only to disguise the mischief, ventilations to diffuse it in the atmosphere, fumigations to destroy it completely.

A. M. CORIN.

TRISECTION OF THE ANGLE.

For ages have the mathematicians of the west sought in vain for a demonstration of the trisection of the triangle; they have even ventured to pronounce it *insoluble*. But what neither the English, nor French, nor Ge[illegible] science have been able to accomplish, has at length (so at least we are positively assured,) been effected by a Turk (!!!) "the most humble, the weakest of the servants of the defender of the truest of all faiths, Massdaried-[illegible]e Seid Hussein, the first As-sociate of the Imperial Academy of Fortification, Constantinople!" The claim to the discovery is made in a pamphlet lately published by the said Seid Hussein. What renders the matter more surprising is, that the author has not only deceived himself, but obtained the suffrages of all the suffragans and members of the Turkish academy.

NOTICES TO CORRESPONDENTS.

Communications received from Y. Z. —Mr. Tonkin — H. C——l — Mr. Weekes—T. M. B.—Mr. Lake — J. Brown—Az—Mr. Short—T. H. G.

F. M. is certainly entitled to an early insertion of his reply on the subject of the Transformations of Matter, but it came quite too late for a place this week. It shall, however, appear next week.

The Supplement to our sixth volume is in preparation, and will be published at the close of the year. The difficulties in regard to it, alluded to by "Mentor" and "An old Subscriber," will all (we trust,) be obviated.

B. R.'s communication, though extremely clever, is rather foreign to our range of subjects. He had better forward it to the *Lancet*. It has been left, as he directed.

Janus—Send the drawing, with a particular description of it, and it will be inserted.

Communications (post paid) to be addressed to the Editor, at the Publishers', KNIGHT and LACEY, 55, Paternoster Row, London.

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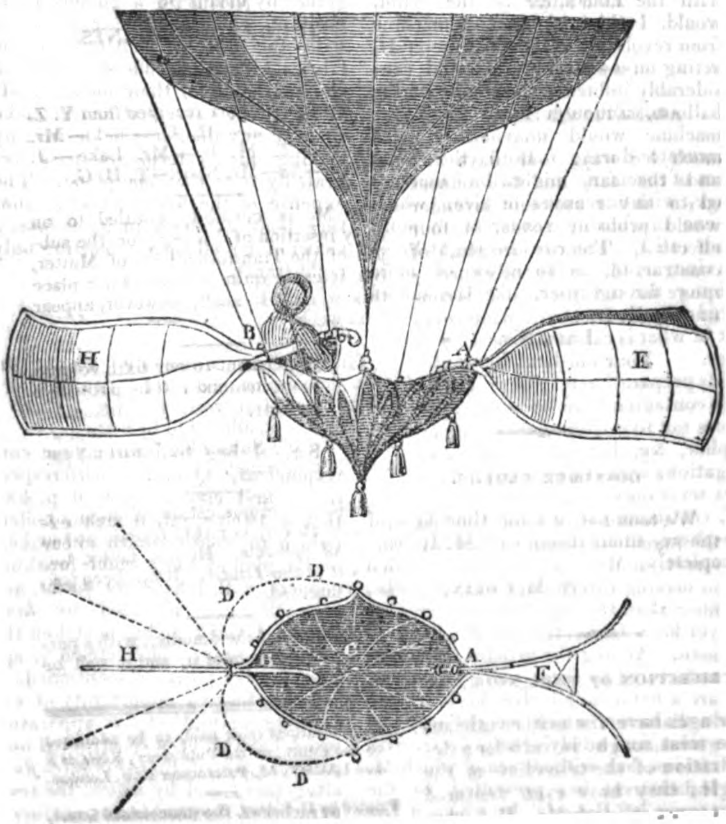
Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 178.] SATURDAY, DECEMBER 16, 1826. [Price 3d.

"Awake to the call of LABOUR. I will teach you to remedy the sterility of the earth, and the severity of the sky; I will compel summer to find provisions for the winter; I will force the waters to give you their fish, the air its fowls, and the forest its beasts; I will teach you to pierce the bowels of the earth, and bring out, from the caverns of the mountains, metals which shall give strength to your hands, and security to your bodies, by which you may be covered from the assaults of the fiercest beasts, and with which you shall fell the oak, and divide rocks, and subject all nature to your *use* and *pleasure*." DR. JOHNSON—Rambler.

METHOD OF STEERING BALLOONS.



METHOD OF STEERING BALLOONS.

Sir,—As the science of aerostation has as yet proved comparatively useless to the world, I think it is high time that one more attempt should be made to steer a balloon through the atmosphere. If you consider this plan, which has occurred to me, likely to be of any avail, by inserting it in the Mechanics' Magazine, you will perhaps eventually benefit the public.

Let C be the car of the balloon, and H a helm, made, as light as possible, of wicker and oiled paper.—And let F be a fan, similar in construction to a double weather-cock (and composed of the same materials as H,) which must be firmly attached to the car at the point A. This, with the assistance of the wind, would, I think, keep the machine from revolving. Then the helm H, acting on a swivel at B, would considerably influence the course of the balloon, although I am afraid the machine would unavoidably make much lee way. Both the helm and the fan might be increased to any reasonable size, which would probably render them more effectual. The car also might be so constructed, as to allow of more range for the tiller, like the dotted line D, D, D, D.

I am, Sir,
Your obedient Servant
S. R. C.

GOSSAMER CLOTHS.

We took notice some time ago, of the ingenious labours of M. Habenstreet, of Munich, who has succeeded in making caterpillars weave cloths, finer than the finest that have ever yet been fabricated by the hand of man. Among the articles since manufactured by these minute labourers, are a balloon, four feet high, by two in diameter, which weighs only five grains, and a lady's entire dress, with sleeves, but without seam, which M. Habenstreet has presented to the Queen of Bavaria, by whom it has been worn (above another dress,) on several occasions. The instinct of these caterpillars, leads them to construct above themselves a covering of extreme fineness, but, nevertheless, firm enough to be almost impenetrable by air; and M. Habenstreet taking advantage of this circumstance, makes them work on a suspended paper model, and in any direction he pleases, by merely touching the limits which ought not to be passed, with oil, for which the animals have such a repugnance, that they will not come in contact with it. Each caterpillar produces about half an inch square of the fabric. The manner of their weaving has no analogy to *ours;* with us the threads are interwoven, whereas these caterpillar-weavers place their threads one above the other, and glue them together by means of a gummy composition, which they extrude along with the threads. Although the fabrics hitherto produced, have been so remarkable for their fineness, M. Habenstreet says, that he can make them of any thickness he desires, by making his caterpillars pass repeatedly over the same plane. The expense of the manufacture is another point strongly in its favour, a shawl of an ell square, costing only eight francs.

SUPERIOR MODE OF TREATING PINE-HOUSES, OR VINERIES, BY STEAM.

Sir,—I beg to inform your correspondent, "Quereris," with respect to his first enquiry, vol. 6, p. 400, that a twelve gallon steam boiler, (which any copper-smith will make,) on the plan of the portable washing coppers, will, I have no doubt, answer the end intended by *him,* though I think he has mistaken the principle upon which steam is applied for the purposes mentioned.

I have had an opportunity of examining several steam apparatus, which have all been constructed on a plan to *supersede* the use of *brick flues* altogether; and by which, the temperature of the pine-house, or vinery, may be increased to any degree of heat required. The plan consists of a steam boiler heated by a furnace, of a size, of course, proportioned to the size of the house: with safety valve, hydrostatic balance, pressure gauge, float stones, &c. annexed; which is fixed outside the back of the house, in a shed erected for the purpose. A main rises from the boiler, which communicates with steam-tight cast iron pipes, continued entirely round the inside of the pine-house, or vinery, generally about one foot from the ground. Cocks are likewise placed in the top of them, about eight feet from each other, for the purpose of occasionally steaming the whole house; the period between each steaming being regulated by the judgment of the gardener. By this process, the vegetation, as well as the flavour of the fruit, is greatly promoted. I have seen pines which have been grown in houses where steam has been used exclusively, finer in flavour, and, I should think, at least one-fourth larger than those grown by the ordinary method. It is surprising this mode of heating by steam is not better known, and more generally adopted; as there cannot be a doubt but it is superior to the other in every respect.

I recollect some time ago seeing an excellent plan of a steaming apparatus on the plan I have mentioned; which was erected at Casina, Dulwich-hill, the residence of the late R. Shawe, esq. An engraving of it has been published in the Horticultural Transactions; it was erected by Mr. Stodhart, of High Street, Camberwell, smith and engineer. He also, it seems, has erected similar apparatus for Sir H. Baring, M. P., Col. Austin, Seven Oaks, Kent, and others; therefore, should my description be not sufficiently intelligible to your correspondent, he can apply to Mr. S. who, no doubt, will give him the information he requires.

I am, Sir,
Your obedient Servant,
VERAX.

P. S. It has occurred to me, that the fire which heats the steam boiler, might be advantageously employed to heat the brick flues of houses where they are already erected. So that either mode might be adopted, a dry, or steam heat, or both. Dampers also might be introduced, so as to apply the dry heat, or not, as required. Also, in situations where the vinery is contiguous to the house, the steam from the boiler might be used to heat a vapour bath, or cooking apparatus; which would save the expense of a separate boiler, as well as the extra consumption of fuel.

THE STEAM ENGINE ACTUALLY CONSTRUCTED AND APPLIED TO PRACTICAL PURPOSES,

By the Marquis of Worcester!

Mr. Stuart, the author of the Historical and Descriptive History of the Steam Engine, has just published the first part of another work, entitled, "Anecdotes of Steam Engines," which contains, among other novel and interesting matter, the following unexpected evidence, that the Marquis of Worcester did not merely imagine the probability of employing steam as a moving power, but that he actually constructed an engine on this principle, and applied it successfully to the raising of water. It may be recollected that, in his former work, Mr. Stuart, differing from most other writers who have touched on the merits of the Marquis of Worcester, (see Mechanics' Magazine, vol. 2, p. 355) inclined to the opinion that, nearly all the "inventions," and this of the steam engine in particular, for which the Marquis took credit, and which have made his name so celebrated, existed in fancy only.* Subsequent investigation, however, has convinced Mr. S. that he did great injustice to the memory of the Mar-

* "The second volume of the Mechanics' Magazine," says Mr. Stuart, "contains by far the best reprint of the *entire* treatise that has appeared.—In this will be found the variations of the printed copies from the MS. in the British Museum."

quis in this respect; nor can any one, we think, who reads the following extract, have a doubt that, as regards steam power, at least, he has all the merit of being both the first to conceive the important uses in the arts and manufactures, to which it might be applied, and the first to avail himself, in practice, of the giant strength, which it has superadded to human industry and skill.

"The fact of the marquess ever having given to the water-commanding engine any, except a *descriptive existence*, is debateable ground with authors in mechanics; and, on that account, it may be considered to require some higher authority than mere inference, to decide the point of his having actually constructed an engine.

"The references, it is admitted, are all drawn from the marquess's *own* account of his *own* invention, and which were addressed to the public, in order to induce them to listen to his schemes, and to patronize them. As his pretensions were as high as his imagination was prolific and sanguine, some shade of suspicion may attach to them as being highly coloured, from a less unworthy motive than deception—the gratification of personal vanity. Yet, surely, even this will not be urged, when he is followed into his closet. In his address to the Deity, the phantoms of an overweening conceit could find no place; after his death, the following manuscript prayer was found among his lordship's papers:—

"'The Lord Marquess of Worcester's ejaculatory and extemporary thanksgiving prayer, when first with his *corporal eyes he did see* finished a perfect trial of his water-commanding engine, delightful and useful to whomsoever hath, in recommendation, either knowledge, profit, or pleasure.

"'Oh! infinitely omnipotent God, whose mercies are fathomless, and whose knowledge is immense and inexhaustible, next to my creation and redemption, I render thee most humble thanks, from the very bottom of my heart and bowels, for thy vouchsafing me (the meanest in understanding) an insight in so great a secret of nature, beneficial to all mankind, as this my water-commanding engine. Suffer me not to be puffed up, O Lord, by the knowing of it, and many more rare and unheard of, yea, unparalleled inventions, trials, and experiments; but humble my haughty heart, by the true knowledge of mine own ignorant, weak, and unworthy nature, prone to all evil. O, most merciful Father, my creator, most compassionating Son, my redeemer, and holiest of Spirits, the sanctifier, three divine persons and one God, grant me a further concurring grace, with fortitude to take hold of thy goodness, to the end, that whatever I do, unanimously and courageously, to serve my king and country, to disabuse, rectify, and convert my undeserved, yet wilfully incredulous enemies, to reimburse thankfully my creditors, to reimmunerate my benefactors, to reinhearten my distressed family, and with complacence to gratify my suffering and confiding friends, may, void of vanity and self-ends, be only directed to thy honour and glory everlasting.'

"Although at every period of his life, he seems to have been deeply impressed with the feeling, that progress never was made in any thing by supine wishes and dilatory efforts, unremitting perseverance and assiduous industry were, in his case, to be of no avail in stemming the tide of adverse fortune; his wishes were written in sand; and in the prosecution of his philanthropic projects he was fated to experience not only the neglect of the public, but the ingratitude of friends, without being convinced of the hopelessness of the attempt at introducing improvements beyond the comprehension and spirit of the age. As long as hope survived, and that ceased not until he 'was summoned by the angel of death,' he continued to prefer with vigour his claims to public attention and patronage.

After his death,* the marchioness,

* The marquis died at London, on the 4th of April, 1667, and his remains were carried in much state to Ragland Church, and interred in the family ce-

who seems to have been of a congenial spirit, and to have been actuated by no small share of her husband's enthusiasm, continued her exertions to introduce the water-commanding engine. The zeal with which she prosecuted her scheme, being considered unbecoming her sex, and derogatory to her quality, a Romish priest, who had some influence with her ladyship, was selected to expostulate on the impropriety of her conduct, and to convey to her the wishes and opinions of her friends. 'All those,' says the confessor, with no small boldness, 'who wish you well, are grieved to see your ladyship to be already so much disturbed and weakened in your judgment, and in danger to use the right use of your reason, if you do not timely endeavour to prevent it, by ceasing to go on with such high designs as you are upon, which I declare, on the faith of a priest, to be true. The cause of your present distemper, and of the aforesaid danger, is, doubtless, that your thoughts and imaginations are very much fixed on your title of Plantagenet, and of disposing of yourself for that great dignity by getting of great sums of money from the king to pay your deceased lord's debts, and enriching yourself *by the great machine, and the like.* Now, madam, how improper such undertakings are for your ladyship, and how impossible for you to effect them, or any of them, all your friends can tell you, if they please to discover the truth to you.'

"'The effects,' continues the confessor, 'that flow from hence are many; as the danger of losing your health and judgment, by such violent application of your fancies in such high designs and ambitious desires; the probability of offending the Almighty God, and prejudicing your own soul thereby; the advantage you may thereby give to those who desire to make a prey of your fortune, and to raise themselves by ruining of you. I confess that the devil, to make his suggestions the more prevalent, doth make use of some motives that seem plausible, as of paying your lord's debts, of founding monasteries, and the like; and that your ladyship hath the king's favour to carry on these designs.'*

"*The great machine* appears, at this time to have been in existence; but it were idle to multiply instances from the marquess's personal history, or from that of his family. The first has been thought to savour of enthusiasm, and the latter might be ascribed, however unjustly, to the praiseworthy, but probably mistaken, gratitude of those whose affection might urge it as a duty to be tender of the reputation of an amiable relation or friend, even in matters which might be considered as those of his wanderings.

"No such objection can, however, apply to the testimony of an eye-witness, and one who cannot be accused as speaking from either interest or friendship. The inspection was made two years after the death of the noble inventor; the account of it, written in a foreign tongue, lay hidden in a manuscript, deposited in a foreign library, for one hundred and fifty years after the machine itself, probably, ceased to be in existence; and we feel no small gratification in being the first to give it a place in the history of the steam-engine.

"About the year 1656, Cosmo de Medicis, grand duke of Tuscany, sought respite and solace from unhappy family dissensions, by visiting the courts of foreign countries. Cosmo was accompanied by a retinue of men of letters and artists, for the purpose of recording those circumstances and scenes which during his journey might appear worthy of remembrance. A minute and circumstantial account of each day's occurrences, was regularly entered into a journal, by the grand duke's secretary. At Cosmo's return to Italy,

metry. Heath examined the vault in 1795, and found there a plate which had been placed on the coffin, with the following inscription:—

Illustrissimi Principis Edwardi Marchionis et Comitis Wigorniæ Comitis de Glamorgan, Baronis Herbert de Ragland, et qui obit apud Londini tertio die Aprilis A Dni. MDCLXVII.

* The Marchioness died in 1681.

this Diary was carefully deposited in the ducal library at Florence.

"From its containing a variety of particulars respecting persons and places in England, it had become an object of considerable interest to those Englishmen who were aware of its existence. But it was not until 1818, that any part of its contents was disseminated by the press, when that portion of the manuscript volume which related to England, was translated from the Italian, and published in a quarto volume.

"In that translation, under the date of the 28th of May, 1699, we have the following account of *one* of Lord Worcester's machines:—'His highness, that he might not lose the day uselessly, went again, after dinner, to the other side of the city, extending his excursion as far as Vauxhall, beyond the palace of the archbishop of Canterbury, to see an hydraulic machine, invented by my Lord Somerset, Marquess of Worcester. It raises water more than *forty geometrical feet*, by the power of *one man only*; and in a very short space of time *will draw up four vessels of water, through a tube or channel not more than a span in width*; on which account it is considered to be of greater service to the public, than the *other* machine near Somerset-house.'

"This therefore is superior in its operation to *another machine, by a different mechanic, and applied to the same purpose.*

"Now, in another part of the same Diary, it is stated, that 'his highness went to see an hydraulic machine, raised upon a wooden tower, in the neighbourhood of Somerset-house, which is used for conveying the water of the river to the greatest part of the city. It is put in motion by *two* horses, which are continually going round; it not being possible that it should receive its movement from the current of the river, as in many other places where the rivers never vary in their course. But this is not the case with the Thames, owing to the tide, consequently the wheels which serve at the ebb, would not do their duty when the tide returns.'

"Nothing can be more satisfactory than this last notice; the water in the hydraulic machine at Vauxhall, by the most easy inference, was *not* elevated by a water-wheel, otherwise the grand duke would not have omitted to mention so striking a deviation from that at Somerset-house. The effect was equal to that of another worked by *two horses*; and a tyro in mechanics would, at first sight, say, that no combination of machinery could accomplish that work by one man, which it required the power of twelve men to do in another. From all the circumstances, therefore, it appears to us clear, that this great effect was produced by some sort of a steam-engine; the very identical 'most stupendous water-commanding engine;' the 'semi-omnipotent engine;' the admirable and most forcible way to drive up water by fire; 'the most stupendous water-work in the whole world,' which he humbly beseeched God to make him humble, as being its discoverer; and which, when he had gone to that 'bourne from whence no traveller returns,' his widow incurred the imputation of insanity for persisting to carry forwards. And well may we add, in his own language, that in our times it appears indeed 'to have been produced by heavenly inspiration,' and in its power, 'boundless in height and quantity.'

"From the brevity of the notice in the grand duke's manuscript, it is probable he was ignorant of its principle. It was too novel to be forgotten, had it been imparted to his highness. But this sort of concealment was the fashion of that time, as it is in some instances that of our own. Other coincidences between the descriptions of Cosmo's journal, and those in the 'Century of Inventions,' are truly remarkable. In both, the height of *forty feet* is stated to be the elevation to which the water is to be raised; in both the attendance of *one man* is mentioned; and *four vessels* of water through a tube or channel of not more than a span in width, being drawn up, is almost the same choice of words used in his celebrated sixty-eighth proposition. In fact, had the marquess been describing the engine himself, from a view of it in operation, without wishing to describe the principle of its operation, he could scarcely have used other terms, than those used in the journal of Cosmo of Medici."

BURSTING OF STEAM BOILERS.

Sir,—The disastrous events which have repeatedly happened, owing to the bursting of steam boilers, naturally turns the attention of humane minds towards any thing which may tend to prevent or mitigate such dreadful evils. An idea having occurred to me on the subject, I hasten to communicate it to you.

I propose to have an outer and an inner boiler; the inner one to contain the water, whilst the space between it and the outer one is intended to contain steam only, which will be supplied by a communication at the top. The pressure will, of course, be upon the external boiler, and as that contains steam only, I presume that but little damage would occur, in case an explosion should take place, as the force of such a small quantity of steam would be immediately destroyed by its expansion. As an additional security, the space between the two boilers might be divided into different compartments, all communicating at the top, which would naturally confine an explosion to that compartment which might happen to be weakest, and principally to the force of the small quantity of steam contained therein. All danger from the hot water would be avoided, as it would still be retained in the inner boiler; I think, too, that the top of the inner boiler might be so contrived, as, in case of an accident, to be easily fixed to the steam pipe, and the vessel might proceed on her voyage as if nothing had happened, though not with equal safety. I need not enter into further particulars, as any engineer who may adopt the plan will easily be able to supply the rest.

I am, Sir,
Your's respectfully,
An old Working Mechanic.

INFLUENCE OF SUGAR IN THE PRECIPITATION OF IRON BY AMMONIA.

The power possessed by tartaric acid, of preventing the precipitation of iron from its solution in muriatic acid by ammonia, is now well known, from the observations of M. Rose and others. M. Peschia has remarked a similar effect produced by sugar. Peroxide of iron being dissolved in nitro-muriatic acid, with the addition of sugar, ammonia, on being added, produced no effect. A solution of iron in muriatic acid, to which sugar had been added before ebullition, presented the same appearances with ammonia; but if the muriate of iron and sugar had not been boiled together, then the ammonia precipitated the oxide. Gum arabic, which scarcely differs from sugar in its composition, has not this property.—*Ann. de Chemie.*

ILLUMINATED CLOCK FACES.

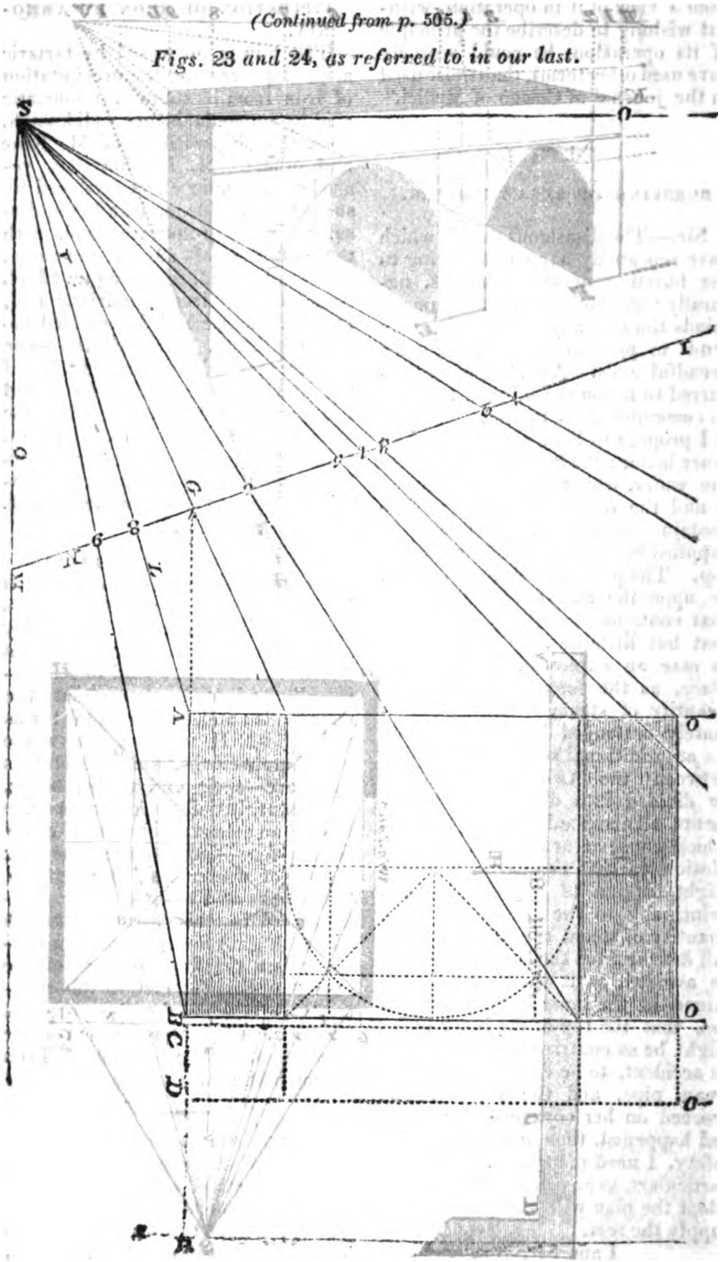
The face of the new clock, which has been put up at St. Bride's Church, Fleet Street, is nightly lighted up with gas, an improvement which we should be glad to see universally adopted throughout the metropolis; and, indeed, in all towns and cities. It will not only make our church clocks twice as useful as they are—their dial plates being, at present, invisible for about twelve hours (on an average) out of every twenty-four—but take from the dark nights of winter half their gloom. The clocks of Venice have been illuminated in this manner (though not with gas) for upwards of a century; but the first instance of the example being followed in this country, was furnished by the people of Glasgow, who, about two or three years ago, lighted up their Tron church with gas.

PURIFYING GUM LAC.

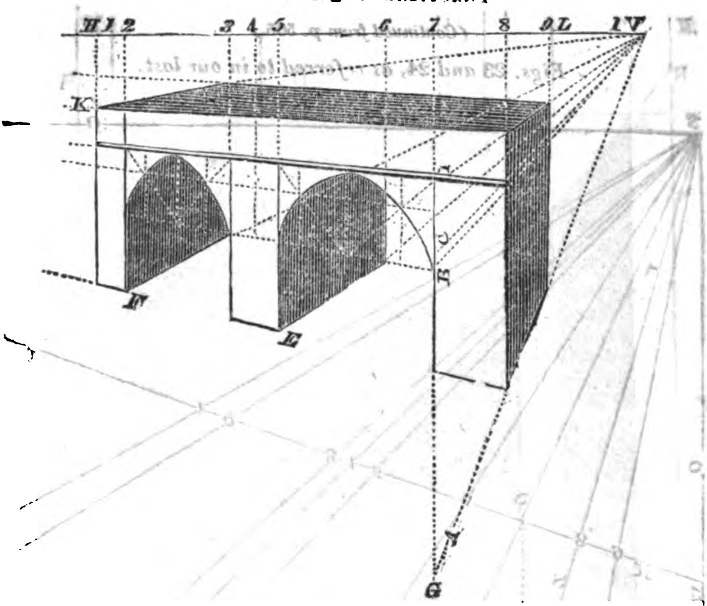
Can any of your readers communicate a method of freeing gum lac from the last portions of its colouring matter? I have thrown it down from its solutions by various reagents, but, hitherto, universally without success. M.

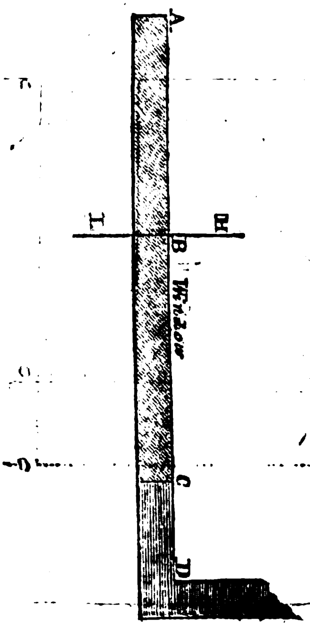
(Continued from p. 505.)

Figs. 23 and 24, as referred to in our last.



Problem 7.—Figs. 25, 26, and 27.





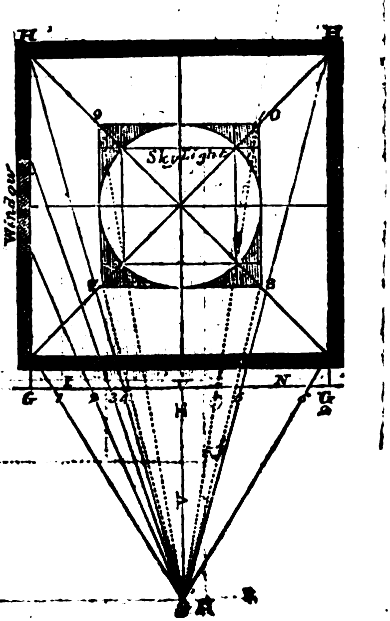
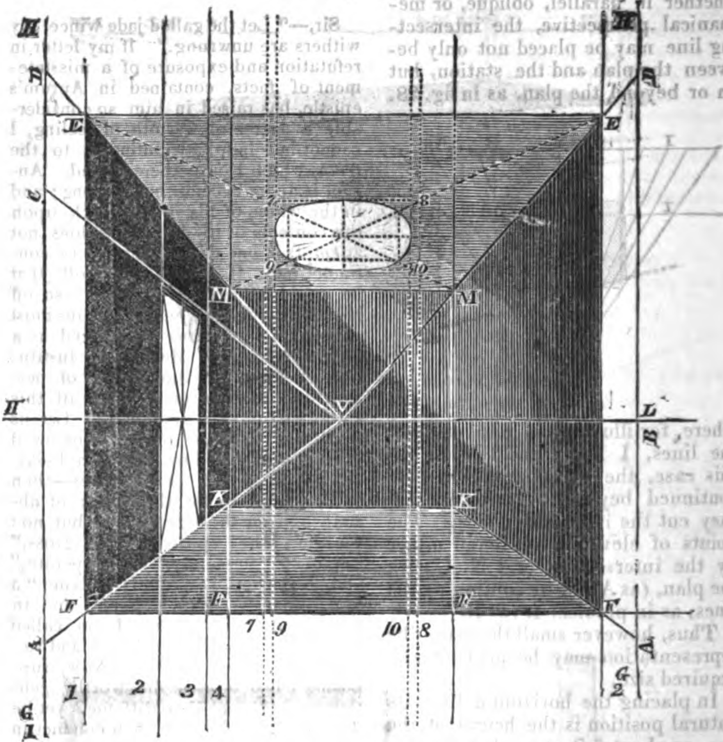


Fig. 27.



The plan, elevation, and station, being given to delineate the interior of a room, with a French casement and sky-light, in parallel perspective.

The principal variation in this figure, is the situation of the vanishing point, which is here placed in the centre, (this is no rule, though it is frequently the best position in interior views, large landscapes, &c.)

To find its place, having drawn the rays to the station, and the intersecting line, I N, according to problem 1, draw from S the ray, V L, cutting I N at right angles, and its intersection gives V. the vanishing point.

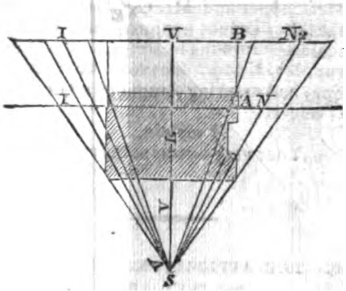
The sky-light must be drawn on the plan, (and if, as in the present instance, circular, enclosed in a square,) and rays drawn from each angle to the station; to which, also, rays must proceed from the angles of doors, windows, projections, &c.

The rays, 1, 4, 5, and 6, relate to the room; 2 and 3, to the window, and the dotted rays, 7, 8, 10, and 9, to the sky-light.

To find the representation of the room, having raised the perpendiculars as in problem 1, set off from H L, on G H, 2, the geometrical height of the walls, A D, and L, on G H, 1, the same, and also A C, the height of the window. Then draw the lines, A V, A V, D V, and D V; and where they cut the perpendiculars, 1, 4, 5 and 6, draw the parallel lines, E E, F F, K K, and M M, and the height of the window will be found by the intersections of the line C V, with the perpendiculars, 2 and 3.

To find the situation of the sky-light, draw on the ceiling the dotted diagonal lines, and where they intersect is the true centre; then, where the perpendiculars cut the diagonals, draw the square, 7, 8, 9, 10, and find the circle by problem 4.

It may be here observed, that whether in parallel, oblique, or mechanical perspective, the intersecting line may be placed not only between the plan and the station, but on or beyond the plan, as in fig. 28,



where, for illustration, I have drawn the lines, I N, 1, and I N, 2. In this case, the visual rays must be continued beyond the angles, till they cut the intersecting line. The points of elevation are found either by the intersecting of I N, 1, with the plan, (as A,) or by continuing the lines, as in problem 1, (as B.)

Thus, however small the plan, the representation may be made of any required size.

In placing the horizontal line, its natural position is the height of the eye, or about 5 ft. 6 in. but in machinery, panoramic views, (sometimes called bird's eye perspective,) &c. it is often convenient to elevate it above the object to be delineated, and, under which circumstances, the drawer must use his own discretion.

When the student is thoroughly versed in the science, it will occasionally be productive of advantage, to deviate slightly from its exact rules, when a striking effect is required; as though the drawing may be perfectly correct, when viewed from the proper station, many objects would appear bad to the general observer, particularly columns, cylinders, &c. but such deviations must be made with the utmost caution, and in the best taste; and in representations of machinery, or where great accuracy is required, should rarely be attempted.

M. H. S.

(To be Concluded in our next.)

GRATUITOUS LECTURING.

Sir,—"Let the galled jade wince, my withers are unwrung." If my letter in refutation and exposure of a misstatement of facts, contained in Aurum's epistle, has raised in him so considerable a degree of warmth of feeling, I cannot but help attributing it to the *truths* which I have there stated. Aurum is angry because he is wrong; and in the whole of his *gentle* attack upon the contents of my letter, he does not attempt, in one single instance, to contradict me. He knows very well, that he could not support his case; so off he flies in a tangent, and complains most pathetically of being denounced as a false friend of the Mechanics' Institution; being made the vehicle of personalities and so on. After all this show, what does it amount to? Let us strip the jackdaw of his borrowed plumes, and see how he then looks. He complains of personalities—then we look to him for the virtue of abstaining from the use of them—but, no: we find the epithets of "gross," "spleen," "unseemly," "intemperate," and, further on, he politely calls me "a fool," after saying he shall not, and in the quotation of poetry, I am called "arrogant" and "senseless," and accused of "sinister views." Now, supposing I had abused the worthy gentleman, is he not even with me? yet he declares that he holds such conduct in abhorrence—admirable consistency!

The point on which Aurum seems most to feel, is that of being denounced as a *false* friend. If he wished to rebut this charge, and to show that I accused him wrongfully, why did he not disprove the facts I advanced to expose his misstatement? No, this he could not do with any kind of propriety, he therefore contents himself with characterising my reply to him as unbecoming. Not one word does he offer in refutation of the facts I brought forward; his are mere assertions, mine are positive truths. He asserts that we differ only in opinion, and that my letter only proves his assertion, but let us examine the case, and see how a plain tale shall set him down. Aurum, in his first letter, stated, that the committee of the London Mechanics' Institution managed their affairs badly; to prove this, he observed, that the lectures were bad; to prove that the lectures were bad, he offered as evidence, "the consequent decrease in the attendance of the members." Now, I stated, and Aurum has not thought proper to contradict me, that the attendance of the members was as good as it had ever been, and in this I have been supported. The whole of Aurum's charge hinges upon the non-attendance of the members; this assertion of his being disproved, the whole of his charge, "consequently," falls to the ground. Now, Aurum being a member of the institution, could not have attended the lectures, or, if he did attend them, it is pretty clear that he has misrepresented the attendance of them. A person who thus speaks of the institution at random, cannot be a friend. Thus says the same poet, and let Aurum apply the sense of the words:

"Beware of *tattlers*; keep your ears
Fast closed against the tales they bear,
Fruits of their own invention."

Aurum, had he looked carefully at my letter, would find that I did not charge him with calumny; I said that such appeared to be the case, and that if he did not come forward, and honestly confess he was in the wrong, he would then sacrifice his character for veracity, and his object would appear to be that of doing the Institution all the injury he could, while professing, in fact, such an abundance of friendship. His letter is all smoke; it is, as I have before said, no reply at all to the charge of misstatement of facts. He may now do as he pleases; I shall not take notice of any other communication he may favor you with. He charges me with gross personality, and, at the same time, commits the same fault in a most glaring manner; but I appeal to the good sense of those who may please to read our correspondence, to judge between us. The case is before them; they will be able to see, that I have fully sustained my charge against Aurum of misstatement.

I will take this opportunity of replying to Argens, who has been pleased to be very pleasant, on my stating that various gentlemen stood high in reputation in the scientific world. He says that such information is "news" to him, so it may be—but (I quote his own words) "Assertion for assertion, the one as much entitled (to say the least) to respect as the other."—Argens, in his wisdom, has, some how or other, confounded me with my "chieftain," T. M. B. It is a pity that gold and silver should not be able to make a better *shine*, than they present in the Mechanics' Magazine; but, to return to Argens; it does not follow that because these lecturers do not stand high in reputation, that their lectures should be so bad that the members would not attend them. Having "the steeps of science to climb," they would be the more careful of their characters; and be it remembered, that Mr. Cooper and Mr. Ogg *are paid*, so that they cannot be quoted as evidence against gratuitous lecturing. Thanking you, Mr. Editor, for your kind attention, and assuring Aurum of an absence of anger.

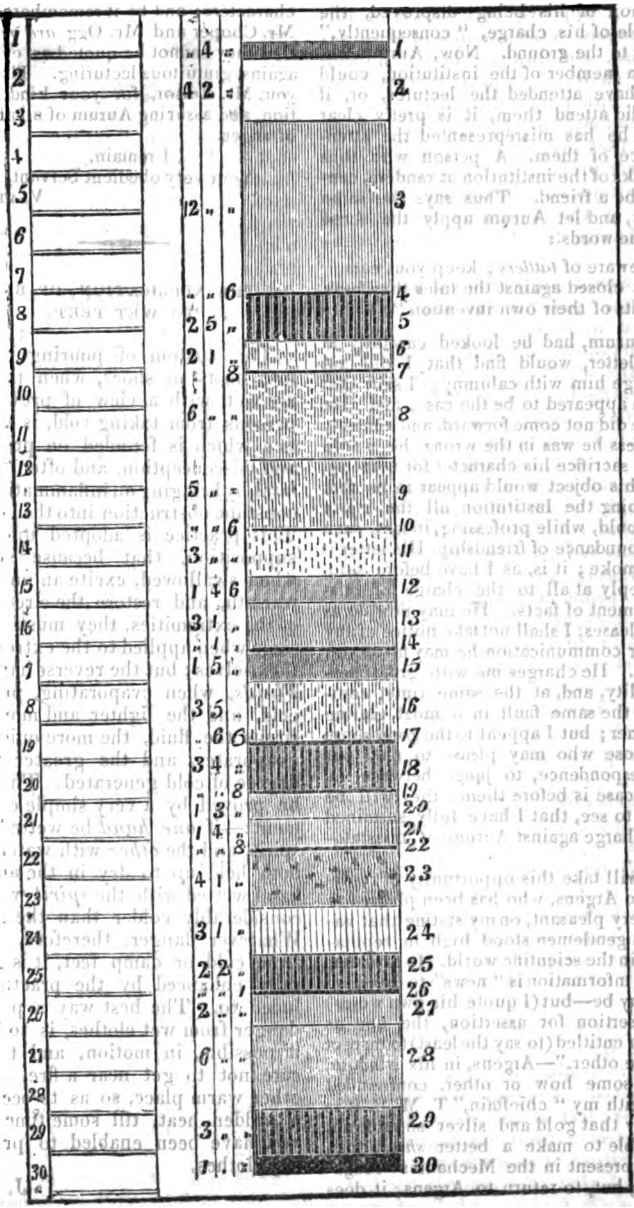
I remain,
Your very obedient Servant,
VIATOR.

ON THE APPLICATION OF BRANDY TO WET FEET.

The custom of pouring brandy into boots or shoes, when the feet are wet, with a view of preventing persons from taking cold, is a practice which is founded on prejudice and misconception, and often proves fatal, by bringing on inflammation and constant obstruction into the bowels. This practice is adopted upon the supposition, that because spirits, when swallowed, excite an universal warmth, and restore the circulation of the extremities, they must do the same when applied to the extremities themselves; but the reverse happens. *Fluids*, when evaporating, produce cold, and the lighter and more spiritous the fluid, the more quickly it evaporates, and the greater is the degree of cold generated. This may be proved by a very simple experiment:—if *one hand* be wetted with spirit, and the *other* with water, and both held up to dry in the air, the hand wetted with the *spirit* will feel considerably colder than the other. Whatever danger, therefore, arises from cold or damp feet, it is generally enhanced by the practice alluded to. The best way to prevent danger from wet clothes, is to keep, if possible, in motion, and to take care not to get near a fire, or any other warm place, so as to occasion a sudden heat, till some time after you have been enabled to procure dry clothes.

J. C.

SUGGESTIONS TO MECHANICS' INSTITUTIONS FOR THE COLLECTION OF GEOLOGICAL SPECIMENS.

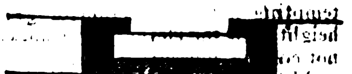


SIR,—I have heard with much pleasure that several of the Mechanics' Institutions have begun to form collections of the subjects of natural history and of mechanical inventions, &c. I approve very much of this extension of the pursuits of these societies, and thinking he will do well who shall aid so praiseworthy a design, either by contributing to such collections, or by showing others how they may do so, I shall add no further preface to the following observations, to which I beg the attention of the numerous members of Mechanics' Institutions in this country.

I would suggest in the first place, to those persons who are daily engaged in boring, or have otherwise opportunities of examining the strata of the earth passed through in searching for coal or other minerals, that they might, with much instruction and amusement, and with but little trouble, construct sections or representations of the strata passed through, which would form very acceptable contributions to such collections as I have spoken of. Without taking into consideration the great value of a series of such sections shewing the disposition of the strata in different parts of a parish or district, as tending to facilitate and encourage the study of geology, it must be very evident that, even in a local point of view, much labour and expense might be avoided by having such assistance.

It generally happens that the miner has a good idea of the depth at which he will reach the mineral sought for, in which case he may begin to form his section when he commences sinking, and add to it daily as the work proceeds; as, for instance, suppose the depth to be sunk is 60 feet; then, by making his section five feet high, he will give an inch to a foot, which, except in cases where the strata are very thin, is more than sufficient to show all that is wanted. Suppose the first rock to be five feet of sandstone, then let him select a fragment representing in miniature, if possible, any streaks or veins that may occur in the bed, and form it into an oblong of about five inches in length, with the requisite depth, (five inches,) and of the breadth of the grooves represented in fig. 2,

Fig. 2.



for which two inches is sufficient. This piece will form the top of the section, and, being placed in the frame, must be covered by the fragment of the next succeeding rock, shaped and proportioned in the like manner, and so on through the whole series.

When the depth of the sinking is uncertain, a specimen of each rock must be preserved in regular order, with an account of the thickness of each bed; and when the work is finished, and the proportion that can be conveniently given to the section is ascertained, let him proceed as before.

I think your readers will understand me, with the assistance of the prefixed figure, which represents, on a very small scale, the first 76 fathoms of the Northumberland Coal Field, namely, from the surface to the high main coal.* One side of the section should be covered by a slip of paper, with the provincial or other names of the strata and their thickness inscribed. On the other side should be compartments for containing rough specimens of each rock, that they may be taken in the hand and observed at pleasure. In selecting these rough specimens, it will be an advantage if the contents of the rocks, (as the petrifactions of the limestones,) are shewn; and where the rock contains many species of shells, impressions of plants, or other fossils, more than one rough specimen may be preserved the better to shew the whole.

The face of the section will not in general admit of any polish, but it will be an improvement, and give it a neat appearance, if a coat of any common varnish be laid over it, which will also show more distinctly the

* The names of the different strata in this table shall be given in our next.—EDIT.

joinings of the specimens and their contents.

It will be observed, perhaps, that the depth I have mentioned is a very shallow boring. I was afraid of frightening my readers from attempting to form a section of great height, but the clever workman will not confine himself to these hints; and I have sometimes thought that a series of sections, extending from the floor to the ceiling, would make very curious and instructive pillars for the hall or library of a Mechanics' Institution in a mining district. They would at least be novel, possess variety, nay, who knows but they might become fashionable!

However, when intended for a collection, the whole depth may be represented by two or more such sections.

I cannot conclude without remarking, that it seems to me very practicable for the Mechanics' Institutions in the country, by a system of communication and exchange, to assist each other in forming collections to illustrate the geology of our island. It is much to be wished that this study were more generally cultivated. As a science geology is comparatively new, and has not yet received much attention from general observers. Most of our works on the geology of England, are the productions of those whose acquaintance with many parts of the island was necessarily obtained by a hurried and superficial examination, and consequently have not that accuracy which might be obtained had each particular district its own geologist, capable of giving a systematic description of the formations in his neighbourhood. Till observers shall by some means be multiplied, it is vain to expect that the contradictions and obscurities of this science will ever be removed by the exertions of a few individuals. I know of no means better calculated for extending this study, than its more general introduction into the Mechanics' Institutions, and shall be much gratified if the foregoing observations shall in any degree tend to produce that effect. Your's respectfully,

Northumberland. G. W.

LONDON MECHANICS' INSTITUTION.

The editor of the Mechanics' Magazine having kindly acceded to a proposition of mine, that a certain portion of the pages of his extensively circulated miscellany should, statedly, be devoted to the recording of the proceedings of the London Mechanics' Institution, I now, for the first time, enter upon my task.

The principles on which I shall proceed, in the execution of this project, I will endeavour clearly to explain at an early opportunity; suffice it, for the present, to say that I am only a common member, my connexion with the institution being merely that of an annual subscriber.

A fitter opportunity for commencing this series of papers than the present, could not have offered itself.—On Tuesday evening last, December 12, the members of this institution met, in order to celebrate their third anniversary. It has been usual, hitherto, to commemorate the day by a public dinner, but, for many prudential reasons, this pageant was, for the present year, dispensed with, and H. R. H. the Duke of Sussex having expressed his intention of being present, it was determined to distinguish the occassion by the presentation of two prizes, offered by the Rev. Robert Fellowes, for the best essay and the best model on mechanical subjects. The officers of the institution were the judges, and no person was qualified to contend unless he had been a member of the institution twelve months, and was a mechanic. The prizes were two sums of ten pounds each.

At 20 minutes past 8, H. R. H. the Duke of Sussex, accompanied by Dr. Birkbeck, Professor Millington, Dr. Gilchrist, Mr. Mc William, Mr. Tooke, the honorary solicitor, Mr. Pettigrew, and several other gentlemen, with the committee of the institution, entered the theatre. The audience immediately rose, and greeted the royal duke with three hearty cheers.

Dr. Birkbeck, who was evidently suffering under a severe attack of illness, advanced to the lecture table, and, in a short address, reminded the members of the purpose for which they had met. In speaking of the essay, Dr. Birkbeck observed, that out of eight, which had been sent in for the prize, seven had chosen for their subject the lever, the eighth the screw. The whole of these essays were so excellent, that the intelligent judges regretted that they had not more than one [illegible] who was unsuccessful, the worthy Dr. said, that had he been blessed with education, he would have, no doubt, risen to fame, from the great ability he displays in treating of the lever. The Dr. read the concluding part of it, in which the writer expresses feelings of great gratitude for the instruction he has received at the institution.—The successful candidate for the essay is a journeyman shoemaker. He had joined the institution at its first opening, and since then has only missed three lectures. Of his essay, the worthy president spoke in the highest terms of praise—it put him in mind, he said, of the style of Maclaurin, and, in some instances, he even surpassed in correctness that great author. The three judges, professor Millington, Mr. Toplis, and Mr. Dotchen, had pronounced it a master performance. The author of this essay, whose name is Thomas Oldham, now came forward, and was received with much applause. Dr. Birkbeck led him to H. R. H. the Duke of Sussex, who, expressing the pleasure he felt in having to present him with the [illegible] given at this institution, put into his hand a purse containing the ten [illegible].

Dr. Birkbeck said, that they would now have to present the second prize, which was for an original machine, and he was happy to say, that it had fallen to their lot to have one which, for its simplicity, and elegance, and originality, he had seldom seen surpassed. Mr. Lyne, the inventor, was at one time in the employment of Messrs. Bailey, of Holborn. When this Institution was formed, he was one of the first to join it. He confesses, that when he became a member, he had no knowledge of mechanics whatever, and that all his knowledge was derived from the instruction he had received in this Society. Now he was no longer a journeyman, but an engineer; not working for others, but manufacturing machines of his own invention, (much applause.) Professor Millington would explain the machine, both at rest and in motion

Professor M. then came forward, and addressing His Royal Highness and the members, gave a very clear and particular description of the machine, which was an invention for cutting combs with a knife, so constructed that out of a single piece of horn or tortoiseshell two combs could be cut, instead of, as formerly, half of it being wasted in saw-dust. He described it as [illegible] and elegant machines he had ever seen. His Royal Highness, who examined the [illegible] very minutely, and seemed to take a great interest in the Professor's statement, now presented Mr. Lyne with another purse, containing ten sovereigns, wishing him long life and health to enjoy the fruits of his inventions, and said, that he only regretted the sum was not larger.

Dr. Birkbeck then addressed the members and said, that up to that very minute they had been expecting Mr. Brougham, from whom he had received a letter, dated "The House of Commons," in which he had said, that it was barely possible he should be detained. Should this be the case, he had enclosed a resolution of the Committee of the Society for diffusing Useful Knowledge, to show that he had redeemed the pledge he gave mechanics two years ago. The resolution was to this effect: that under the direction of this Society, a series of useful popular works would be published, to commence early in February next.

His Royal Highness, the Duke of Sussex, then came forward to the lecturing-table. The members immediately rose, when His Royal Highness addressed a few words to them, in which he expressed his pleasure at meeting them; the gratitude he felt to Dr. B. for the exertions he had made in the cause of the Institution, and the sorrow which he felt, and he was sure all would join him in feeling, at the illness of their and his respected friend,—and own his continued interest in the affairs of the Institution. "And Gentlemen," said the Royal Duke, "I need not tell you how much I feel for the interests of this Institution, when I tell you that what I say comes from the bottom of my heart." He then retired, amidst the enthusiastic cheers of the crowded assembly.

NOTICES TO CORRESPONDENTS.

Owing to the space occupied by Engravings this week, the reply to F. M. is again unavoidably postponed.

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Mechanics' Magazine,
MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

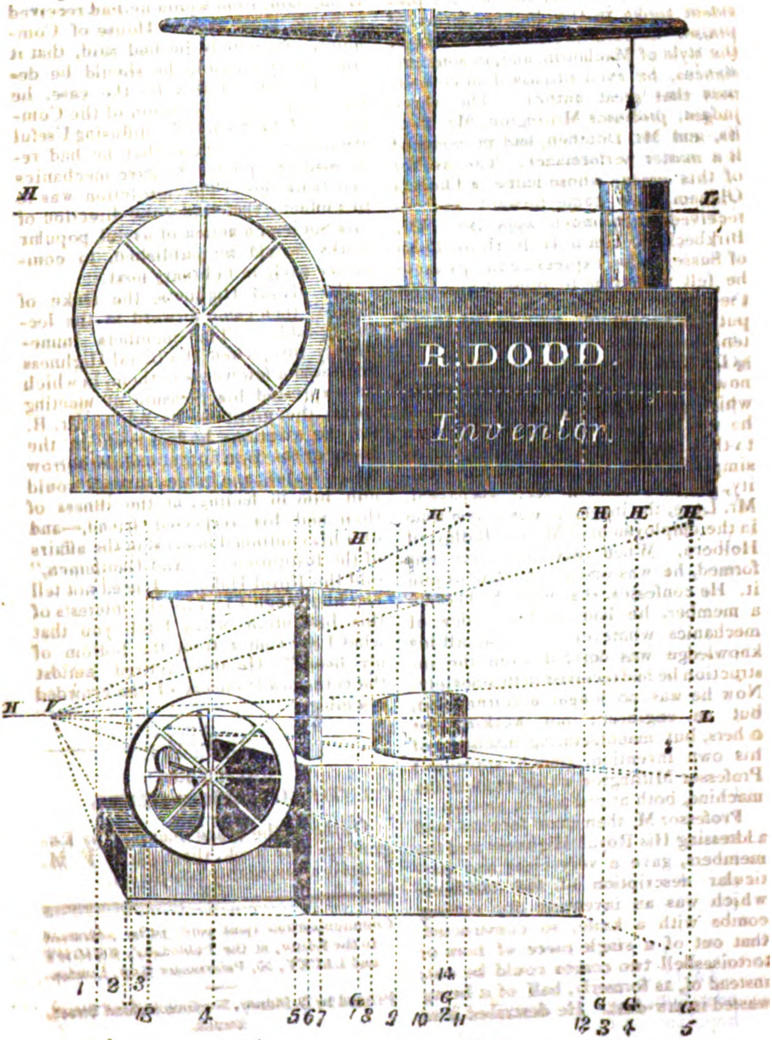
No. [illegible]] SATURDAY, DECEMBER 23, 1826. [Price 3d.

"Is it possible to give a clear, distinct, and proper apprehension of these things (Geometry, Astronomy, &c.) without lines and figures to describe them? Does not the understanding want the aid of fancy and images, to convey stronger and juster ideas of them to the inmost soul?"

Watts' Improvement of the Mind.

PRACTICAL PERSPECTIVE.

(Concluded from p. 523.)



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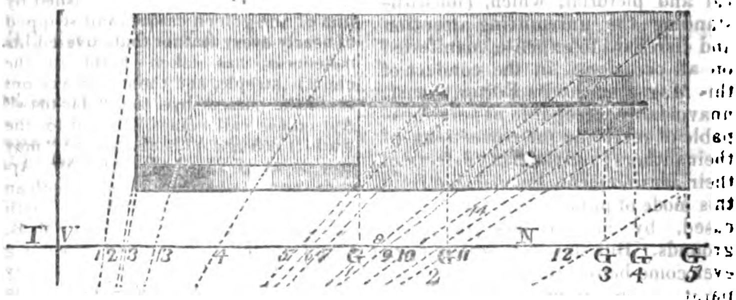


Required, the elevation and plan being given, to delineate a Steam Engine in Practical Perspective.

The pump rods and minutiæ of the engine are omitted, as being an unnecessary addition to a design, already of so complicated a description.

To explain this figure, it will be merely necessary to distinguish the rays and lines of elevation of the different parts, viz.

To the boiler belong the rays 4, 6, 9, 12, and the line of elevation, G, H, 5.

To the cistern belong the rays 1, 2, 5, and G H, 1.

To the cylinder belong the rays 8, 10, 11, and G H, 3 and 4.

To the beam standard, *x*, belong the rays 5, 9, 7, and G H 2.

To the fly wheel belong the rays 2, 3, 5, 6, and G H, 1; and the beam is found by the rays 13 and 14, its elevation being ascertained by the height of the standard.

The size of the drawing precludes the possibility of referring more minutely to the various lines, but if the previous rules are well understood, the student will have no difficulty in comprehending this problem.

The apparent disproportion between the size of the cylinder in the elevation and picture, is illustrative of the observations in my last, but my readers must take into their consideration, the difference in the points of view.

Conclusion.

In bringing these essays to a termination, I have endeavoured, and I hope successfully, to fulfil my original design (see introduction); and though these papers have been more particularly devoted to mechanical purposes, they are no less applicable to general use.

In so limited a space, general rules are all I could lay down, and if I am censured for omitting further examples of machinery, let it be observed, that in an octavo page, drawings of a complicated piece of mill work, would be of such dimensions, as to render the visual rays too minute for explanation, nevertheless, a draughtsman, perfectly master of the preceding pages, would find little difficulty in making any drawings.

Great accuracy and attention are requisite to a beginner, who would be, no doubt, a little incommoded by the multiplicity of lines and in the choice of his stations, &c. but practice would soon make him master of all these points, and he should remember, no science, however simple, can be acquired without some application; and should the expert mathematician exclaim against the omission of many of Brook Taylor's and Nicholson's Theorems, let him consider, that these papers are intended chiefly for the use of those ignorant of the theoretical principles of the science; and that it has been my aim throughout, to throw as few obstacles as possible in the way of the aspiring student, and that by these rules, though the humble mechanic may not be able to produce a delicately finished drawing of inventions, which, for want of such a medium, might otherwise be lost to the world, he may yet exhibit a correct, and intelligible representation.

The numerous errors, typographical and pictorial, which, (notwithstanding the unremitting attention and disregard to expense, manifested on all occasions. in the conduct of this Magazine, by its Editor,) must, unavoidably, creep into papers incapable of receiving the corrections of their authors; and the many defects in their arrangement, inseparable from this mode of publication, must be excused, by my readers, on these grounds. But should this little work ever come before the public in a separate form, it may doubtless, in these respects, be materially improved.

And now, with sincere thanks to those gentlemen who have afforded me their advice and assistance during the progress of these essays, and gratefully acknowledging the favourable manner in which they have been received,

I remain, Sir,
Your obedient Servant, and
Well wisher,
M. H.

London Institution, Dec. 1, 1826.

GRATUITOUS LECTURING.

Sir,—When "Aurum" and "Argens" are in the field, struggling so manfully for the keys of knowledge, it would ill become so ancient a friend and servitor of theirs as the undersigned, to remain an idle spectator. Many is the time they have *stood for him*, when, by reason of his *weight*, he was himself unable to move about; and the least he can do in return is, to *give them a lift* on an occasion like this. He may take leave also to say for himself, that though his face *is* rather of the *brazen* cast, the brains within have a very considerable reputation for acuteness; so much so that, when at times the generosity and profusion of "Aurum" and "Argens" have procured for them the appellation of *pounds foolish*, it is the *penny wisdom* of your humble servant which has been almost always the means of bring them round again.

The present contest indeed may be considered as already next to decided; for "T. M. B." who first took the field in defence of Gratuitous Lecturing, (Saturday, Nov. 4,) has since quietly abandoned it; and his auxiliary, "Viator," after getting soundly thrashed by him of the golden casque, and stripped of nearly every feather that covered his nakedness, has taken flight to the church steeple, and thence croaks out to all the passers' bye, that "Jackdaw" Aurum (*he* call names, Oh, not for the world!) is *beneath* his notice, and "may now do as he pleases." Ah! Mr. Argens, how could you confound such an ill behaved bird as this "Viator" with our old and right trusty friend T M. B. Could all the flapping and screaming of the creature blind you to the mighty difference between them? The one so pluckless and petulant, and the other all manliness and sincerity.—To mistake a Tom-tit for an Eagle, or a Gosling for a Swan, were a trifling blunder compared to this.

I am inclined, Sir, to think, that Generalissimo Aurum *has* committed an error in saying that the attendance on the Lectures of the London Mechanics' Institution has recently been on the decline. It is but charitable, however, to suppose that he gave us his own impression of the fact, rather than that he wilfully misrepresented it. No one indeed can imagine he would be so foolish as to make an intentional misstatement of a fact which so many hundreds could instantly contradict. But, admitting that he is in the wrong as regards this single and merely subordinate circumstance, it is surely arguing after a new fashion to set him down as being therefore in every thing else unworthy of regard. To assume such airs as "Viator" has done, on account of a slip of the tongue like this, is but a braggart's way of covering a defeat on every other point. It puts one in mind of the fencer who, pushed into a corner, and, gasping for breath, suddenly put up his sword, and claimed all the honours of a triumph because his antagonist happened, in the *crisis*, to drop his *sword-knot*.

To be done however with this recreant—for I presume it is with every one's leave, and nobody's regret that he quits the field—allow me to remind your readers that not one of all the arguments so powerfully urged by "Aurum" and "Argens" against Gratuitous Lecturing, has as yet been met by any thing like a fair and to-the-point answer. It stands still without contradiction, that to solicit and accept of instruction in the arts and sciences, from your better informed neighbour for *nothing*, in order that you may make *something* of that instruction in the way of pounds, shillings, and pence, is in reality as mean and beggarly, as to solicit and accept of food and clothing or nothing, in order that you may be spared the wholesome necessity of earning them by your own industry. No one, at least, has offered to shew that there is the slightest difference between the two cases. It is still also as true as ever, that what "lightly comes, lightly goes." It is still, too, unquestioned and unquestionable, that what you *beg* you cannot *order*, and that you must, therefore, take gifts as they happen to be showered upon you—the mustard perchance before the beef, or the beef without the mustard. And it is still (to hasten to the end of the catalogue,) an undisputed fact, that all the most zealous and intelligent friends of the working classes, Mr. Brougham and Dr. Birkbeck in particular, concur in these views of the subject. Believe me to be Sir,

Your's as well as
"Aurum" and "Argens's"
Most devoted servant,
THE COPPER CAPTAIN.

P. S. I have said nothing of the words of *David* Honor, for certes he is not of the race of Solomon. R. W. D. is of a better class of reasoners, but every person must see that he loses sight of general principles in individual example. It is a maxim as old as the hills, that exceptions prove nothing.

STRENGTH AND QUALITY OF HOPS.

Sir,—I shall feel obliged if any of your correspondents can inform me, in a future number of your truly valuable publication, the best method of ascertaining the strength and quality of hops. I am a private brewer, and generally observe the old rule of a pound of hops to a bushel of malt. I usually judge of them by appearance, and rubbing them between the hands, &c. I, notwithstanding, sometimes find, with the same quantity of hops, a great variation in the bitterness of my beer. If any of your very numerous readers can assist me in the difficulty, they will confer an obligation on your constant reader,

AMICUS SCIENTIÆ.

MR. SMITH'S TABLE FOR THE CONSTRUCTION OF SUN DIALS.

Sir,—In your magazine for January last, No. 118, p. 87, there is a table for the construction of sun dials, by Mr. Smith, (from the Philosophical Magazine.) I should be extremely obliged to Mr. M. Smith, or any other correspondent, who would be kind enough, to favour me with the method by which it was constructed, through the medium of your magazine.

I am, &c.
C. K.

GEOGRAPHICAL EXERCISE.

Whether does an inhabitant of the equator move through a greater or less portion of space in the night than in the day? And what are the greatest and least velocities? Shew likewise, how much greater a portion of the earth's annual orbit does a person move through from six o'clock in the evening, until six o'clock in the morning, than another inhabitant does, from six o'clock in the morning, until six o'clock in the evening? A solution from some of your numerous and ingenious correspondents, is respectfully requested by,

A Member of the Literary and Philosophical Society of Armley, near Leeds.

FALLING BODIES.

The American newspapers mention a case which has lately puzzled the wise of that country considerably. Two balls, of the same shape and density, the one weighing six pounds and the other an ounce, being dropped simultaneously from the belfry of a meeting-house, the little ball went ahead of the big one for some time, and betting was three to one in its favour—when lo! all of a sudden, the big ball suddenly shot ahead of the little one, and came to the ground first! Will some of our readers be so good as explain, for the benefit of our transatlantic brethren, how the little ball came to get the advantage in the first part of the distance; and why, having once got the advantage, it did not maintain it throughout?

QUESTION IN ARCHERY.

What difference would there be in the distance of flight of an arrow three feet in length, of a defined weight, and one of four feet in length, of the same weight, both shot from the same bow in succession, under the same circumstances, and by the same hand?

OBSERVER.

ILLUMINATION OF CHURCH CLOCKS.

Professor Millington proposes that the dials of church clocks, instead of being illuminated externally by gas or other lights, should be made transparent. The following remarks by the professor on the subject we extract from a letter in *the Atlas*.

"I foresee many difficulties in the external illumination of church clocks, from their height and the danger that would in some cases attend the lighting of the necessary lamps, as well as the difficulty of fixing them; besides which, they would not only be unsightly, but even in the way during the day time, and in tempestuous weather it would be difficult to keep them alight, (even though inclosed in lanterns,) on account of their elevated and exposed situations. Now, by making the dials of leaded or casement ground glass, with the figures so gilt or painted as to be opaque, a single and internal light would answer every purpose, at the same time that it would be easily managed, and would be perfectly protected. It would also be more economical, both in the first expense and afterwards, because a much less quantity of light would answer the purpose, and I am sure the effect might be rendered beautiful by the display of a little taste. St. Paul's Cathedral offers an excellent opportunity of trying the experiment, because there the central part of the dial is already formed of glass, upon which a night dial might be painted, while the figures of the day dial would remain without any alteration in the present stone framing."

PRESERVING POTATOES.

Sir,—Having spent a very considerable portion of my life on salt water, (more than twenty-four years,) I must naturally be supposed, during such a period to have felt and experienced many of its usual attendant privations. Trifling as it may seem to a landsman, one of those serious privations (to me, at least,) was the want of a good potatoe. None, perhaps, but those who have been pent up for nine or twelve months or more, engaged in blockading enemies' ports, and similar services, can well imagine how grateful a supply of this valuable root is to those so situated. Melancholy, indeed, is the sound, when the wardroom steward announces to the caterers that the "last of the murphies" is about to be used. I have long considered that some mode might be adopted to make this esculent of more use to voyagers. To do so completely, germination must be prevented, and the natural juices must be kept preserved, if possible, in their fresh state, for on that I imagine will depend their antiscorbutic qualities. I was induced to try imbedding potatoes in different substances, and confining them in jars for a twelvemonth, but did not succeed as to stopping the germination. One experiment seems to offer a mode (on a small scale at least,) for getting a supply at sea, which, however small, to a sick person living for a long period on salt diet, might eventually be the means of preserving life. In March I found, on digging in the garden, a potatoe, (the oak-apple, a large sort,) which had lain in the ground all the previous winter; this potatoe I put in a stone pickling jar, in the centre of sea coal ashes, taking care to ram down the ashes quite solid about it, and so continuing until the jar was full; into the mouth a bung was driven tightly down, so that no air might be admitted. I deposited my jar in a chest in a cool lumber room, and on the 30th May, being fourteen months after, I found my old potatoe had left its shell and completely passed into another very fine one, about 2-3rds of the size of the parent, and another about the bigness of a walnut. It had all the appearance as if produced in the ground, with its leaves, &c. in the natural way, and, on boiling it, ate in every respect and was as mealy as this sort of potatoe usually is.

Should any of your ingenious correspondents have made any similar experiments, I shall feel much pleasure in seeing their methods mentioned; and if the desideratum I have stated above could be accomplished, it would be conferring a very great benefit, on navigators in particular.

I have never, Sir, troubled your valuable columns before, but should be happy if any hints or suggestions of this sort might be thought deserving of a space in them.

I am, &c.

Exeter. S. H.

SAIL-BURNERS.

"I have made a species of little rocket, containing one ounce of wild-fire, to be discharged from a common musket against the sails of a ship or amongst the enemy's tents and baggage waggons. Unless fired within the distance of one hundred yards, and without sufficient elevation, or a diminished charge, this projectile is so constructed as never to go through the canvass, but to stick firmly into it and set it on fire. With a few such rockets, and a dozen of muskets, a ship's sails in dry weather may infallibly be set on fire in a few minutes, at the distance of 1500 yards. *Fascii*, or bundles of fifty or sixty of these *sail-burners*, may be projected from a carronade or howitzer. They may be made of any size, although, to ensure their sticking in the canvass, I think they ought not to exceed one inch in diameter." *Col. Maceroni's Military Hints.*

ROCKETS WITHOUT WINGS OR STICKS.

M. Vaillant of Boulogne, has discovered a new mode of discharging rockets without either wings or sticks. In a trial recently made, notwithstanding there was a strong westerly wind, his rockets mounted much higher than the common ones, without deviating in the slightest degree from the right line.—*French Papers.* In the "Military Hints," of Col. Maceroni, (noticed elsewhere in our present number,) he mentions that he (also) has devised a method by which an ordinary Congreve rocket may be arranged so as to be thrown from a howitzer or mortar without any stick, *with the precision of a rifle ball, and one third further than the range of the respective shells.*

LUNARDI'S MARINE LIFE PRESERVER.

Sir,—The following is an extract from an old newspaper. The idea, though an old one, may be new to some of your readers, and, perhaps, not uninteresting

L.

"Last Thursday Mr. Lunardi repeated an experiment he has often made on the Thames, to ascertain the merits of a machine to save persons from drowning. The machine is in the form of a canoe, but very small, and is fastened round the trunk of the body by the most easy and expeditious contrivance. It is formed to carry a little provision, or to serve as a trunk for clothes, when not used in difficulties.

"Lunardi, accoutred with this machine, and covered with oil-skin, plunged into the Thames at Battersea-bridge, amidst the acclamations of a great concourse of people; he moved off with rapidity, and landed safe at Chiswick. The superiority of the machine to the cork jacket seems to arise from its convex bottom, by means of which, the person relying on it, is always preserved with his head upwards. In the use of the jacket, if by accident or violence the head is turned downwards, the jacket will be his destruction."

GRATUITOUS LECTURING.

Sir,—I have maturely weighed the arguments pro and contra, having reference to "Gratuitous Lecturing," and it appears to me, that the balance is against it. One principal objection to the system, appears to be that stated by T. M. B., but which, he has endeavoured to obviate, by considering the lectures in the light of a friendly gift; for, on looking more closely into this comparison, I detected an error which my mind had previously suspected, viz., that the auditors in this case, must be considered not only as accepting that gift, but also as soliciting it. For, by analogy, if I, knowing that my friend has a number of plants in his possession, build a green-house in order that he may be induced to give me plants with which to stock it, I most undoubtedly act a very mean part, and such as every one should be ashamed of. Yet nothing less mean or shameless, is the conduct of the members of the London Mechanics' Institution, who procure a theatre, for the avowed purpose of inducing men of science to lecture therein gratis. I hesitate not to say that such conduct is even worse than it is represented by "Aurum," where he says it may be compared to that of the idle and the base receiving their sustenance at the hand of charity; for these receive that which is necessary to support life, but those, a luxury.

As to T. M. B.'s averment, that no ill effects have arisen from the system, let me ask him, how he ascertained such to be the case, seeing that the effects are produced on *the mind?*

It would appear that "Aurum" has fallen into error respecting the lectures at the London Mechanics' Institution, as regards their utility to others; he appears to have judged by his own standard, which is evidently higher than ordinary.

But however good the aforesaid lectures may be (which is yet questioned) this of course will not apply generally.

"D. Honor" in answer to Aurum's question, says, that "by retaining our money, we please others, and have it for equally useful purposes:" the former part of this proposition is not valid; because, although we may please some, we do displease others; the latter part, I conceive is the only solid argument, that can be urged in favour of the system; for "R. W. D." must be sadly out in thinking that there is anything so favourable to a young and talented lecturer, as money; and "Veritas" is incorrect in advancing that the absence of approbation implies disapprobation, in that sense in which the word would be understood by an audience who paid for what they heard.

I am, Sir,
Your old correspondent,
JOSEPH BROWN.

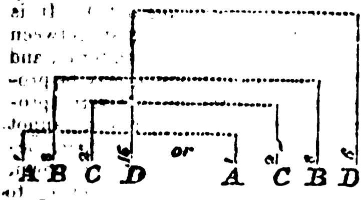
DOCTRINE OF PROPORTION, OR RULE OF THREE.

(Continued from p. 503.)

Observation 4. It plainly appears from the above stating, that the terms are placed according to the numerical proportion, found between two terms of a like kind, without regard how, or in what proportion, those terms are either proposed or produced. Still it is evident, that (how much soever this arrangement may appear to arise from a mathematical fastidiousness), in every stating in proportion, this numerical proportion between the terms, will exist in whatever order they may stand.

Observation 5. Now it is evident, that (whether in the above stating, or in the foregoing), where four numbers are supposed proportionals, and that two and two each represent a like kind, such two numbers should also stand in like denominations of their kind, otherwise the proportion will prove false to that which is intended. Thus in the above stating, if the term 2lb., should be substituted by an equivalent of 32oz., it is manifest, that the proportion of 1 to 32, cannot be represented by the comparison of 8 to 16. From which we infer; that,

Observation 6. If in your proportionals, those of the same kind be converted into the same denominations of their kind, the four proportionals may then be represented by four magnitudes, without respect to kind or quality. Thus the above statings may be represented:



Observation 7. Thus in Euclid's Elements, Book 5, where four proportionals are proposed, proportional magnitudes are demonstrated, as he has in fact expressed them. Arithmeticians have therefore made use of quantities in like manner, to certain of which, they have applied assignable properties as regards kind or quality, by which the doctrine of proportion has been made applicable to the determinate values of arithmetical quantities, &c.

Observation 8. Therefore, from observation 6, it may be seen, that, if in either of the given statings, we divest the quantities, expressing the proportion of their assignable value, or in other words, of the characters placed over each, the numbers or quantities will be as properly proportionals in one arrangement as in the other. Thus:

As 1	:	8	: :	2	:	16
Or as 1	:	2	: :	8	:	16

Observation 9. From observations 5 and 6, we further observed in support of the above, that where the proposed quantities are of several denominations, if quantities of a like kind are converted into like denominations of their kind, they will, also, taken two and two, be in like proportionals to each other, as above; and in both cases, will produce the same result in quantity as is shewn above; if, therefore, the proposed question had been given thus:

If 1lb. 2oz. of tea, cost 10s. 6d. what will 2lb. 4oz. cost at the same rate? the statings by both methods, would then stand as follows:

By abbreviation.

As 9	:	21	: :	18	:	42
Or as 9	:	18	: :	21	:	42

Or by further abbreviation thus:

As 1	:	21	: :	2	:	42
Or as 1	:	2	: :	21	:	42

Observation 10. From the foregoing it may now be shewn, that the four proportionals exhibited under the original method, will, in their arrangement, prove in perfect coincidence with the proportions of Euclid, concerning proportional magnitudes, and which we may consider as equally applicable to proportional quantities. Connected with the present discussion, the following will be sufficient. Hence we have, that, when four magnitudes (or quantities) are proportionals, they shall also be proportionals when taken alternately. Thus

If 1	:	8	: :	2	:	16
So shall 1	:	2	: :	8	:	16

Or

If 1	:	2	: :	8	:	16
So shall 1	:	8	: :	2	:	16

Whence the arithmetical rule for the original method:—Which, if the proportion be direct, the *fourth term* shall bear such proportion to the third, that the second does to the first; or to the second, as the third to the first.

Again, the definition of direct proportion;—*more requires more, and less requires less*; when the third term is greater than the first, the fourth term shall be greater than the second, or, on the contrary, less. Which is evident from the demonstration of the proposition of Euclid, Book 5. If the first of four magnitude has the same ratio to the second, which the third has to the fourth, then, if the first be greater than the second, the third is also greater than the fourth; and if equal, equal; if less, less." Hence, in either of the statings last given, the third number is greater than the first, and the fourth is greater than the second.

Thus, the truth of both methods, as far as regards the doctrine of proportion, is fully confirmed. Which may appear most analogous to the circumstances or object of the question or proposition, we shall now consider.

The principle upon which this rule (the rule of three) is founded, has been already given, namely: *that the magnitude or quantity of any effect varies constantly in proportion to the varying part of the cause.*

Whatever demonstration four proportionals may be capable of when produced, some regard should certainly be had to the rationale of the principle by which they are produced. This necessary distinction should therefore be carefully observed in the present instance.

Observation 11. Now, in whatever proportion the fourth term may appear when found, it is evident it should be regulated according to a certain cause, proposed ratio, or proportion, and should stand in proportion to that term with which it is most immediately connected, and which is the cause of its being produced. See the given example with the original method of stating; from which

Observation 12. It may be seen, that in every operation two of the given terms are *fixed* or unvariable, and between which is the determined ratio; that the third is the varying cause, between which, and the result produced, or fourth term, the same ratio must exist, or in other words, are to each other in the same proportion as the other two. Therefore it is plain, that when the fourth term is found, two of the four proportionals or terms must be considered variable, according to the circumstances of the operation.

Observation 13. Thus, in the original method of stating the given example, it has been shewn, that the varying part of the cause is that term which affects the answer, and causes a greater or less effect to be produced in proportion to its magnitude or quantity. Thus, the fourth term varies in proportion to that varying cause, according to the proposed ratio. Thus, in the original method of stating, this varying cause is evidently the quantity 2, which, by the given ratio, produces the quantity 16.

Observation 14. Now, we may suppose a common transaction of purchasing goods, as for instance, in the given example: there the commodity *tea* is to be purchased; the quantity of which is, of course, at the option of the purchaser; the seller therefore proposes a certain ratio, by which the price of the quantity purchased shall be regulated. It is evident, no ratio can exist between a known and an unknown term; and the quantity purchased, may be properly considered the last term proposed; the ratio therefore cannot exist between that and another, because that is previously unknown, and from that we infer an effect to be produced by a certain ratio. The seller then can only propose a ratio between quantities known, as between his merchandise and its price. Thus, in the present example, the proposed ratio is between the quantities 1 and 8, by which the proposed quantity, 2, produces the quantity 16, or as any other varying cause would produce a proportional effect. Thus, as before observed, we have four proportional quantities, to which may be applied assignable properties, so that the value of each term may be known, and thus they are made applicable to the ordinary enquiries of valuing goods, or other calculations whatsoever.

(To be concluded in our next.)

ALGEBRAICAL EQUATION.

Sir,—I attempted, a few days ago, to solve the following equation by a simple one; and, having succeeded, I am induced to forward it to you, in hopes you will insert it for the benefit of your students in algebra.

I remain, Sir,
Your constant Subscriber,
HERBERT D.

Given $\left.\begin{array}{l} x^3-y^3=152 \\ x^2y-x^2y=48 \end{array}\right\}$ to find x & y.

OF TIN FOIL AND SILVER LEAF.

Mr. Editor,—Will you inquire of some of your ingenious friends, if they can recommend a composition to make tin foil stick to cloth, that it may not be affected by damp? I have tried glue, gum, and paste, but it does not answer; for, as soon as dry, it peels off. I am also desirous of knowing what will keep silver leaf from being tarnished—I have hitherto used the white metal, but it has a coarse appearance, and I should prefer silver leaf if it could be kept bright.

I am, Sir,
An Enquirer after Knowledge.

ANSWERS TO THE ARITHMETICAL QUESTION, p. 468.

We have received answers to the arithmetical question proposed by Herbert D——, from R. Farley, T. K., Clyde, G., E. K. Juvenal, Georgiana, and Dot and Go One; all of which are precisely similar. As "there is a lady in the case," and that a young and promising one, we hope we shall stand excused to our other correspondents, for giving her solution the precedence. It is as follows:—

Dear Sir,—As Mr. Herbert D—— says his question, in No. 170, is intended for beginners, and I shall be only nine years old next week, I hope you will be so good-natured as to let him know, in an early number, that I have found out the answer.—A.'s share is 143l. B.'s 697l. and C.'s 4147l.

GEORGIANA.

The arithmetical operation, by which these results are obtained, is thus explained by Mr. R. Farley:—

From 4987l. the whole sum,
Subtract 840 sum of A. & B.'s sh.

Remains 4147 = C.'s share.

Now, 4147l. divided by 29, = 143l. = A.'s share, which subtracted from 840l. leaves 697l. = B.'s share. So A.'s share is 143l. B.'s 697l. and C.'s 4147l.

"G" refers for a particular mode of working the exercise to Walkingame's Tutor's Assistant, p. 78.

TRIANGULAR BELLS.

The New London (Connecticut,) Gazette contains a certificate from four men, who, at the distance of nine miles, heard a bell of this description, lately placed in the steeple of the Baptist church in that town. It is said to be "made of steel, at half the price of other bells, may be rung by a child, and is so light as not to shake the building."

WATER-PROOF PERCUSSION COPPER CAPS.

Col. Maceroni has invented a simple and efficacious method of rendering percussion copper caps perfectly water-proof. The following description of it we extract from "Military Hints," by Col. Maceroni, a small pamphlet full of ingenious and important suggestions. "It consists in dipping the open rim of the cap into green taper wax, melted in a plate over a lamp. The melted wax must not be so deep as to ascend into the cap up to the percussion powder at the extremity, but only so much as to form a slight lining of wax around its inner base. This will suffice to cause the cap to close hermetically over the nipple; so that, provided it be not cracked, and the gun have no lateral vent-hole, (which it ought not to have,) the loaded piece may be put over the lock into a pail of water, without affecting either the cap or the charge. It is sufficient to have a few such prepared caps in store for wet weather."

TRANSMUTATION AND DISPERSION OF MATTER—MR. ALLEN'S LECTURE.

"Link after link the vital chain extends,
And the long line of being never ends:
Organic forms, with chemic changes strive,
Live but to die, and die but to revive;
Immortal matter braves the transient storm,
Mounts from the wreck, unchanging but in form."

DARWIN.

Sir,—I heartily concur with Vindex, who, in his letter in No. 170, regrets that any thing relating to the "doctrines of religion," should occupy a place in the Mechanics' Magazine. He is, however, on his own subsequent shewing, mistaken in imputing to me the onus of that introduction. My article on Mr. Allen's lecture, was entirely *physical*,—founded on evident and acknowledged *facts*, which it would be equally absurd and impossible for me, or any one else, to call in question. With all deference for Mr. Allen's chemical science, I think he should not make himself "uneasy," on the score of having "brought to light" dangerous "discoveries." Had he been so guilty in the eyes of the rulers, there is as effective an inquisition here, at the present moment, as either of those which overturned the "dangerous" doctrines of a Galileo, or a Lawrence, by compelling them to recant those facts they had brought to light, which might be "subverted to serve the purposes of impiety!" On this score, Mr. Allen has nothing to fear; and he may, over and above, comfort himself in the reflection, that notwithstanding Vindex's insinuation, his doctrine, pious or impious as it may be, was taught, though probably not so chemically demonstrated, long before he, William Allen, was ever heard of;—that is to say, by certain eastern philosophers, whose elucidations on that subject were afterwards misapprehended and distorted by the Hindoo priests, into the *spiritual* metempsychosis.

The philosopher Empedocles says, "There is neither life nor death for any mortal, but only a combination, and a separation, of that which was combined, and this is what, amongst men, they call birth and death. Those are infants, or short-sighted persons, with very contracted understandings, *who imagine any thing is born which did not exist before, or that any thing can die or perish totally!*" These *facts* were also taught by Pythagoras, Plato, and several others. Empedocles also says, "There is a kind of affection by which the elements unite themselves, and a sort of discord, by which they separate or remove themselves!"

With reference, therefore, to the above sublime truths, derived from the sagacious, unshackled contemplation of nature, Mr. Allen's lectures can only be regarded as technical illustrations,—the late-born produce of the united efforts of thousands of Allens, during ages of experiments in their laboratories!

"The absurdities and contradictions," which Vindex finds in my letter, cannot be attributed to me; for *I* have stated nothing, save the proposition of the particles, but what has been taught 4000 years ago, illustrated by Mr. Allen, and amplified by Vindex himself in prose and verse. If then, any "absurdity" be apparent in my article, it can only result from the juxtaposition of real *facts*, with certain fanciful adjuncts, which are without the pale of all fact or demonstration whatever. So, as I have not taken on myself to be either the expositor of the *facts*, or, much less the compositor of the adjuncts, "the absurdity and contradiction" must attach elsewhere.

It is true, Mr. Allen did not say in so many words, that "a body once decomposed and dispersed throughout the universe, could *never* be brought together again;" but that gentleman, as any other chemist might have done, so clearly demonstrated, that our poor bodies were decomposed, recomposed, and dispersed, through ten million billions of modes, shapes, and places, as assuredly would have left us in utter despair of ever seeing a single "house built up again with the same materials," had I not stepped forward with the proposition of the final exhaustion of the changes on the particles of the said "materials." Now, this was evidently a mere mechanical affair, which Vindex himself observed, "stretching probability to the utmost, might happen." Surely Vindex is not the man one would take him to be, if he has any objection to stretch probability or possibility, or impossibility, to the very utmost!

Vindex says, that "every organised being *endowed with a soul*, is perpetually in a state of change as to its physical body." Good—that is just what we have been talking about; but why should this process be now confined to animals "endowed with a soul?" Does Vindex mean, that horses, dogs, &c. &c. do not eat, drink, perspire, and "throw off particles;" or does he, like the compassionate and more consistent Hindoos, furnish every thing that liveth with one of these souls? Surely this requires further explanation! The succeeding remarks on the perpetual changes which organized bodies undergo, by particles thrown off by perspiration, &c. are mere amplification of known and indisputable *facts* which, in my article in question, I, for the sake of brevity, refrained from stringing to the others which I considered sufficient for my purpose. By what kind of "confusion and contradiction" of ideas Vindex has been led to place these additional *facts*, which are quite to my purpose, and as much mine as they are his, or any body's, in hostility against me, I am "not, in my present state, qualified to understand." On the same principle of "confusion," Vindex has wasted much time and paper, in giving a supererogative extract from "Parkes' Chemical Catechism," and has very unfairly brought out, "a Davy and a Home," in hostile array against poor me, who never dreamt of calling in question any one of the many important *facts*, with which these illustrious men have enriched the public catalogue of knowledge!

Thus far, Vindex has spoken of men, and things, and *facts*; and it would be exceeding well, I repeat, that nothing of a different nature should find a place in the Mechanics' Magazine; but—REASON preserve us!—he now brings a "saint" and an "archbishop" into the field, to prove that we shall, and that we shall not, rise with physical bodies—that they shall be our *own very* bodies, but that they shall be *different*, &c. &c.!

These slight discrepancies, however, apart, I am inclined to maintain, that both the saint and the divine lean, as I do, towards the *material* nature of the bodies to be raised. Vindex, then, has not been lucky in his quotations. The bishop says, "they shall be so far the *same* bodies, that every one shall have properly *his own*, and be truly the *same person* he was before; but so far *different*, that those of good persons will be subject to none of the sufferings, none of the infirmities of this life," &c. Now, although this is not as clear as one might wish, especially from an archbishop, it is, at least, very consolatory; particularly to myself, who stickle for the physical and *bodily* resurrection, which we have all (Christians I mean,) been taught from our cradles. It is a very great pity, that the divine should have concluded his demonstration by such a phrase as—"these things we are not qualified in our present state to understand," which, by ignorant or presumptuous people, might be called a blowing up of his own reverend authority. This is the reason, I fear, why Vindex himself, in the "confusion" of his ideas, gives his archbishop a flat contradiction! He would have us knock under both to his quotation, and to his confutation of it. He says, "Hence we may be certain, (!) that our bodies, at the resurrection, will not be as they are now, made up of particles of carbon, hydrogen, &c. which "are not suited to enjoy the pleasures of heaven." The archbishop, to be sure, does not actually name carbon or hydrogen; but he distinctly promises us "the same bodies," "our own bodies," which we all know contain abundance of such substances.

Vindex is still more directly at variance with the authority he quotes, who distinctly says, "For this we say unto you by the word of the Lord, that we which are alive, and remain unto the coming of the Lord, shall not prevent those which are asleep."

"For the Lord himself shall descend from heaven with a shout, with the voice of the archangel, and with the trump of God; and the dead in Christ shall rise first."

"*Then, we which are alive and remain, shall be caught up with them in the clouds, to meet the Lord in the air; and so shall we ever be with the Lord.*"—1 Thess. iv. 15, 16, 17.

Here are flesh and blood, skin and bone, carbon, hydrogen, azote, lime, silica, and caloric, "all caught up." Yet, in the face of this assurance, given in as clear and decided language as it is possible to frame, Vindex asserts that no such substances "are suited to enjoy the pleasures of heaven!"

It may be well to remark, *en passant*, that St. Paul was the more especially qualified to furnish the very best information concerning the matter in point, as he publicly declared himself to be one of that late-formed but much abused sect, called *Pharisees*, the only individuals amongst the Jews, who ever had any idea of a future state, or "of the hope and resurrection of the dead."*

In addition to the authority already quoted, I will also add, that many of the earliest "fathers of the church," such as Tertullian, Arnobius, Clement of Alexandria, Origen, St. Justin, and Irenæus, have all discoursed of the soul as a corporeal substance,—very ethereal to be sure, but still as matter. Whether this substance contained hydrogen, carbon, or nitrogen, is another affair, which it would appear, none of the aforesaid gentlemen were chemists enough to demonstrate.

After all that I have said, Sir, I will leave it to you to determine, whether Vindex, or F. M. be the man, who "brings into discredit the doctrines of religion?"—F. M. who in his observations on Mr. Allen's lectures succeeded, *as Vindex himself allows*, in establishing on mathematical certainty, a real resurrection of the body;—or the said Vindex himself, who quotes infallible authorities, only to display his self-sufficiency and unorthodoxy, in swerving from them?

With such "certain" knowledge—with such hitherto unexampled power—with "reasons as plenty as blackberries," pray good Vindex, pray be more precise—be more specific and more liberal in your information—hasten to the assistance of the great fathers, Sanchez, Tamborini, and other casuists—decide at what particular moment the soul takes possession of its corporal tenement? Whether it is then as big as a *grown-up soul*, or is only an infant soul, which subsequently thrives and fattens on pap and porridge, pudding and beef—tell us whether the soul of a born idiot, be of the same quality, shape, and materials, as that of a Socrates, a Julian, a Newton, or a Byron, and in what the difference of quality or texture truly consists? These are but a tithe out of the many questions I should like to put to the error-dispelling Vindex, did not my space compel me to sketch only the skeleton of an article, leaving Vindex, who has such a knack at amplification, to fill it up with the best analogous materials, of which he will find plenty to his hand, and be much the better for his work. However, a couple or so more questions I must put, before I conclude, as well as suggest an idea or two, for Vindex's especial benefit and edification.

To speak seriously, I am very far from recommending much deference to "authority," as it is called, for it is plain, that whenever the human mind permits itself to be guided by it, without *proof*, it is sure to sink into the most pernicious errors, and abject imbecility.

It requires courage as well as sense to think, and more so to speak

* Acts xxiii.

for one's self. I, however, will take the liberty to proceed, by observing, that the great John Locke says, that "philosophy is a system by which natural effects are explained," by which, I suppose, he means *demonstrated*. Plato, however, says, "Those who admit of nothing but what they see or feel, are stupid beings, who refuse to admit the reality of invisible things." With every respect for this great inventor of chimeras, I will, however, ask, whether there is no difference between the admission of a possibility, and the proof of a reality! If, for the sake of argument, a thing be admitted to be possible, is that a proof that it is? But such is the reasoning which our learned doctors have inherited from Plato and his dreaming friends, the Egyptian, Chaldean, and Assyrian priests.

Descartes goes further than Plato,—he says, "we must necessarily conclude from this alone, that because I exist, and have the idea of immateriality, its existence is *therefore*, most evidently demonstrated." So, if our imagination presents us with the idea of a sphynx, or flying horse, or any other fantastical being, we are, on that authority, to insist that such things really exist! Wings exist, and horses exist; and the most disordered or fruitful fancy can never settle on any materials for its unnatural combinations, than such as it is acquainted with, and have some real existence.

Descartes allows that an immaterial substance, "cannot be said to have any extent or dimensions, but only inasmuch as we say of the fire contained in a piece of heated iron, which fire has not, properly speaking, any other extent or shape than that of the iron itself."

It would seem that Descartes did not know that the particles of caloric, or fire, have size and dimensions; and that their introduction must increase the volume of his iron; but waving this, it is evident that, if from his fancied modification of immateriality we subtract the subject, (the iron) the modification itself disappears. In fact, for so great a genius, this must be regarded as a very unhappy illustration; for, even allowing the immateriality to have parts like the caloric, which it is positively denied to have, such parts must be dispersed throughout the universe, upon their separation from the iron which confined them.

In the schools it is never considered requisite to prove a *negative*; indeed, this is ranked by logicians amongst the things impossible to be done; but it is considered of the highest importance to soundness of argument, to establish the *affirmative* by the most conclusive reasoning and evidence. Now, to affirm of a thing with *truth*, it is necessary to be acquainted with that thing. To have indeas, it is necessary to have perceptions; to have perceptions, it is absolutely requisite to have sensations; to have sensations, requires organs capable of receiving and transmitting them. No idea can be and not be at the same time! The idea of substance is that of a thing solid, or fluid, or gaseous, in fine—of something.

The metaphysicians tell us, that an immaterial body is a *substance of* an unknown nature; simple, indivisible, void of extent, invisible, *impossible to be discovered by any of the senses*, (how did they become acquainted with it?) and that its parts (after having said it has no parts!) cannot be separated even by abstraction or thought! On what, then, does Vindex found his ideas of such a substance, or rather negation of substance! Pray let him tell us how it acts, or how it is to be acted upon? In what specific part or place does it abide, when it occupies *no* space? If he tells us it does occupy any place, that is, space, I will let loose upon him a host of "divines" and metaphysicians, who all declare, it has no parts, size, or extent whatever; so that any one such *no*thing may as well be, and in fact is, as much in Saturn's ring as in his body!

We certainly do not know the essences of any thing or substance; if by that word we are to understand that which constitutes its peculiar abstract nature. We can only know things by the perceptions and ideas they furnish. It is very possible for a thing to exist of which we have no knowledge; but again, a thing must be *something*, and it assuredly exists not for us until we acquire a knowledge of it,—and we have no means of acquiring a knowledge or idea of any thing, but by our senses,—and those senses can only be acted upon by something which has power of action and impingement, *i. e.* parts and motion. A certain description of reasoners,—arguers I mean,—would perhaps say,—because a blind man sees no colours do not colours exist? I answer, that the men who do *see*, may attempt to describe them to their blind neighbour; and it is even *possible* that as colours proceed from certain tangible surfaces, he may be able to form some vague idea of them from the touch. At any rate, the blind man would be held somewhat presumptuous, even could he feel the colours, besides receiving as he might some account of them from every man, woman, and child who actually sees them, were he to set himself up to describe the nature and variety of every shade! It was practically shewn how we are compelled to judge only by our sensations, when a celebrated blind man described the colour red to be "like the sound of a violin!"

The great source of human misery is the ignorance of nature. Men cling to blind opinions imbibed in their infancy, which, warping their minds, prevent their expansion, and keep them in perpetual infancy by rendering them the slaves of fiction. They go on from year to year, *professing* opinions on the authority of others who have entirely ranged out of their sphere, and have a "vested interest" in deceiving them! They dare not exercise their reason, because from the time they were fed with a spoon, they have been told it is criminal! They are therefore content to pursue will o' the wisps, which only bewilder, impoverish, and degrade them.

How numerous are the men, who, reasoning on false premises, or rather on no premises at all, discard the evidence of their senses, glory in the increase of their delirium, and most complacently enveloping themselves with a cloud of ignorance, sink deeper and deeper into the unfathomable depths of error!

To such pride, ignorance, and error, are to be attributed the origin and the endurance of those odious chains which Bramins, Bonzes, and tyrants, have from the earliest ages forged for the children of simplicity. The priest exclaimed, "believe me, and obey the king—but reason not!" The king responded, "feed, honour, believe the priest, and obey me,—but beware of expostulation!"

Such are the monstrous errors from which have proceeded the hatreds, persecutions, massacres, and despoliations, which, during so many thousand years, have degraded the human species below the beasts of the field!

Happily, a new era promises to dawn upon the long benighted nations. Reason begins to be heard in the councils of men. That pestiferous influence which at all times has caused the persecution of those who have been the first to give natural explanations of the phenomena of nature, will one day be dispersed by the triumph of truth and sound morality; man will soon begin to learn that he ought cheerfully to submit to be ignorant of causes hid from him by an impenetrable veil; that such as do not, are either influenced by a most irrational pride, or the desire to deceive. He will then discover that the aim of his researches should be happiness,—which he can only expect to attain in proportion as he arrives at truth,—in proportion as he is virtuous and rational,—and inasmuch as he contributes to the happiness of his fellow beings.

This is my hasty answer to Vindex, who I hope will read it in kindness, and with attention; and I more particularly recommend that he would peruse and inwardly digest two admirable articles in recent numbers of the Westminster Review,—one "On Ecclesiastical Establishments," the other "On the Formation of Opinions."

To C. J. I beg to return my best acknowledgements for his courteous notice, approval of my sentiments, and promised coadjutation, ex-

pressed in [illegible]
And so I take my leave of J. C.—of Vindex,—and of the subject of this paper, intending when next I use my little pen for the "Mechanics' Magazine," it shall be on something tangible,—mechanical,—and useful.

With great esteem,
I am, Sir,
Your's, &c.
F. M.

[We do not very well like the turn this discussion has taken, and should be sorry to be individually identified with some of the opinions that have been broached and indicated in the course of it. Feeling well satisfied, however, that *a fair hearing* can never do any harm to the cause of truth, we leave our correspondents to conclude the controversy among themselves, requesting only that it may be conducted, as heretofore, in good temper, and brought to a termination as speedily as possible.—EDIT.]

SHIP-BUILDING.

Sir,—I find that one of your correspondents, who takes to himself the significant "nomme de guerre" of "*A Thames Flounder*," has objected to the hint I ventured to suggest in a former number, that the curve line of the body of some fishes might, probably, be of use in naval architecture. His first objection is, that, whereas fishes are constantly immersed in their native fluid; ships, on the contrary, are not designed for such a state of things—granted: but, of necessity, a great part of every vessel is, either constantly, or at times, immersed; and, of course, to this part only, I would think of applying the construction indicated. Secondly, he reasons, that as the body of a fish is flexible, therefore its contour is not applicable as a naupegic line. Undoubtedly the bodies of fish, upon a fish-stall, are flexible, so, most likely, are the living bodies in a state of quiescence; but muscles in their state of energy, (and the body of a fish is all muscle) are, [illegible] personal experience will convince [illegible] state of elastic tension. [illegible] experience will bear us out in asserting, that the most elastic vessel will, cæteris paribus, be the most effective in all respects—witness the clinch-built craft. But, in this instance, I did not altogether speculate, [illegible] some years since, I built a small boat, in whose lines I endeavoured to imitate a particular species of this curve, and the experiment was attended with the most complete success. I am therefore, still of opinion, that the properties of this natural curve are, at any rate, worth investigation, with a view to its application as a water-line; and, with respect to those parts of a vessel which are designed to be always above water, I will not say that we may not draw with advantage from another series of the animated works of nature.

I am, Sir,
Your obedient servant,
MONAD.

NOTICES TO CORRESPONDENTS.

The description of R. F.'s machine in our next.

Mr. Vitryville's "new mode of conveyance" appears to us to be contrived precisely on the same principle as that of Mr. Vallance. We beg to refer him to what has been said, as to the latter, in our 162nd and 167th numbers.

We shall be glad to receive from C. W. A. the report of which he speaks.

Communications received from [illegible] L. A.—W. S.—G. W.—[illegible] Y. [illegible] T. M. B.—Tyro.—Guillo[illegible] De Guzman—Arnold Merrick—[illegible] Tertium Quid.

Next week the Supplement, with Preface, Index, &c. to Vol. [illegible]

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Mechanics' Magazine,

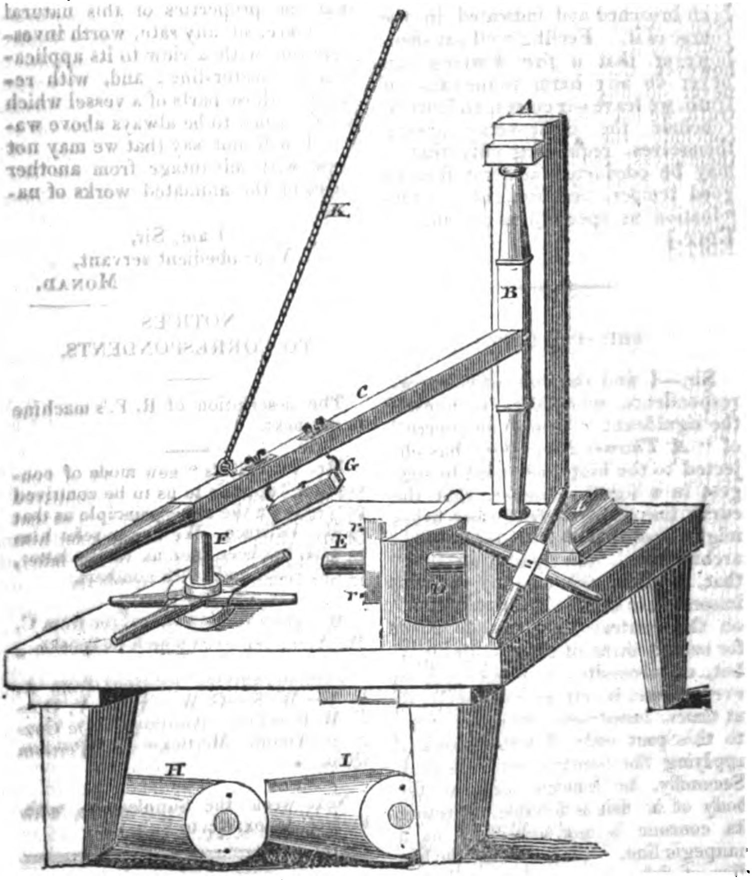
MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 175.] SATURDAY, DECEMBER 30, 1826. [Price 3d.

"There is no art or science that is too difficult for industry to attain to; it is the gift of tongues, and makes a man understood and valued in all countries, and by all nations; it is the philosopher's stone, that turns all metals, and even stones into gold, and suffers no want to break into its dwellings; it is the north-west passage, that brings the merchant's ships as soon to him as he can desire; in a word, it conquers all enemies, and makes fortune itself pay contribution.

CLARENDON."

STRAW BONNET PRESSING MACHINE.



STRAW BONNET PRESSING MACHINE.

Sir,—In consequence of an enquiry in your valuable miscellany, p. 350, Vol. iv., I take the liberty of transmitting a description of a machine, for pressing straw bonnets, of my own invention, and which, having studied economy, will, I think, answer the object in view at a much cheaper rate, and with less trouble in the use of it, than that of your correspondent of February last. The one from which this drawing is taken, has been in constant use for a considerable time.

The whole is mounted on a substantial bench or platform. *A*, is an upright, firmly fixed by the cross-piece, marked *L*; *B*, has a pin at the top and bottom to accommodate the lever to either the crown or band of the bonnet; *C*, is a lever, with a swivel at *B*, so as to turn to the level of the large block, *I*; *D*, is a strong poppet, through which passes the wood mandril, *E*; *F*, is another pin of the same size as *E*, which runs in a hole through the bench, and is turned by the crosses; *G*, is the iron heated by pads, by removing the cover represented in the drawing; *H*, is a block for pressing the crown and band; *I*, is another, of greater diameter at one end than the other, for pressing the peaks, &c. of bonnets; *H* is first placed on *F*, and the crown pressed; it is then removed to *E*, on which the band is also pressed; it is then taken from thence, and the block, *I*, placed in its stead; the blocks are fixed to the horizontal pin by the small screws *r*, *r*. *K*, is a chord suspended from the ceiling, to hang the lever on when out of use.

P. S. The whole of the machine is of wood, but the pressing box and swivel at B. It must, therefore, be obvious, that it must far exceed the one alluded to before in point of cheapness. Should any one wish to purchase this, it is for sale at a very cheap rate. The lady, to whom it belonged, having given up business, has, now, no use for it. Further particulars may be known by application, post paid, to J. B. M., No. 5, Serampore Place, Lymington, Hants.

I am, &c.
An original Subscriber,
Rt. F * * * * * *.

ON THE RATES OF CHURCH CLOCKS.

Mr. Editor,—In your nubmer for March 1826, p. 276, there is a letter from Mr. Wynn, containing remarks on the alleged acceleration and retardation of church clocks, by the action of the wind on the hands; to which cause the difference observed by a traveller, of a quarter of an hour in the time between the church clocks of different towns, is there attributed. Having, for at least thirty years, paid particular attention to the performance of the church clocks, both where I reside, and in the places I have visited, I have not been able to trace any perceptible error in their performance, to the action of the wind on the hands.

The clock at St. Mary's Church, Cambridge, which has a face to the west, has been observed to perform for a quarter of year, with no greater variation, during the whole of that period, than 15 or 20 seconds. The clocks at St. Paul's and the Horse Guards, in London, at the Exchange, Liverpool, at the Register Office, Edinburgh, and many others which perform with great accuracy, have dials exposed to the wind, and are not affected by it. In York Minster there are two clocks; the one by Thwaites of Clerkenwell, without a dial, strikes the hour and quarters, and performs with an accuracy nearly equal to St. Mary's at Cambridge; the other, an old clock, by the late Hindley, of York, has a dial to the south; it cannot be depended on to keep very near to time, and sometimes varies as much as two minutes in a week; but after long observation, I am satisfied this is owing to changes in the temperature or moisture of the atmosphere, and not to the action of the wind on the hands. In fact, if a strong west wind should either propel or retard the hand in one part of its circuit, it would have an opposite effect in the other; and the errors would correct each other. The heavy pendulum of a church clock is not to be affected in a perceptible degree by any action on the hands.

That the clocks in different towns often vary from each other very considerably, is undoubtedly true. Where I have observed a material variation from the true time, I have frequently made an enquiry; and have rarely traced the error to any fault in the mechanism; except that for want of a maintaining spring, some clocks stop for a minute or two whilst they are being wound up. It often happens, that the watch-maker who has the care of the church clock, is so much occupied with the concerns of his shop, that he neglects to ascertain the true time, or if he has ascertained it, to correct the error of the clock. In other cases, he is ignorant of, or inattentive to the equation of time; and tries to keep the clock with the sun; this alone produces an alteration of half an hour between November and February. Frequently the regulation is left to the sexton, who has no means of ascertaining the time; but moves the clock at random, or according to the opinion of his neighbours. In many instances the clergyman has a fancy to have the clock faster than true time; or it is put *back*, in order that couples may be married before 12; or put *forward*, that evening service in winter may be performed without candles.

The pendulums of some church clocks have not been adjusted to time for a series of years—There is one in this city, which has gained at the rate of about 15 minutes a week for several years; because the pendulum cannot be lengthened without cutting away part of a wall.

But where the regulation of the clock is attended to, by an accurate meridian line, or a correct sun dial placed out of the reach of mischief; the equation observed, and the pendulum ball adjusted as occasion requires, a common church clock usually does not vary above a minute in a week; so that if compared and adjusted with time once a week, it is sufficiently correct for all ordinary purposes. Greater nicety than this is only required in observatories.

I send you a perpetual daily table of equation; and another shewing the proper difference, according to the longitude, between the clocks of various places.*—Mr. Wynn's plan of increasing the power of church clocks in striking, seems deserving of attention.

I am, Mr. Editor,
Your obedient servant,
J. G.

York.

* These very useful and original tables shall be given, in our next and following numbers.—Edit.

I shall be obliged to any of your astronomical readers, to state if there will be a *total* eclipse of the sun in England, for the next 300 years.

HOW TO REMOVE PAINT FROM OAKEN PANNELS?

Sir,—I beg leave, through your widely-circulating Magazine, to solicit from some of your learned and scientific readers, information on the following matter:—I was in the country a short time since, on a visit, at an old family mansion, the rooms of which are mostly handsomely lined with oak; some properly left in their natural state, others painted white. It is at present wished to restore the pannels of the painted rooms to their original state; any of your readers would confer a favour, by pointing out the cheapest and most effectual process for eradicating the paint from the oak wainscotting, so as to leave it without injury in its original natural state; and also if any, and what varnish would be best, and whether it is necessary to apply it after withdrawing the paint.

I am, Sir,
Your obedient servant,
Breconian.

DOCTRINE OF PROPORTION, OR RULE OF THREE.

(Concluded from p. 537.)

Observation 15. Now in the new method of stating, the varying cause appears in proportion to a term with which it can have no other analogy or relation than that it is actually, when determined on by the purchaser, larger or smaller than that term, and cannot, therefore, be influenced, increased, or lessened, in magnitude or quantity, as an effect produced by, or in proportion to, that cause. This method, therefore, seems subversive of the object of the rule when justly considered: thus, to say merchandise is to merchandize as price to price, we may imagine by this statement a result is intended to be produced from price or money as a cause, when the strict intent, meaning, and object, of the proposition is manifestly opposite. Therefore,

Observation 16. Keeping in mind the foregoing observations upon the assignable values of the terms, we may express the original stating of the given example, and say,—If the quantity 1 of any kind, is to, or will produce the quantity 8 of a different kind, so will the quantity 2 be to or will produce the quantity 16, the same of the same as before, which will hold true in all cases. Hence the principle just laid down, that *the magnitude or quantity of any effect, varies constantly in proportion to the varying part of the cause.*

The principal recommendation advanced in support of the new method of stating questions in proportion, is, that one general rule is thus made equally applicable to *direct* as well as to *inverse* or reciprocal proportion. This, were a mere scientific arrangement desired, would be highly essential, from its apparent congruity with the subject treated of. But the simplicity of the method has been rather partially considered. A strong objection, too, may be urged against its introduction into the works of school authors, namely, the determination of the greater or the less of the first two terms, which is necessary in the process there described. Thus, in proportion by fractions, this preparatory process will frequently involve the perplexity both of the scholar and master. For instance, before the stating can be completed, it will be necessary to ascertain the greater of two fractions, which cannot in all cases be determined by inspection; thus fractions of different denominations may have to be reduced to others of the same, compound fractions to single ones, and lastly, single ones to a common denominator, in order to come at this point. In short, this rule has been considered by the generality of writers more intelligible divided into two parts, and experience has fully confirmed their opinion.

Observation 17. From the foregoing discussion, the grounds upon which the matter of both arguments has been founded will now be shewn. That the arrangement of four proportional quantities has been made capable of dispute by different authors, will appear from the manner in which each advocate has considered the proportion of the terms. The proportion has been considered either as *applicate* or *abstract*. The old method is subservient to both; the new plan only to the latter; if this second consideration of the proportion be admitted, the rule or principle is evidently wrested from its purpose.* Thus, in controverting an established and rational principle, as attempted in the new method before cited, the stating represents a cause uninfluenced, producing as its effect the evident and given cause of another effect, its supposed result: thus a cause is made the effect of a cause, with which it can only be *abstractedly* considered; and the effect of a cause made the cause of another effect, with which it cannot be *applicately* considered; so that causes are demonstrated as proceeding from causes, and effects from effects. This must evidently prove the statement or the reasoning to be false. Things individually considered cannot be supposed to influence others of their like, also abstract; and if effects be produced, the connexion of each effect with the cause

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* Mere scientific invention, if unconnected with useful results, would be, as the moving combination of the mechanical powers, unproductive of effect or acting upon nothing. Or at the best, a result abstractedly produced, without evincing the applicate principle by which such result is obtained, is but a dark and confused method of proceeding. The stations of four proportional magnitudes or quantities, like the constituent parts of the mechanical powers, would represent an inutile symmetry, if not applicate to the ordinary and evident reasoning of natural causes.

from which its results should be demonstrated to produce a similarity of effects, and not causes with causes.

Lastly. If, therefore, against the old method of considering the proportion, as applicate and abstract, it be objected that quantities unlike cannot represent a rational proportion one to the other, neither by the new mode do like quantities bear a real or applicate proportion conformable to the evident reasoning, object, and intent, of the principle upon which the rule is founded, and by which the result is produced. And, considering the quantities in either abstractedly, they have in the foregoing disquisition been proved proportional quantities, as conformable to the doctrine of proportion in one method as in the other.

To proceed farther upon this subject would lead to an almost endless discussion. The method of working the rule, commonly termed Compound Proportion, would become equally the subject of dispute; and would involve a branch of the mathematics, upon which even the greatest of all mathematicians (Euclid,) has not escaped censure.

Your correspondent does not expect to shield the inconsistencies of these scattered observations by the errors of others, and though inclined to hold with the reasoning of those *egregious blunderers* whose names he has quoted, yet it would be an evident wrong to traduce the opinion of others because less supported by authorities. Yet every Mathematician, Scrutator, and each in the infinite series from A to Z, &c. &c. in the nomenclature of ANONYMIES, must not expect to find that all will

"—— Pay a due submission,
And acquiesce in his decision."

With this conviction, he has not offered the foregoing observations with any design to instruct your readers, but to call forth a more erudite analysis than that which he has adopted, and a confirmation or disproval of what has been hitherto advanced upon this important subject, so as to establish its truth by the strictest reasoning. If this be obtained, though he may be proved the most egregiously erroneous of all writers upon its discussion, his object will be realized, and a sufficient reason and justification be furnished for what he has offered.

I am, Sir,
Your obedient servant,
H. H.

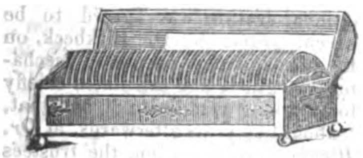
Nov. 2, 1826.

M. LA BEAUME'S NEW GALVANIC BATTERIES.

M. La Beaume, who has acquired considerable reputation in the metropolis for his successful application of galvanism to the cure of diseases, (particularly those of the digestive organs, and of the head and the nervous system, consumption, asthma, gout, rheumatism, &c.) has just published a small volume containing the details of his singularly efficacious practice, and a description, which we now propose to lay before our readers, of some new galvanic batteries of his invention; to the superior powers of which, in the developement of the galvanic influence, may be chiefly ascribed the many happy restorations to health and enjoyment, of which M. La B. has been the honoured instrument.

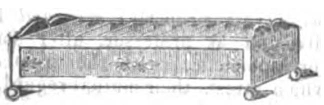
The object of the *first* of M. La B.'s batteries is, to increase the galvanic power, *ad libitum*, and to continue it for a great length of time, without any fresh excitation. "These most desirable results are effected by a metallic and a semi-metallic substance, combined with another less oxydable metal, the surfaces of which are acted on by one or two mineral acids diluted with pure water. The power and duration obtained by these means are very great, though contrary to the hitherto acknowledged laws of galvanism, which require two dissimilar metals and one interposed fluid to develope the galvanic influence. It is not only capable of increased power, but, by a simple contrivance, it perpetuates its action to almost any length of time for a succession of operations; these advantages are obtained by the shape and position of the plates; for, instead of being square and stationary, as in the common battery, they are circular and made to revolve on an axis at the will of the operator. As only one segment of the circle is used at one time, four different operations may be effected in each revolution of the entire circle, without the trouble of wiping any part of the circle. A constant stream of galvanic fluid may thus be exhibited almost *ad infinitum*, and the unpleasant effluvia arising from the frequent addition of acid, as in the common mode, is prevented. The apparatus, being concealed from view in a handsome covered box, cannot give alarm to the most timid patient. The greatest facility is afforded in removing the oxide from the surfaces of the plates by a few revolutions round its axis, and the virtue of the acid solution in the cells remains in full strength for a very long time."

The figure which we here insert,



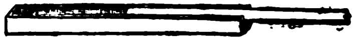
is a representation of this galvanic battery as it appears on the table, with the cover open, and one half of the circular plates displayed.

The two following drawings represent the series of plates out of the box, and the box with the crystal cells which contain the acid.



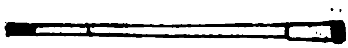
When it is required to clean the plates, they are suspended in a box *without cells*, and, by means of a handle fixed to one end of the spoke, made to revolve on their axis, and to come in contact with a knife, which cleans their surfaces from all oxidation.

The rest of M. La B.'s batteries are all of a *portable* description. One contains four series of plates, which he states may be preserved in good order for some months, or even years. Another, intended for use in cases of suspended animation, is represented in the following drawings.



It consists of three or four hundred plates, in a box of about three feet long, three inches deep, and three inches wide. The circular plates are about the size of half a crown, and when the apparatus is taken out, the box is filled with diluted nitric acid, and the row of stringed plates is placed horizontally on the two supports of the battery.

A third sort of portable battery is contained in a common walking-stick, for the convenience of town or country practitioners, when no conveyance can be immediately obtained for a larger battery.



This galvanic cane consists of three divisions; the first contains a bottle of acid, salt, and linen rag, covered by a metal cap affixed to the handle of the stick, and which is to be used as a cup to mix the acid with water. The second division is composed of two parts, one sliding on the other by means of a groove; when opened, it forms a pair of galvanic batteries of three or four hundred plates of combined metal, which are connected together by an arched wire. The third division, which is the smaller end of the stick, contains a small lancet, the conducting wires,

&c. and is also held by the hand during the operation. This stick contains all that is necessary for the galvanic process except water, which can be obtained on the spot.

But the most portable battery of all, consists of two or three hundred plates of the form and size of a shilling or a six-pence, contained in a small box which may be carried in the pocket.

Each pair is separated by a piece of cloth, on the principle of Professor Aldini, (the nephew of the celebrated Galvani,) and "this battery," says M. La B. "is more powerful than his, because I combine the semi-metal with one of the other metals."

The subordinate parts of the galvanic apparatus, as the directors, conductors, &c. are not so well explained by M. La B. as we could have wished. He informs us they are on "a new principle," and that is all he says respecting them. He alludes also, in different places, to certain "*directions*" to operators with his batteries, as being necessary, but gives none. Of these omissions, however, we speak rather with regret, than in the language of complaint; for it must be allowed, that an individual who declines to avail himself (as M. La B. does,) of the uncertain protection afforded by our patent laws, has a right to adopt whatever other means he thinks best, to secure to himself the benefit of his inventions. Every information that is wanted may, we presume, be obtained by application to M. La B. himself.

ARITHMETICAL QUESTION.

I should feel obliged to any of your intelligent readers, who will give a neat solution of the following question:—

From a pipe of wine, containing 110 gallons, 10 gallons were drawn off, and the vessel replenished with 10 gallons of water; after which, 10 gallons of the mixture were drawn off, and then 10 gallons of water poured in; now, the like process having been repeated *four* times, it is required to find how much wine remained in the vessel, supposing the two fluids to have been thoroughly mixed each time?

CLYDE.

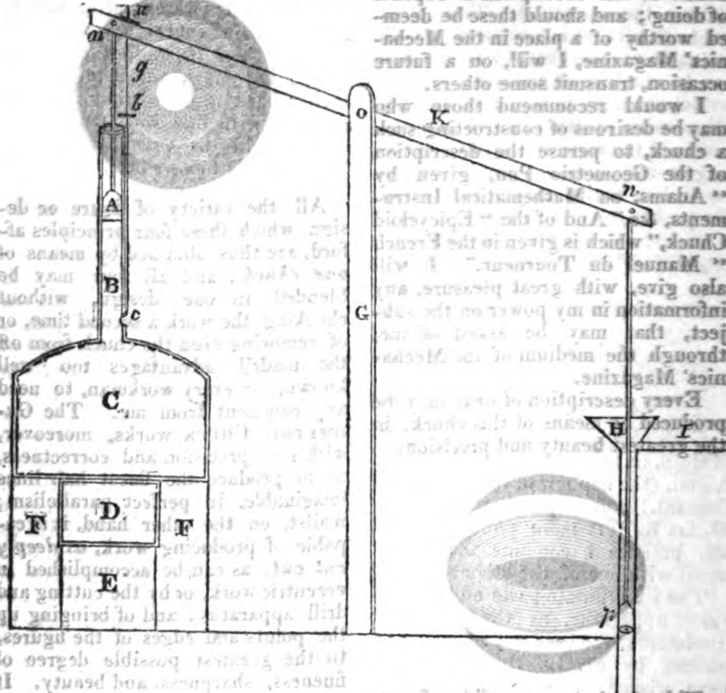
GRATUITOUS LECTURING.

Sir,—In the course of the discussion which has been carrying on in your pages, on the subject of Gratuitous Lecturing, I see it is stated that Doctor Birkbeck is one of those who have expressed a decided opinion that mechanics ought to pay for whatever instruction they receive. In confirmation of this statement, I beg to mention, (on the authority of an historical account of Anderson's Institution, Glasgow, which I find in No. 7, of the Scots Mechanics' Magazine) that when the trustees of Professor Anderson were enabled to give effect to his favourite idea, as expressed in his will, of extending "Experimental Knowledge to the artificers of Glasgow," "an additional lecture was agreed to be given, *gratis*, by Dr. Birkbeck, on the principles and powers of mechanical engines, and calculated chiefly for working tradesmen;" but that, "about two years afterwards, at *Dr. Birkbeck's suggestion*, the trustees resolved that *models* should be obtained to enable him to enlarge the course of instruction of the Mechanics' class," and that, "*to render that class productive, a small fee, of five shillings on each ticket*," should be taken. It is farther stated that when, on the 4th of April, 1824, the managers proposed to Dr. Birkbeck, *to take the risk of all expenses upon himself*, and to receive the fees of the classes," Dr. Birkbeck (very properly) *resigned* his situation as professor, after some correspondence with the trustees, which attests their mutual regard."

I am, Sir,
Your obedient Servant,
GLASGUENSIS.

Tower-hill, Dec. 18, 1826.

ECONOMICAL IMPROVEMENT IN THE STEAM ENGINE.



Sir,—I forward you what I conceive to be an improvement in the steam engine, particularly as regards saving of expense.

E, is the grate; D, is the fire-place; F, F, the brick-work; C, the boiler; B, is a tube; *c*, is a valve placed in the tube B; A, is a piston which is fitted air tight in the tube B; *a*, *b*, two small projecting iron plates fastened on the rod of strong iron, *g*; G, is a post; K, is a beam riveted at O; *n*, is cut into the beam and riveted through *p*; sucker, I, is a trough where the water runs away, as this might be applied either to canals or machinery. The steam being generated at C, forces the piston A, up, and that raising the beam K, strikes against *a*, which opens the valve *c*, and the steam escaping, the weight of it overcoming the pressure of steam falls to B, and striking against *b*, shuts the valve *c*, when again the steam having the same power, forces A, up, and it acts as before described. The action of the beam might either be employed in drawing water for canals or turning machinery. If A, should not be heavy enough to overcome the pressure of steam generated, then a weight might be placed on the end of the beam, over the piston, at *n*, which would have the desired effect. The construction of the drawing of the water is too simple to require explanation.

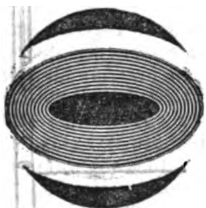
I am, &c.

DESCRIPTION OF THE GEOMETRIC CHUCK.

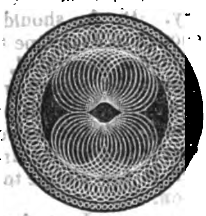
Sir,—Some years back I constructed an instrument on the principle of the *Geometric Pen*, and as I made it screw on to the nose of the mandril of my lathe, in the same manner as the eccentric, oval, or other *chuck*, I have called it the GEOMETRIC CHUCK. I now present you with four specimens, illustrative of what a chuck of this description is capable of doing; and should these be deemed worthy of a place in the Mechanics' Magazine, I will, on a future occasion, transmit some others.

I would recommend those who may be desirous of constructing such a chuck, to peruse the description of the Geometric Pen, given by "Adams, on Mathematical Instruments, &c." And of the "Epicycloid Chuck," which is given in the French "Manuel du Tourneur." I will also give, with great pleasure, any information in my power on the subject, that may be asked of me, through the medium of the Mechanics' Magazine.

Every description of oval may be produced by means of this chuck, in the greatest beauty and precision.



This chuck is susceptible of performing all the work of an ECCENTRIC CHUCK.



The GEOMETRIC CHUCK produces, also, at the will of the workman, by putting on a stop, all figures compounded of the *loop outwards*,

and of the loop inwards.

All the variety of figure or design which these four principles afford, are thus obtained by means of *one chuck;* and all four may be blended in one design, without chucking the work a second time, or of removing even the chuck from off the madril, advantages too well known, to every workman, to need any comment from me. The GEOMETRIC CHUCK works, moreover, with such precision and correctness, as to produce the finest hair lines imaginable, in perfect parallelism; whilst, on the other hand, it is capable of producing work, *as deeply cut out*, as can be accomplished in eccentric work, or by the cutting and drill apparatus; and of bringing up the points and edges of the figures, to the greatest possible degree of fineness, sharpness, and beauty. It perfects its work, also, with inconceivable rapidity; in working it, the lathe may be caused to revolve as in common turning, indeed, it is no exaggeration to say, that, in comparison with the eccentric chuck, it performs in the ratio of minutes to hours. Suppose, for instance, it were required to give, on the lid of a snuff box, a finishing circle of beading, composed of 360 divisions; with the Eccentric Chuck, the lathe must be stopped, and the chuck adjusted *three hundred and sixty times*, and the time this will take, every practitioner full well knows; whereas, the Geometric Chuck, will complete the same number of beads from only *one setting of the chuck*, and without stopping the lathe or taking the tool from the work.

I am, Sir, &c.

J. H. IBBETSON.

South Street, Chelsea.

GRATUITOUS LECTURING.

Sir,—As I am not at all ambitious

of the honour of the "last word," I do not intend vieing with Viator in his imitations of the frequenters of a certain *fashionable* watering place; neither shall I hereafter, if he ever thinks fit to re-appear, notice his communications, however they may be directed against me, unless he can bring his language into something like dispassionate argument, and divest it of the personalities which have, hitherto, (in my opinion) disgraced it. He has not, in any degree, even directed his artillery against the main question under discussion, but solely against a very subordinate point, arising simply out of the fact, that the same thing may make very different impressions on different minds. Not but that it is good generalship to attack what appears to be the weakest point; still, in this case, I can neither commend the skill nor the courage of Viator's attacks. I trust, now, that T. M. B. will again come forward, and, by restoring the discussion to its legitimate and proper direction, put Viator to the blush, and shew him, that however desirable allies may be in cases of danger, still honourable conduct can only ensure respect, and judicious movements render assistance valuable.

I am, Sir,
Your very obedient servant,
AURUM.

December 26, 1826.

P.S. The Copper Captain has entirely superseded the necessity of my entering more fully into the subject; to whom, and Joseph Brown, the lovers of independence are, in no small degree, indebted.

A.

Sir,—It was not my intention to have again written on this subject, (I mean that of Aurum's *mistake*, as to the attendance on the lectures of the London Mechanics' Institution), but I cannot allow the scandal of the "Copper Captain," to pass unnoticed, and must beg for the liberty of a small space in your pages to reply; although, I confess, I think they might be much better filled.

My object, in writing to you at the first, was only to correct Aurum's *mistake;* to that one single point I have faithfully kept, and, therefore, the simile of the former claiming all the honours of the combat, on account of the sword-knot accident, will not here apply. I claim but the victory on one point; that of having exposed a very injurious misrepresentation.

That I set Aurum down as being, in every thing else, unworthy of notice, because he committed a fault, I flatly deny, and I refer to my first letter for direct evidence to prove the contrary.

I do not fear, but that my general will again take the field; at any rate, I trust he will not debase himself by any unfair measures, or commit himself by evasion and mean subterfuge.

I shall now take my leave of Mr. Penny Wisdom, (who does not seem inclined to overrate his price,) and, trusting that I shall not have again to trouble you on this score, I bid "good night to Marmion," and hope, in future, to see Aurum assisted by such reasoners as Mr. Brown. With this wish I shall conclude, and

I remain,
Your very obedient Servant,
VIATOR.

Sir,—In my undersigned capacity, (which I have been free to take on myself, as I think it much wanted,) I would just hint, to certain of the disputants, on the subject of gratuitous lecturing, the propriety of conducting the discussion with less acrimony and petulance, and more good feeling and temper; always bearing in mind, "to press their point with *modesty* and ease." Being an impartial, though not an uninterested spectator of the combat, I trust these remarks will be kindly received, as coming from a

"MODERATOR."

Dec. 24, 1826.

[We cordially join in the recommendation of "Moderator," and must positively decline inserting any more letters, but such as bear directly on the points at issue, and are couched in perfectly moderate and courteous language.—EDIT.]

PILE DRIVING.

Sir,—In answer to the enquiry of a Carpenter, in No. 170, I send him the well known law of falling bodies. Their force is double their weight, by falling only through a space of 1¼ inch, but in further descending, their force will increase only as the square root of the distance through which they pass. His iron ram of six cwt., would therefore by a fall of 1¼ inches only, strike the pile with a force equal to 12 cwt., but by a fall of 20 feet, which amounts to 192 times the above distance, it strikes with a force equal to the square root of the last distance or about 14 times its actual weight, viz. about 84 cwt. Its declination will neither increase nor diminish its force. I have explained the subject briefly, in order to occupy as little space as possible in your valuable pages, but shall be happy to treat the subject more at length if required.

I am, Sir,
Your humble servant,
ARIES.

(ANOTHER ANSWER.)

Bulbourne near Tring, Dec. 7th, 1826.

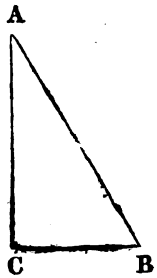
Sir,—I send you the following answers to the questions on pile driving, by "A Carpenter," in the 170th No. of the Mechanics' Magazine, which, I hope, will prove satisfactory.

The force of percussion is measured by the product arising from the body moved, multiplied by the velocity, and the velocity of a body falling from rest by the force of gravity, is (by Mechanics) as the square root of the space fallen. Hence, we have the following easy rule for finding the comparative forces with which a ram strikes a pile, after falling through any given spaces.

RULE: *Multiply the weight of the ram, by the square root from which it falls, and the product will be as the force exerted on the pile*

Thus, in the proposed quotation, the weight of the ram is given 6 cwt., and the space fallen 20 feet; we have, therefore, $6 \times \sqrt{20} = 6 \times 4{\cdot}47 = 26{\cdot}82$ for the required force, which is equal to the force exerted by a weight of 26·82 cwt., after falling from quiescence through a space of one foot: for, by the above rule, the force exerted by a ram of 26·82 cwt., falling from rest through a space of one foot, is as $26{\cdot}82 \times \sqrt{1} = 26{\cdot}82$ as above. If the space fallen be 50 feet, we shall thus have $6 \times \sqrt{50} = 6 \times 7{\cdot}07 = 42{\cdot}42$ for the required force, which is equal to the force exerted by a weight of 42·42 cwt., falling from rest through a space of one foot.

The loss of power occasioned by the declination of the engine, is thus estimated.



In the above figure, let A C represent the engine in its declined situation, A B being equal to 11 feet, and B C 20; thus, from the well known principle of Mechanics— that, if a weight is placed on an inclined plane, that weight is to the effective part thereof in the direction of the plane, as the plane's length is to its perpendicular height,—we shall have $AC : BC :: 6 : \frac{6 \times BC}{AC}$, or in the proposed questions (because $AC = \sqrt{AB^2 + BC^2} = \sqrt{11^2 + 20^2} = 22{\cdot}82$, and $BC = 20$) $22{\cdot}82 : 20 :: 6 : 5{\cdot}25$; therefore 5·25 cwt. is the weight acting in the direction of A C, and this, multiplied by the velocity, which (by mechanics) is known to be the same as if the ram had fallen from rest, through a space equal to the perpendicular height of the plane, gives $5{\cdot}25 \times \sqrt{20} = 23{\cdot}4675$ for the force in the direction of A C. In order to get the force in the perpendicular direction, we have, by the *resolutions of forces*, 22·82 (A C) : 20 (B C) :: 23·4675 ($= 5{\cdot}25 \times \sqrt{20}$) : 20·56.—20·56 is, therefore, as the force in the perpendicular direction, or in the direction of the pile, the difference between which and 26·82 gives 0·26 for the loss occasioned by the declination of the engine.

In the above calculations, the resistance of the air and the loss of power by friction are not taken into the account, neither of which, in the first case, would much affect the conclusions; but, in the latter case, the loss by friction would, I apprehend, be very great, and would therefore occasion a greater difference than is calculated above. I am, Sir.

W. Lake.

ANSWER TO FELIX FORD'S QUESTION ON CLOCK WORK.

Sir,—Your correspondent, "Felix Ford," (Vol. vi. p. 415,) wishes to know the length of a pendulum for a clock with a certain combination of wheels. Now I think the following operation will produce an answer sufficiently near the truth.

By his question, the number of revolutions made per hour by the escapement wheel $= \frac{84}{6} \times \frac{72}{6} = \frac{6048}{36} = 168$; ∴ the time in which it makes one revolution $= \frac{1}{168}$ of an hour, $= 21\ 3\text{-}7$ seconds; and as the escapement wheel contains 27 teeth, the pendulum vibrates $27 \times 2 = 54$ times in 21 3-7 seconds, or 151 1-5 in 60 seconds. Now in 60 seconds a pendulum 39·2 inches in length makes 60 vibrations,

∴ as $\overline{151\frac{1}{5}}|^2 : \overline{60}|^2 :: 39{\cdot}2$: to the length sought.

Inch. Inch.

Or, 571536 : 90000 : : 39·2 : 6·17

∴ 6·17 inches = the length required.

And, per question, a pinion of 8 teeth on the arbor of the hour-wheel works in a wheel of 96 teeth, on the arbor of which is the fusee, ∴ the fusee revolves in $\frac{96}{8} = 12$ hours; and ∴ the fusee revolves exactly 14 times in 7 days, or 168 hours.

I remain, Sir,

Your obedient Servant,

H. C****ll.

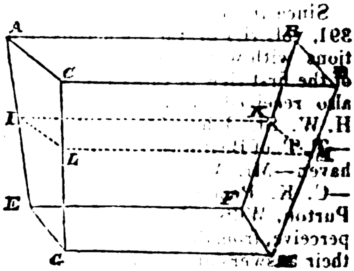
Erratum in my last communication.

Vol. vi. page 472, 1st column, line 24, for *I* read *L*.

Chigwell, Dec. 2, 1826.

THE SECOND VIEW OF THE RESERVOIR CASE.

Sir,—I beg leave to send you the following answer to the second view of the reservoir case, as stated in the 166th No. of the Mechanics' Magazine.



In the above figure, let A B = a = 200 feet, A C = b = 40 feet, E G = c = 8 feet, E F = d = A B — A C — E G = 168 feet, and the perpendicular height = 20 feet = h. The solid content of the reservoir (*Simpson's Fluxions*, art. 154,) =

$$\overline{a \times b + d \times c + \overline{a+d} \times \overline{b+c}} \times \frac{h}{6}$$

$$= \overline{200 \times 40 + 168 \times 8 + \overline{200+168} \times \overline{40+8}} \times \frac{20}{6} = 90026\tfrac{2}{3} \text{ cubic feet.}$$

Let x be put for the depths to be pumped out by the first set of labourers, and we shall have $h : x :: a - d : \overline{\text{J K} - d}$; therefore, by multiplying means and extremes, we have $h \times \overline{\text{J K} - d} = x \times \overline{a - d}$, and $\text{J K} = \frac{x \times \overline{a-d}}{h} + d$. And in the same manner J L is found to be $= \frac{x \times \overline{b - c}}{h} + c$; consequently, the solid content of the part to be pumped out by the first set of labourers (or of the part above the plane,) I M, is =

$$a \times b + \frac{x \times \overline{a-d}}{h} + d \times \frac{x \times \overline{b-c}}{h} + \ldots$$

$$a + \frac{x \times a - g}{h} + d \times b + \frac{x \times b - c}{h} + c \times \frac{a}{x};$$

which, by the question, must be $= \frac{90026}{2}$: whence, by reduction, &c. we get the cubic equations, $x^3 + 185 x^2 + 5275 x = 52730$, from which the value of a will be found to be 7·7852 = the depth in feet to be pumped out by the first set of labourers, which was to be found.

I am, Sir,

Your obedient servant,

Wm. Lake.

Bulbourne, near Tring.

Since inserting our summary (p. 391, vol. vi.) of the numerous solutions with which we were favoured, of the first view of this case, we have also received answers to it from H. W. St. John's Place, Wakefield—T. T. of Bedford—J. E. B. Whitehaven—Mr. Wm. Tonkin—Monad—C. K. Pembroke Dock—and Az, Purton, Wilts. Monad and Az will perceive, from the said summary, that their answers are in some particulars erroneous; all the others are correct, and in accordance with the majority of those previously received.

J. E. B. makes the same remark as N. H. did: namely, that to pump out half the *quantity* of water, is by no means to perform *half the labour*; since it must require more power to pump out the lower than the upper half; and he therefore proposes the following as a

THIRD VIEW OF THE RESERVOIR CASE.

It is required to determine what depth of water the first party must pump out of a reservoir 40 feet wide at top, 8 feet wide at bottom, and 200 feet long, that they may perform half of the *labour*?

J. E. B.

TUNING AND BUILDING ORGANS.

Sir,—It is probable, that the failure of your correspondent, K., of Madras, (pages 341,) in his experiment with Dr. Robert Smith's table of beats, was in consequence of the organ not being at the proper pitch for the numbers calculated. If he will tune, in the first place, middle C of the diapason-stop, or the next C below of the principal, to concert-pitch, or so that the air contained in that pipe shall make 240 complete vibrations, backward and forward, in one second of time, he will find the following numbers of the beats of the flattened fifths in ten seconds, answer his purpose. The best time for tuning an organ is, at a mean temperature and pressure of the atmosphere, and when the air is dry. Let the following letters stand for middle C, and the sounds next above it, then the fifth above middle C, should beat flat 22; above C sharp, 23; D, 25; E flat, 27; E, 28; F, 30; F sharp, 31; G, 33; A, 37; B flat, 40; B, 42. The major thirds above C, D, E flat, E, F, G, A, and B flat, will be perfect; and the major thirds above C sharp, F sharp, G sharp, and B, will be so much sharper than perfect as to be extremely disagreeable. It is usual to tune from C, by ascending fifths (and occasionally descending octaves, in order to keep near middle C,) as far as G sharp; and by descending fifths (and occasionally ascending octaves,) as far as to E flat, the resulting fifth, A flat E flat, will be so much sharper than perfect as to beat 234 times in ten seconds; and this very harsh fifth is called by some tuners *the wolf*, *(quinte du loup.)* It may be of use to remark, that half any one of the preceding numbers will be the beats of the same fifth taken an octave lower.

This is the system preferred by Bedos de Celles, in his magnificent folio, in French, on organ-building, p. 429-1770. Dr. R. Smith, at p. 189, of his Harmonics (1759), directs the tuner, as a proper method of tempering the common scale of organs, to make the third and the fifth, above the same bass note, beat equally quick, the third beating sharp, and the fifth beating flat.

With respect to the next inquiry, I have tried with success, three methods of dividing the cylindrical surface of organ barrels, to mark the proper places for the pins and stapins,—first, by taking a thin brass plate with concentric circles scratched on it and divided, by means of a clockmaker's engine for cutting wheels, into suitable numbers of equal parts, and fixing it by a screw passing through its centre into that end of the wooden axis of the barrel which is farthest from the handle of the organ. *Second*, by using a wheel, larger in diameter than the barrel, framed of seasoned mahogany, and turned cylindrical, with an iron screw fixed in one end of its axis for the purpose of screwing into the end of the axis of the barrel. This end of the axis of the wheel, must be long enough for the wheel to be without the frame work of the organ, in every situation of the barrel. Writing paper is pasted on the outer cylindrical surface of the wheel, forming a belt about 2½ inches wide, which is divided into a number of equal spaces by ink-lines, made with a drawing pen held steadily against it, while the wheel is made to revolve. Each of these spaces or loops is divided by cross lines into the bars or measures which are to occupy one revolution of the barrel, and every measure is afterwards divided, by shorter lines or by dots, into six equal parts on one edge of the space, and into eight on the other edge. The musical mechanic will be at no loss for the choice and application of these numbers to the different sorts of time. In both these methods, the endless screw is displaced, the plate or wheel, and the barrel revolve together, and a fixed pointer shews at what divisions to depress the requisite keys, so as to mark on the paper covering of the barrel points, where the flat wire pins and staples are to be afterwards inserted. The wheel is more accurate and convenient than the plate, and is, I believe, most in use with men who follow this employment of setting barrels. For large organs, however, if not also for small ones, the *third* method deserves the preference. To practise this method, the endless screw is used to turn the barrel in its place, the handle serves as pointer to equal divisions on concentric circles, drawn on disks of card, previously put on the end of the spindle, and fixed against the outside of the frame-work. Thus, the turns of the handle for one revolution of the barrel, multiplied by the divisions on the disk employed, will give the number of equal notes, if not equal spaces, into which the barrel may be easily divided. Some ingenious persons use a train of wheel-work, with changeable wheels, moved by turning the handle, instead of employing the divided disks of card.

The flat brass wire may be purchased, in sorts, at Wright's in Drury Lane. I believe that the staples are commonly made by fixing one end of the staple-wire in a vice, then winding it on a rectangular parallelopiped of hardened steel, of a proper thickness, and in width equal to twice the height of the staples. This covering of wire is afterwards separated into a number of staples, by cutting it with a chisel on opposite sides of the piece of steel in the middle of its width. Bedos describes various tools for this work, consisting chiefly of four pairs of long pliers, each formed into five different steps, or thicknesses, making in all, staples of twenty different sizes. See plate 101, and page 594—(1778.)

I am, Sir,
Your obedient Servant,
ARNOLD MERRICK.

PIANO-FORTES.

Sir,—I should feel obliged to the writer of the notice of a French Patent *Elliptical* Piano-forte, page *188, invented by a common workman, if he would answer the following queries respecting it, and which will give him but little trouble, if he has examined the instrument. Are the two sound-boards separate or connected together? Are they in the same plane; if not, how are the two planes situated with respect to each other? Are the circular ends any thing more than like our square piano-fortes with *rounded corners*? Foreign piano-fortes are much inferior to ours in quality of tone and power, but are thought, by many, to be superior in lightness and quickness of touch. I should be glad to see a description of their *action*, or system of moveable parts, as hammers, &c. "The suppression of the angles," or corners, of the piano-forte, is of little or no advantage to the tone.

The "Patent Self-performing Piano-forte," mentioned in page *215, is, probably, Clementi's, price from 160 to 300 guineas; it is in the form of a cabinet piano-forte, and may be played on with the fingers.

A. M. Corin.

EXPANSION OF WOOD.

I should be glad to see, in your very useful work, a statement of the dilatation and contraction of any of the seasoned woods, commonly used by joiners, consequent on a variation of the temperature and moisture of the atmosphere, as determined by careful experiment. Some account of the variation of deal rods, in length, may be found, I believe, in the ordnance survey of England, but it is a work which I cannot now refer to.

M.

CHANGE WHICH MERCURY UNDERGOES IN ITS MEDICAL PREPARATIONS.

Sir,—Having lately been much occupied in the preparation of the Pilulæ Hydrargyri and Unguentum Hydrargyri, of the Pharmacopœas (or what, perhaps, the generality of your readers, unacquainted with pharmacy, will better understand by the terms, Blue Pill and Blue Ointment), I am much divided in opinion, as to the change the mercury undergoes, whether it be merely mechanically divided by the trituration; or whether by the action of the atmosphere, assisted by the trituration, it be converted into an oxide. There appear to me to be many arguments for and against each supposition, and I shall be glad of the opinion of any of your correspondents on the subject; after which, I will give them mine; and, in the mean time, Sir, believe me,

Your's, with respect,

Tyro.

Sleaford, Dec. 1, 1826.

THE "ALGEBRAIC EQUATION.

Sir,—Herbert D.'s second equation should have been x^2y-xy^2, and the following is my humble attempt at solving the question.

$$\left.\begin{aligned} x^3-y^3 &= \ldots\ldots 152 \\ x^2y-xy^2 &= \ldots\ldots 48 \end{aligned}\right\} \text{per quest.}$$

$$x^3+x^2y-xy^2-y^3=200 \quad \text{by addition.}$$

$$\text{but } 4x^2y-4xy^2 = 192 \quad \text{by multn.}$$

$$x^3-3x^2y+3xy^2-y^3= 8 \quad \text{by subtn.}$$

$$\therefore x-y = 2$$

Now divide 2nd equation by $x-y$, and $xy = 24$;

$$\text{but } \overline{x-y)}^2 = x^2-2xy+y^2 = 4$$

$$\text{and } 4xy = 96$$

$$x^2+2xy+y^2=100 \text{ by add.}$$

$$\therefore x+y = 10$$

$$\text{but } x-y = 2$$

$$2y = 8 \text{ by sub.}$$

$$\left.\begin{aligned} \therefore y &= 4 \\ \text{and } x=10-4 &= 6 \end{aligned}\right\} \textit{Ans.}$$

Clyde.

CELLAR DRAINING.

Sir,—I beg to inform "*Inquisitor*," whose communication you inserted on the 28th October, that his cellar may be drained by the following plan:—Spring an arch over the well, 18 inches below the surface of the cellar, and over this another arch INVERTED, *laid in cement*, the water being kept well pumped out during the work, and until the cement is properly set. Let a layer of cement be next applied over the whole cellar floor, extending upon the walls to the height of three feet; the joints should be previously picked out, which will afford the cement a good tooth-hold, and the bricks well washed, to cleanse them of all impurities, which might prevent the cement from adhering. I recommend the *double* arch in consequence of the danger there is of the upward pressure of the fluid bursting a single one, which I have known frequently to happen, and I advise the cement to be laid over the walls 18 inches higher than the water usually rises, by way of additional security. The pump being left in the well, the water may be used for domestic purposes. This subject being one of general concern and utility, I may, perhaps, afford the reader some useful hints, by describing the following case. In August last, the Rev. Mr. Marriott, of Horsmonden, Kent, sunk a circular tank for rain water, 10 feet in diameter, and 14 feet in depth, the bottom being paved with bricks, and laid in Parker's cement, which covered also the sides from top to bottom; at 18 inches above the bottom of the tank, a spring of hard water burst in, which was kept pumped out, till the plastering was finished; but such was the pressure of the fluid, that on the morning following the completion of the work, the cement was found forced up from the bottom, and the tank containing 18 inches of hard water. All subsequent attempts to resist the influx of this spring into the tank proving unavailing, I recommended a small hole to be excavated to the depth of 18 inches below the bottom, directly under the end of the pipe of the pump, this pipe I lengthened by the addition of another piece, sufficient to reach to the bottom of the hole, and setting the pump to work, the tank was kept clear of water whilst I proceeded in the following manner: I laid three courses of bricks in cement upon the bottom, sloping every way from the sides to the centre, forming an inverted dome, and plastered it over with the *fresh* cement. When the cement had set, the pumping was stopped, and I sawed off the additional piece of pipe, plugged the end securely, and cemented it over. No water ever afterwards penetrated. In conclusion, I must remark that much spurious cement is manufactured and sold; the buyer should therefore be careful to procure genuine, as no other can be depended on. I remain, Sir, &c.

JOHN READ.

FREEING COPPER PLATES FROM WAX.

Being an amateur of the art of engraving, I have for my own amusement engraved names, &c. on brass plates, and in filling the letters with black wax in order to shew the engraving better, I find a difficulty in getting the wax off the plate without chipping it out of the letters and injuring the surface. If any of your numerous correspondents will be kind enough to state how the wax can be most easily removed, they will confer a lasting obligation on

Your's, respectfully,

PERSEVERANCE.

NOTICES TO CORERSPONDENTS.

Mr. N. Short's Introductory Discourse on Natural Philosophy, and Mr. Weekes's interesting Scientific Experiments and illustrations, will both be commenced in our next.

J. H. Y.—O——.—Corporal Trim— and N. E. B. on "Gratuitous Lecturing," wish to skirmish in a field which is already sufficiently occupied. Besides, there is nothing new in what they offer on the subject.

Communications received from J. P. (omitted to be acknowledged a few weeks ago.) — Norvicensis — C. K. (Pembroke) — R. B. — Whinstone — An Independent Mechanic—W. W.— and E. T. A.

The publication of the Supplement, containing Preface, Index, &c. &c. to Vol. VI. is unavoidably deferred till next week, when will also be published Part XLIV. being the concluding one of this volume.

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