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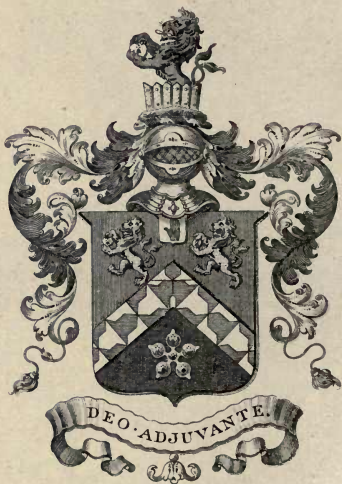
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GEOMETRIC CHUCK. London. 1833.

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A
BRIEF ACCOUNT
OF
IBBETSON'S
GEOMETRIC CHUCK,

MANUFACTURED BY
HOLTZAPFFEL & Co.



WITH A
Selection of Specimens
ILLUSTRATIVE OF SOME OF ITS POWERS.

By JOHN HOLT IBBETSON, Esq.

LONDON :
PRINTED FOR THE AUTHOR,
BY A. HANCOCK, MIDDLE ROW PLACE, HOLBORN ;
SOLD BY HOLTZAPFFEL AND CO. CHARING CROSS,
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1833.

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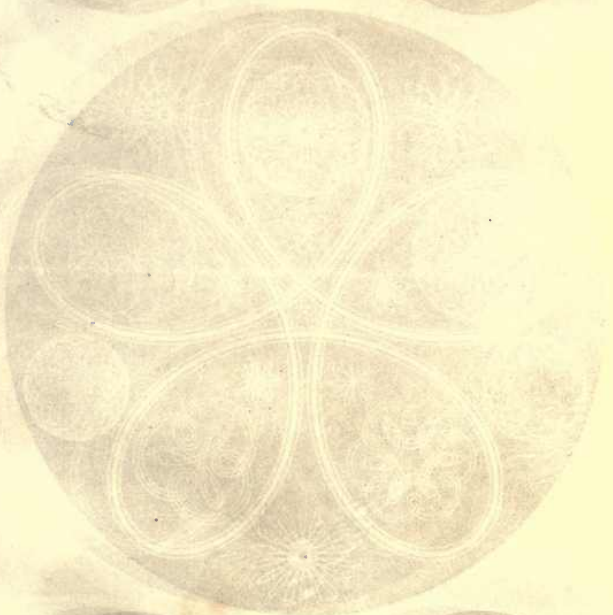
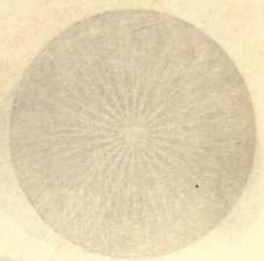
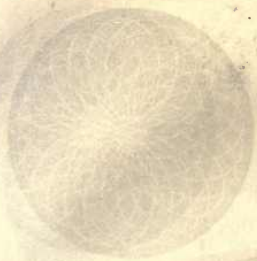
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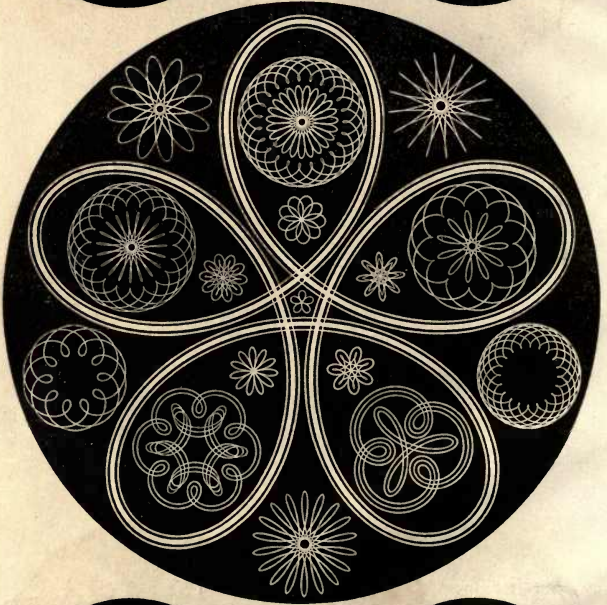
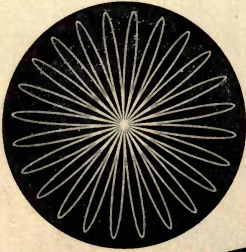
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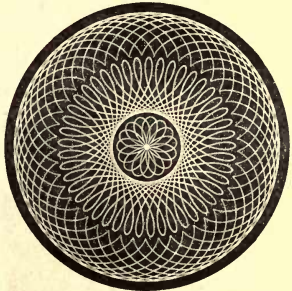
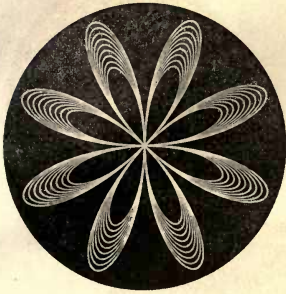
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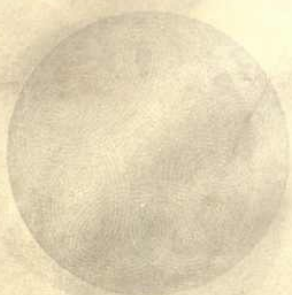
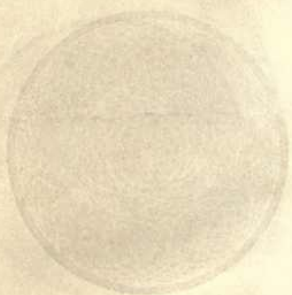
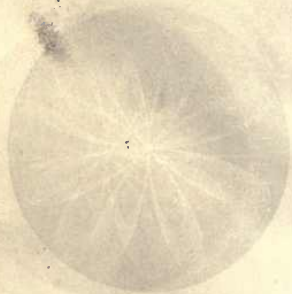
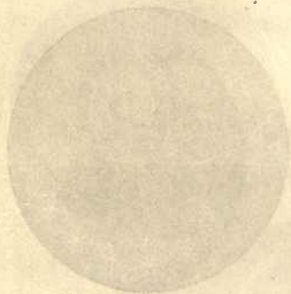


DIAGRAMS ILLUSTRATING THE EPICYCLOIDAL CUTTING FRAME.



DIAGRAMS ILLUSTRATING THE EPICYCLOIDAL CUTTING FRAME.





A BRIEF ACCOUNT, &c.

THE object of this Memoir is to bring under the notice of the Public—particularly under that of the Amateur Turner and of those who take pleasure in the investigation of the organical description of curves—the powers and capabilities of the Instrument alluded to in the title page. In Turning and Mechanics I am self-taught and an Amateur only, but as I contrived the Instrument and constructed it with my own hands, even to every screw, from the raw materials of brass and steel, it is fair to conclude that I must be better acquainted with its working powers than those who never saw it, and who, consequently, can know nothing whatever about it. This is so self-evident that I should not have made the

remark had not some writers in the *Mechanics' Magazine* pretended to lay down laws regarding it, which are quite at variance with my views and with what I know to be the fact. The power of describing *Spirals* has been ascribed to it, which I had previously explained, in that publication, it could not do. I am at no loss to produce spirals by means of my *Turning Apparatus*, as the following Specimens, which I executed by it, will



prove; but, I say that the *Chuck* I have contrived is not capable of producing them; and, further, that not any instrument, which is *attached to the mandril of the lathe and works round* with the mandril, can be so constructed as to move a plane against a fixed point in such a way as to describe the curves these Specimens exhibit. Every curve that can be generated by *compound circular motion* has a tendency to return into itself, and must eventually do so if sufficiently extended. The spiral is a curve which is constantly receding from itself, and its very properties are, that, it may be infinitely extended; and it, therefore, *never can return into itself*. The motion of the mandril is a *fixed circular* one, and is the *primum mobile* of the Chuck; and, therefore, let the motion of the Chuck be what it may, the combined motion of the *mandril* and the Chuck can *never so move a plane against a fixed point as to describe a spiral*. A figure, bearing the semblance of an ellip-

sis, may be patched up from portions of circles or spirals, but such a figure will not be the more an ellipsis because the maker of it chooses to call it so. The writer to the Mechanics' Magazine has completely fallen into this error: *he chooses* to call a curve he has produced, *a spiral*; and because he calls it so, has vanity enough to suppose that others will agree with him that it is so. The mandril, he states, must only be turned *half round* (rather a novel way, it will be said, of working the lathe), because when the mandril has been turned half round, the spiral returns into itself, being (he says) a *new property in the curve he has discovered*. Sublime and astounding discovery indeed!!! The mind had better be a perfect blank than imbued with error and nonsense.

The organical description of curves is a subject full of interest to those who are at all curious in such matters, particularly when instruments are resorted to for ob-

taining their loci. I do not presume to take credit to myself for knowing more about the construction and action of such instruments than others know, who have paid equal attention to the subject; but I pledge myself to this:—I never have nor ever will commit my ideas to paper on any subject whatever, that I have not previously investigated and endeavoured to make myself master of. Conscious of this, I will never succumb to the charlatan, who, by dint of sheer effrontery, assumes a position that neither his exertion nor his experience entitles him to occupy.

I will here relate a circumstance which will shew, that, even what those say whose business it is to understand these matters, is not always to be depended upon. In “Adams on Mathematical Instruments, by Jones,” we read as follows, at page 148. “Plate II, represents another kind of Elliptical Apparatus, acting upon the principle of the oval lathes; the paper is fixed upon the board A. B., the

“ pencil C. is set to the transverse diameter by sliding it on the bar D. E., and is adjusted [to the conjugate diameter by the screw G. ; by turning round the board A. B. an Ellipsis will be described by the pencil.”

Strange, however, to say (but it is no less true) this instrument will not produce an Ellipsis, nor can it be made to produce one: it is constructed on a wrong principle, altogether, to do it. It is, indeed, a most singular thing, that so eminent a Mathematical Instrument Maker, as Adams was, should so minutely describe an Instrument and the manner of working it, without ever trying whether it really would generate an Ellipsis. This mistake has been decanted from edition to edition, and I suppose will continue to be so; but I must observe that an error like this, in such a publication too, is an occurrence that fills the mind with doubt, and creates a disinclination to believe any thing that does not carry conviction or

proof with it. The curve which this Instrument really does describe on the board, is called by Landen, in his Mathematical Memoirs, the Geometrical Oval.

When I first made my Chuck I called it "The Geometric Chuck;" and, certainly, no other Chuck had been so called. In the Mechanics' Magazine of the 26th Sept. 1829, there is a letter dated "Whitby," in which the writer says, that he has "possessed Geometric Chucks and Compound Geometric Chucks, but that the idea of them came so easily, and must have occurred to many others besides himself, that they did not appear to be worth communicating." Now, I neither pretend to know what Chucks the writer of that letter may have possessed, nor how he came by them, nor whether they were or were not worth communicating to the Public; but I know that neither he nor others who have written on the same subject in the Mechanics' Magazine, could even be acquainted with the construction

of the Instrument I had so denominated, much less possess any of them. I have said before, and I repeat it now, that I have never made any particular communication of the mechanism of this Instrument, but to four gentlemen, who gave me their words and honour, under their hand-writing, that they would not divulge any part of it in any way whatever ; and Messrs. Holtzapffel have only recently become acquainted with its mechanical contrivance. The reasons are best known to the writer of the letter why he called the Chucks he possessed, by the same name I had called mine ; and as he thought so indifferently of them, and knew nothing of the construction of mine, it would have been as well if he had called them something else ; for I don't think that he will readily find any one to agree with him, that an Instrument, capable of producing such beautiful figures and correct work which the Geometric Chuck does, *was not worth submitting to the notice of the Public.* I

should imagine that the opinion, alone, of such experienced manufacturers of turning apparatus as Messrs. Holtzapffel, would set at rest any opinion he might form on such a subject, let him be who he may. It is singular that individuals should so wander out of their way merely for the sake of decrying and finding fault with the pursuits and exertions of others. I know nothing of the writer of the letter, who he is or what he is, and *I have never till now written a syllable with reference either to him or his productions.* I am not at all envious of any thing he has done; and, judging from the examples he has set before the Public, I am quite content, if he will but allow me, to “go on in my own way.” He has exhibited no specimen which I do not know the mechanical means of obtaining; as may be, possibly, shortly proved to him. Again, he says in his letter—“Now, Sir, with all this apparatus, “and the practice I have had in the line, “I should be a very dunce if I could not

“shew you as many hundred specimens as “Mr. Ibbetson has done.” The writer must recollect, that many a true word is spoken in jest. I am inclined to ask him where these hundreds of specimens of his are to be found? Such trash of assertions are as disgusting to the liberal mind, as they are discreditable to the writer. He most likely thinks that his letter is replete with good taste, information, and science, and that his discoveries will heap on his head unfading honours; others, however, are of opinion that he could not do better than place himself under the bushel he speaks of, where he says something about a candle having been burning so long, and where I will, for the present, leave him.

I had determined to pass all such absurdities by in silent contempt, and for a length of time have done so; but as I am now coming before the Public again, with some further specimens of the performance of my Chuck, and intend, also, to make

known some quite new inventions in the Turning Apparatus, I am desirous of clearing away some of the rubbish which besets my path. I have, moreover, been led into this explanation by the determination that the Instrument I have constructed shall stand before the Public on its own merits, and on the powers which I will prove, by ample specimens, it really possesses. I wish it to stand on its own legs, and not to be propped up by nonsensical assertion of its possessing powers, which it never entered my head to attempt to assign to it, well knowing that they did not come within the range of action of such an Instrument.

All instruments, having any claim to novelty, either in principle or in their working powers, should be designated in some way that will effectually establish their individual identity. From what I have already said, it is quite clear that a great deal of confusion and misunderstanding would be thereby avoided; and there

is, perhaps, no better way of doing it than by assigning to them some appropriate name. Under this feeling I denominated my Chuck "The Geometric Chuck," because it was the Geometric *Pen* which gave me the idea and led me to adopt wheels and pinions to communicate motion to different parts of it, and because the term *geometric* was strictly applicable to it on account of its various capabilities of describing lines and curves: And, besides, *there was no other Chuck, on record, so called.* I am desirous, too, of placing the Chuck before the Public as one that was invented and constructed by myself; and I therefore propose, further to distinguish it from all others, by Messrs. Holtzapffel and Co. causing to be engraved on each Chuck they make, "IBBETSON'S GEOMETRIC CHUCK, MADE BY HOLTZAPFFEL & Co." and that will also effectually secure the Amateur, who may wish to have *my Chuck*, against being supplied with any other; and will guaran-

tee the Chuck to perform all the work which the specimens set forth.

The mechanism of this Chuck is essentially different from that of any other Chuck, or Instrument of the kind, that has in any shape or way appeared before the Public. In one point, however, I am like an already published Instrument, and I will explain it, as I am desirous of rendering to others what belongs to them. When I first contrived my Chuck the *Manuel du Tourneur* was a book little known in this country, and I had never seen or heard of it. I became possessed of it afterwards, and found it contained a description of an instrument, therein called "La Machine Epicycloïde," which screwed on the nose of the mandril and is worked on the plan of wheels and pinions; but this Instrument and my Chuck were quite different, as might naturally be expected: they were put in action on altogether a different plan, and the eccentric adjustment in my Chuck

was a *right-lined* one, whilst in the Machine Epicycloïde, it was a *circular* one. The moment I saw the circular method I preferred it to the one I had adopted, finding that it afforded facilities in the construction and working of the Chuck which overbalanced the right-line movement; and I immediately altered my Chuck, and gave it the benefit of it. Since then I again resorted to the right-line movement; but I now adhere to the circular one, which I think, after all, is the best.

The powers of this Chuck infinitely exceed any thing that Suardi achieved by his Geometric Pen, or appears to have contemplated as falling within its power. I have introduced many principles into the Chuck which Suardi does not in any way advert to in his book; and some of them are of so fortuitous a nature, as to bid defiance to the art of man to produce copies by any other Chuck. I remember once making a gentleman, in

one minute, a convert to my opinion and assertion on this point, who had always most determinedly opposed them; and as this anecdote forms a link in the progress of bringing the Chuck to its present state, I will relate it. I took him to my lathe, and turned some trifling figure with the Chuck. He said: Well, and who can't do the same thing? There is no difficulty in doing that. I replied; no, there is not; but I think I shall be able to do something that will induce another opinion. I then took one of the wheels out of the Chuck, fixed it in the vice, and filed out some of its teeth. The wheel, thus mutilated, was returned to its place in the Chuck, and I again turned a figure. This figure happened to be a very curious and beautiful one, and as different from the former as two things could well be. I shewed him that by merely altering the angular position of this mutilated wheel, the curve became again changed, and so on. I then asked him what he thought

of the chances of these curves being instrumentally copied, and whether he thought any one would be able to discover the arrangements of the Chuck, under which they were produced. He observed that he was quite satisfied—that he was as fully convinced, after what he had seen, that I was right, as he had previously thought me wrong.

The powers of my Chuck have appeared before the Public in various ways, from the year 1817 to the present time. In 1820 I presented a book to the Society of Arts, on the subject of Preventing the Forgery of Bank Notes, which contained a large assortment of engravings executed by this Chuck; and the fact of its being an Instrument that accomplishes its work in the most finished style, and in the greatest imaginable degree of correctness, symmetry, and beauty, has been further established by my publishing various other specimens, and by many presents to friends of work done by it on ivory, wood, metals, and even on glass.

In August, 1829, Messrs. Holtzapffel and Co. communicated to me that they were desirous of adding the Geometric Chuck to their Catalogue of Turning Apparatus, for the use of their customers; and, in consequence, I entered into arrangements with them for their constructing it for their customers, according to the mechanical principles and arrangement of it laid down by me; and I placed in their hands, at the same time, three books of Specimens, as memoranda and explanation to them and their customers of the extent of the Powers of the Chuck, which I engaged to make known. The capabilities of the Geometric Chuck, as it is constructed by Messrs. Holtzapffel & Co. are thus defined; and the Chucks manufactured by them are guaranteed to perform all the work set forth in those three books; and I wish to press on my readers the fact, that, I never have communicated the mechanism and working powers of this Chuck to any other professional mechanic or engineer whomsoever.

I divide the Geometric Chuck, with reference to its powers, into three divisions or parts; and the three books possessed by Messrs. Holtzapffel and Co. define the curves and figures which come within the scope of each of these divisions.

The first part of the Geometric Chuck is made separately, and forms a Chuck of itself; and the specimens herewith (excepting the spirals) are confined to the capabilities and powers of this first part.

The second part can be added to the first, and the two combined possess the power of placing all the lines and curves that could be obtained from the first part alone, in every conceivable direction and eccentricity; and of combining them in all sorts of ways.

The third part consists in a further extension of the powers of the Chuck, and gives it the property of *dividing the ellipsis, and other curves, into any even number of equal parts*; and this principle of equal division of the ellipsis is the foun-

dation, also, of many very curious figures and curves.

We, all of us, have naturally a predilection in favour of our own productions, and I should certainly have been inclined to say that I was most likely to produce better work from off the Chuck I had made myself, than from any other; and this opinion would have been founded on my knowing all the weak as well as all the good parts of my Chuck: but the specimens herein inserted, of the powers of the first part, I have just now executed with one of the Chucks manufactured by Messrs. Holtzapffel and Co. and I never wish to work with a better instrument. I must, too, in common candour admit that this Chuck afforded me facilities in arranging and adjusting its different parts, in a superior manner to the one I made myself; I am, moreover, highly pleased and gratified by the beautiful style in which the Chuck is got up, both in its appearance and in its correct performance. Messrs.

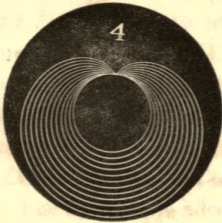
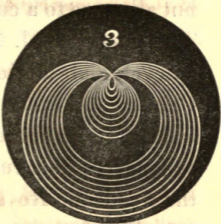
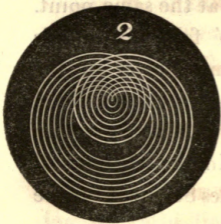
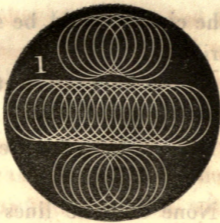
Holtzapffel and Co. have, indeed, done most ample justice both to me and the Chuck; and in proof of its capabilities I need only refer to the specimens herewith.

I now come to the Specimens themselves, which I will bring under the notice of the reader in the order of the Powers of the Geometric Chuck.

FIRST POWER.

Nos. 1, 2, 3, 4, proceed from pure epicycloidal motion.

No. 1. The circles in this piece are the result of two circular motions, of equal velocity, moving in contrary directions. It is, in its nature, of a very curious cast. Suppose as many fixed points as there are circles, to be applied to and brought in contact with the moving surface at the same time; by moving the mandril round



once, all the circles would be simultaneously described.

No. 2. All the lines intersect at different points.

No. 3. All the lines intersect at one point.

No. 4. None of these lines intersect, but all come to a cuspis at the same point. The curve of M. Carré falls within this epicycloidal motion and power of the Chuck; and every line in specimen No. 4 is M. Carré's curve. (M. Carré gives an account of this curve in the Memoirs of the Academie Royale des Sciences for the year 1705.)

SECOND POWER.

Under this power the Geometric Chuck is a complete Oval Chuck, with extensive means of angular adjustment. It will describe every variety of ellipsis, from the right line to the circle, and from the smallest size to the largest that the radius of the lathe will admit of. It places the ellipsis in every possible angular direction; and this gives it the power of forming the right line, which proceeds from the elliptical motion, into any division and number of rays.

Nos. 5, 6, 7, 8, 9, 10, 11, 12, are all specimens of elliptical motion.

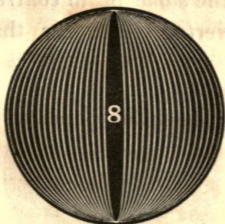
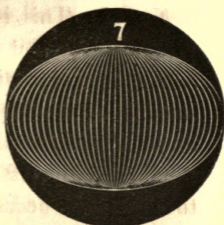
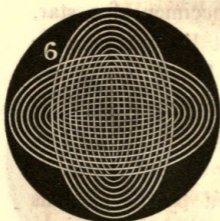
No. 5. The three lines in the centre are parallel ellipses. The two circular motions are in contrary directions. When the same motions are in the same direction

the external figure of two loops inwards is produced; but this figure of two loops inwards belongs properly to the third power.

No. 6. Consists of parallel ellipses commencing from the right line, placed at *right angles*; and the Chuck can also place them at all angles whatever.

No. 7. Consists of a series of ellipses. The same diameter is the conjugate to some and the transverse to others, and is of the same length as the right line in the centre. This specimen commences with the right line and proceeds to the circle; and from the circle to other ellipses. It comprehends *one* right line, *one* perfect circle, and *all* the remaining lines are true ellipses.

No. 8. Consists of a number of ellipses on the same transverse diameter. The conjugate is continually increasing, whilst the transverse remains the same, till, at the exterior line, they become equal to each other, and, consequently, that line is a circle.




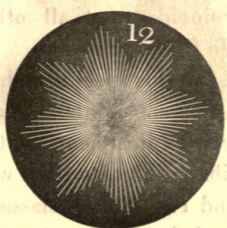
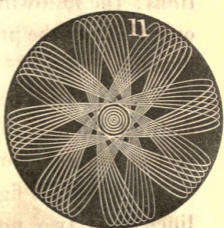
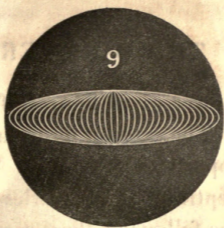
No. 9. A series of ellipses proceeding from the right line.

No. 10. A series of ellipses regularly increasing in size.

No. 11. A series of ellipses arranged in angular sections. This may be diversified in every imaginable way.

No. 12. This is a specimen of a star, produced by the right line proceeding from elliptical motion. The figure of one loop outwards does not come within the limits of this combination of circular motion; and this is curious with reference to the effect occasioned by the motions being in the *same* or in *contrary directions*, adverted to under the Fourth Power.





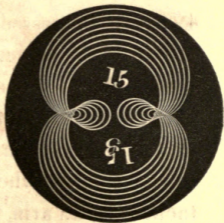
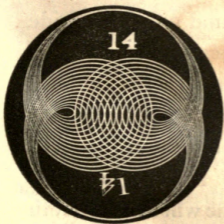
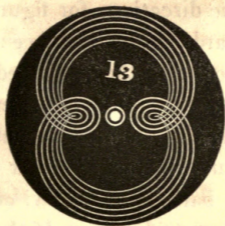
THIRD POWER.

This power gives figures of two loops inwards. The exterior figure in No. 5 belongs properly to this power. The curves are susceptible of numberless combinations: the following three examples shew only three of the principles on which they depend.

No. 13. In this specimen the lines are distinct from each other; and all intersect at different points.

No. 14. This figure consists of distinct lines. At two points of the curve they become coincident, at all other points they recede from each other.

No. 15. In this specimen the lines intersect at different points, and depend on quite different adjustments of the Chuck and describing point, to those which gave Nos. 13 and 14. Suardi classes all these curves, consisting of two loops inwards,



with *elliptical motion*; which, certainly, appears to be their proper association, because the velocities of two circular motions, which give ellipses, are as *two to one* in *contrary* directions, and as *two to one* in the *same* direction, for figures of two loops inwards. For instance: Suppose two rings of brass, the outside edge of one and the inside edge of the other to be of equal diameters, and each cut into 96 teeth. And suppose another circle of brass, just half the diameter, cut into 48 teeth on its outside edge. If the wheel of 48 teeth be passed round on the outside of one of the larger wheels, and round on the inside of the other, it will, in both cases, have turned twice round on its own axis whilst it made the circuit of the teeth in either large wheel. A fixed point attached, by an arm, to the wheel of 48 teeth so that it extends beyond the teeth, will in one case describe an ellipsis, and in the other, the figure of two loops inwards. The figure of *two loops outwards* does not

come within the limits of this combination of circular motion. This is curious with reference to the effect occasioned by the motions being in the same, or in contrary directions, adverted to in the next power.

FOURTH POWER.

This power comprehends triangles and figures of three loops inwards and of three loops outwards. It is particularly worthy of remark, that, in the figures of three loops and upwards the only alteration that is occasioned by the circular motion being in the same direction or in contrary directions, is that the loops turn inwards or outwards. Suppose that, instead of the wheel of 48 teeth just before mentioned, a wheel of 32 teeth be applied, in a similar manner, to the two larger wheels, the

number of loops will be three, because the wheel of 32 teeth will turn three times round in making one circuit of each of the larger wheels; in one case the loops will turn inwards, in the other, outwards.

No. 16. Is a combination of loops inwards and of loops outwards.

No. 17. The circular motions are in contrary directions, producing triangles, &c.

No. 18. The same as the last number; but comprehends four different adjustments of the Chuck.

No. 19. A specimen of three loops outwards, arranged by an adjustment of the Chuck.

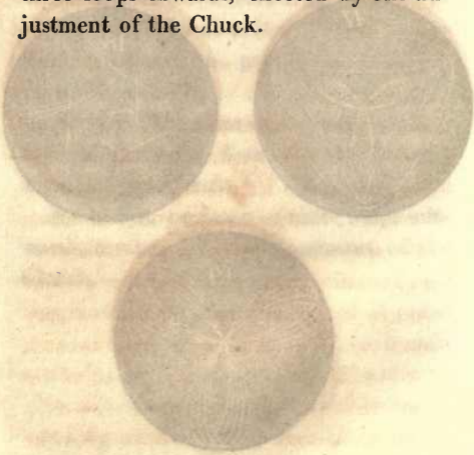


No. 20. Consists of three different loops outwards.

No. 21. Consists of a series of three loops outwards, arranged by a particular adjustment in the Chuck.

No. 22. Consists of three distinct arrangements of three loops outwards.

No. 23. Consists of a combination of three loops inwards, effected by one adjustment of the Chuck.





FIFTH POWER.

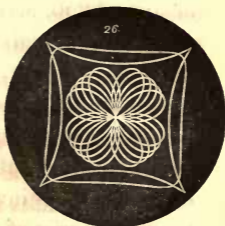
This power comprehends squares, and figures of four loops inwards, and of four loops outwards. If, instead of the wheels of 48 and 32 teeth, mentioned under the third and fourth powers, a wheel of 24 teeth is employed, its combination with one of the large wheels will give four loops outwards, and with the other large wheel, four loops inwards.

No. 24. Consists of a combination of a four looped figure outwards, with a four looped figure inwards.

No. 25. Results from a combination of figures of four loops inwards.

No. 26. A specimen of squares produced by the combination of motion which gives four loops outwards. The centre figure consists of a series of four loops outwards.

No. 27. Consists of a series of four looped figures outwards, decreasing gradually in size from the outside to the centre figure.



SIXTH POWER.

Under this power of the Chuck looped and festooned figures are obtained; and every description of epicycloidal work, from six loops to 256 consecutive loops in the same circle. Most of the intermediate *even* numbers, between the extremes of six and 256, may be obtained; but this power applies only to *even* numbers.

No. 28. The centre of this specimen consists of plain concentric circles. The next figure, eccentric to these, is a series of sixteen loops inwards. And the outside figure is a series of sixteen loops outwards.



SEVENTH POWER.

Under this power The Geometric Chuck is a complete Eccentric Chuck, with a circular Eccentric adjustment to the extent of 96 divisions; and all the work that can be accomplished with the Eccentric, it executes in the most finished style.

No. 29. The outside shell pattern is pure eccentric work. The centre is a star executed by the elliptical motion which gives the right line.

No. 30. Is Eccentric circular work throughout.

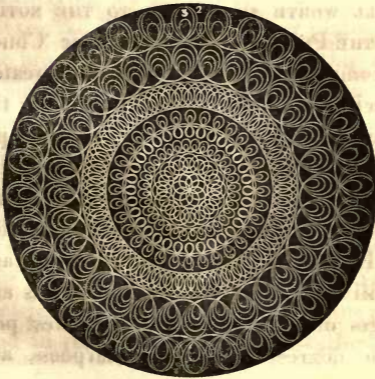


EIGHTH POWER.

This power of The Geometric Chuck consists in its capability of combining all its powers and every kind of work it can accomplish, into one pattern, in any order of arrangement the workman pleases.

No. 31. The centre is a star of elliptical motion right-line work. Eccentric to that is a series of loops inwards and loops outwards; and the next two eccentric circles of patterns consist of epicycloidal loops outwards.

No. 32. This specimen is a mixture of pure eccentric with epicycloidal work. The centre and the pattern next to it, is eccentric work. The next is epicycloidal loops outwards. Eccentric to that is a combination of the loop inwards with two loops outwards, one within the other. Next to that is a series of circles obtained



by the eccentric chuck adjustment. The two circular patterns exterior to that, consist of the epicycloidal loop outwards.

These Specimens must fully convince the Turner of the very extended capabilities of The Geometric Chuck ; and I am quite satisfied that every one who sees them will agree with me, that, THE INSTRUMENT THAT COULD WORK THEM OUT IS WELL WORTH SUBMITTING TO THE NOTICE OF THE PUBLIC. The Geometric Chuck accomplishes its work with the greatest precision and correctness, producing the finest hair lines imaginable in perfect parallelism ; whilst, on the other hand, it is capable of cutting its work as deep in, below the surface, as can be effected either in Eccentric Turning, or in Cutting and Drill work, bringing up the points and edges of the figures to the greatest possible degree of fineness, sharpness, and

beauty: it, moreover, perfects its work with the lathe turning round as fast as the workman pleases, and as it is made to do in common turning.

By means of a slight wooden frame to receive the lathe head, which will stand on a table, the mandril may be placed in a vertical position, and the chuck worked in a horizontal one, by hand motion communicated to the mandril by a band. Under this arrangement the Geometric Chuck becomes an apparatus capable of transferring all its power of delineating curves, &c. to steel and copper plates, by the process of etching; and in this way it may be worked by those who know nothing of Turning, or by those who may prefer etching on plates to that art.

I will now conclude this paper by assuring my friends and Amateur Turners, generally, that, I shall be happy in affording any explanation regarding the Geometric Chuck, they may require from me; and in receiving all communications on

the subject of it, addressed to me, No. 10, John Street, Adelphi, which I shall take pleasure in answering.

JOHN HOLT IBBETSON.

November, 1833.

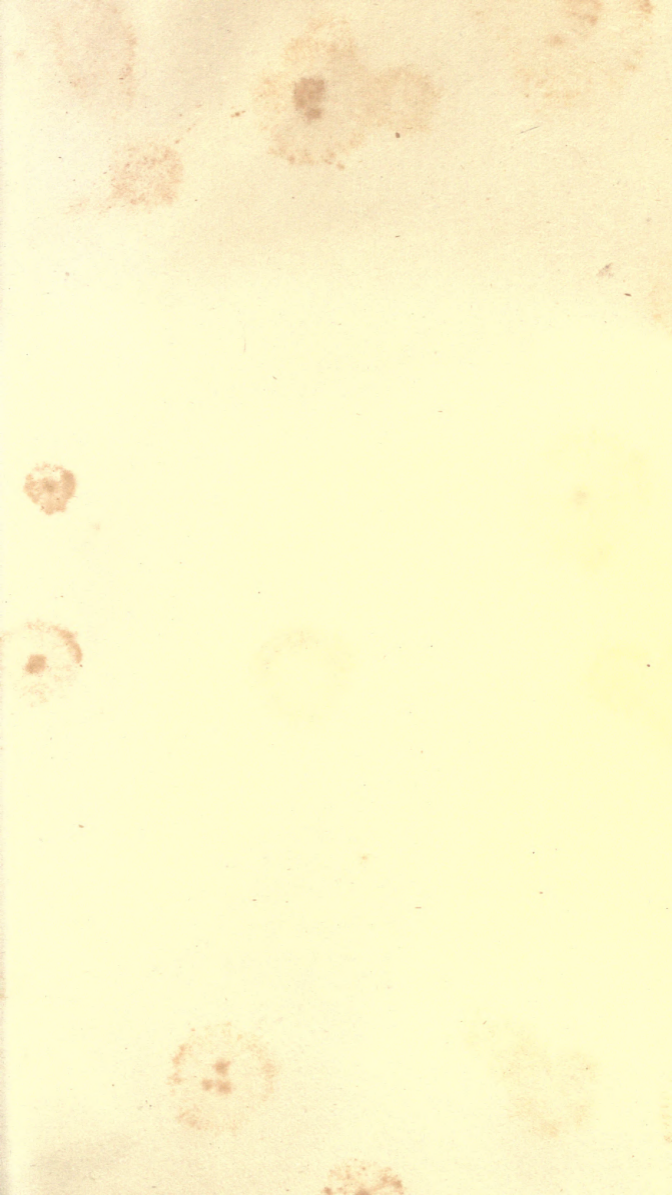
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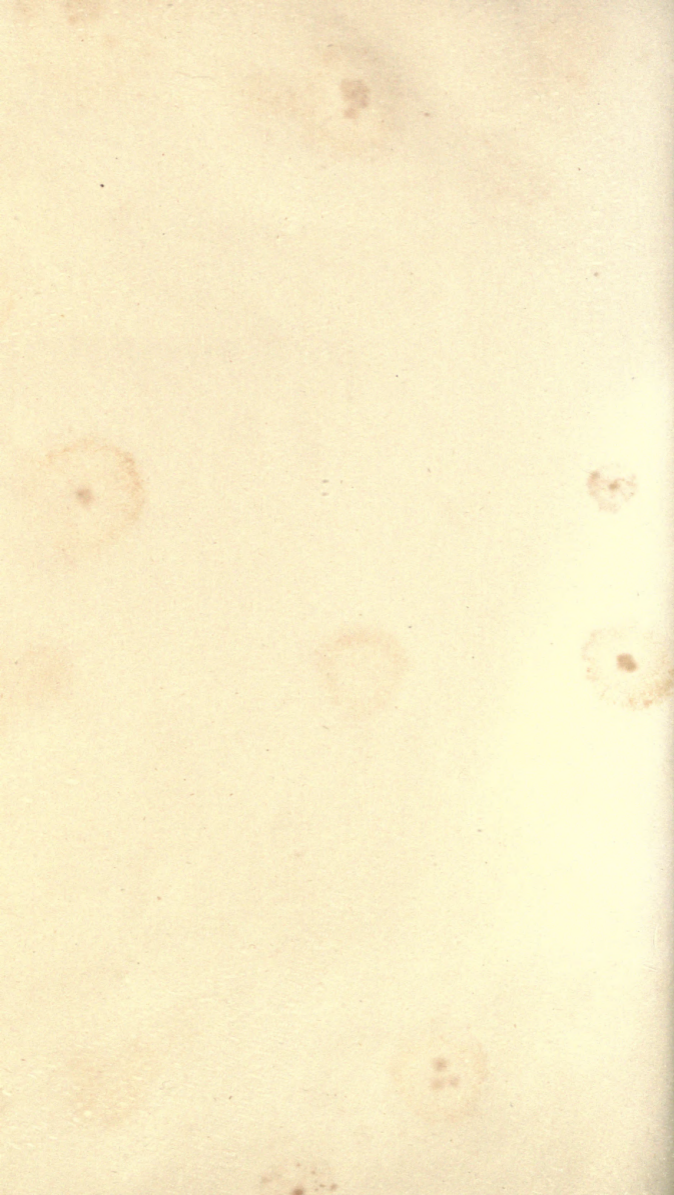
I will again observe that The Geometric Chuck was not, in any way, nor any part of its mechanism employed in the execution of the Spirals inserted at page 4, the production of them depends on a combination of motion which cannot be assigned to that Chuck, nor to any chuck whatever which is attached to and works round with the mandril of the lathe. The other specimens are all the production of what I [have before explained as coming

under the powers of the *First part of The Chuck*.

I am also going to publish my Collection of Specimens illustrative of the *Second and Third parts of The Geometric Chuck*.

under the power of the first part of
The Church of England
I am also going to publish an Collec-
tion of specimens illustrative of the 2^d
and third parts of The Chronicle
Church.







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