# SCIENCE

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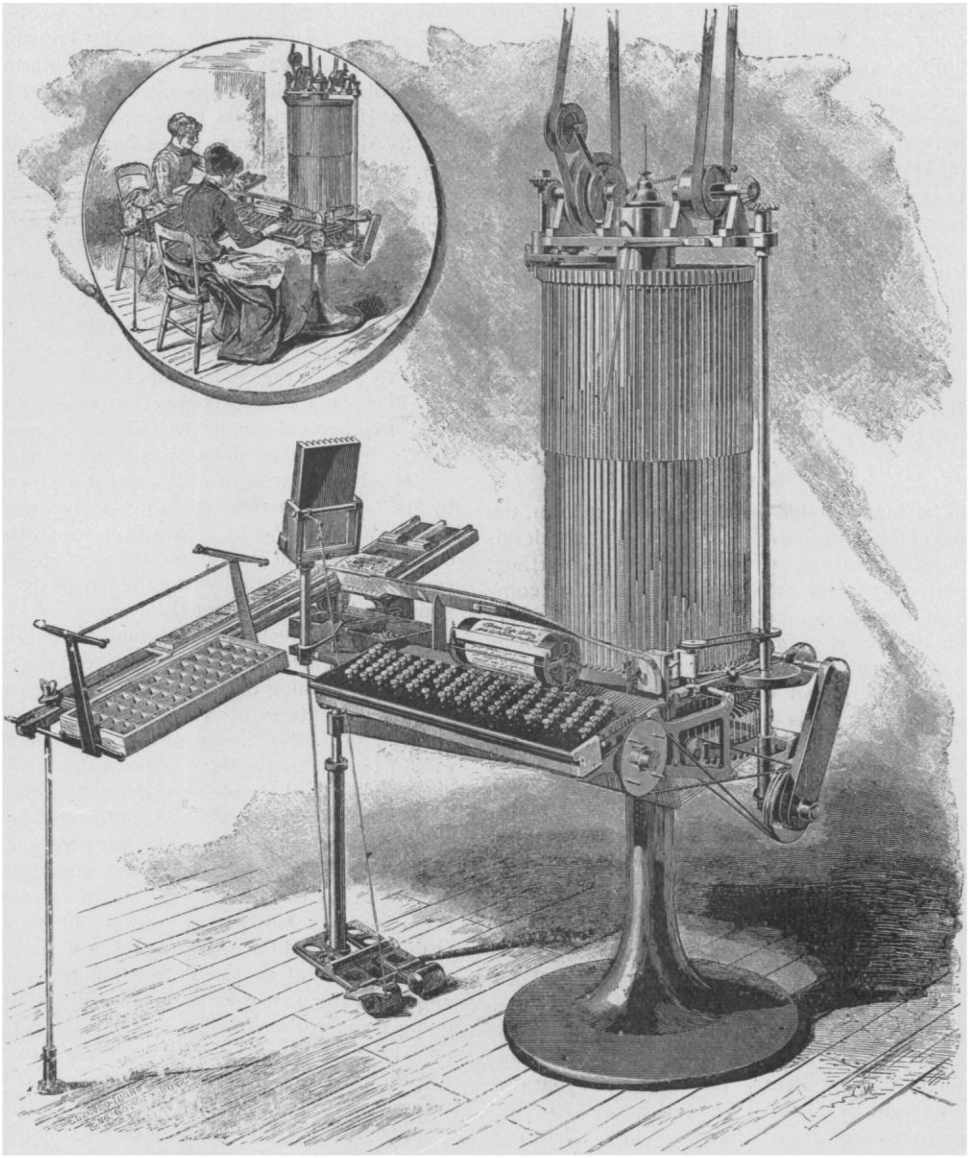
## THE THORNE TYPE-SETTING MACHINE.

IT is nearly ten years since Mr. Joseph Thorne invented the type-setting machine bearing his name. This machine, as now manufactured by the Thorne Machine Company of Hartford, Conn., modified by the improvements suggested during several years' actual use in type setting and distributing, is shown in the accompanying engraving. This machine is now doing good service in book and newspaper offices in this country and Europe. Its working, as seen by a representative of *Science* a few days ago in an office in this city, where several of them have been in use some years, leaves little to be desired in the way of rapid and accurate distribution and composition.

The machine consists of two iron cylinders, mounted vertically one above the other upon the same axis. The upper one of these two is the distributing-cylinder, and the lower one the setting-cylinder. The types, before distribution, are arranged in vertical channels in the upper cylinder, where they rest upon their sides. The distributing-cylinder revolves with an intermittent motion, thereby causing its channels at each step to coincide with and rest directly over similar channels in the setting-cylinder, which remains stationary.

Ordinary fonts of type are used, but each character has distinctively arranged notches, with which correspond wards at the upper end of each channel in the setting-cylinder; so that a type of a given character can only fall into its own proper groove in the latter. In these grooves the types rest on a bottom plate. The types in the distributing-cylinder are in the order they come from the forms; but by the step-like motion of the cylinder, and the action of the wards in the channels of the setting-cylinder, the types are automatically sorted, so that each channel of the stationary cylinder contains only types of the same kind.



THE THORNE TYPE SETTING AND DISTRIBUTING MACHINE.

Composing is effected from a keyboard like that of a type-writer, on a somewhat larger scale. By the depression of any key, through an arrangement of levers and rods, the lowest type in the corresponding groove of the composing-cylinder is pushed radially outwards on to a very rapidly revolving disk, which carries it to an opening in the stationary guard surrounding the disk, and delivers it upon a moving belt, on which the types are carried in their proper order to a revolving lifter, which raises them in succession into a long setting-stick in front of the operator, terminating in a justifying-stick at the upper end of an inclined channel or galley.

In justifying, a section of the composed line of type is drawn to the mouth of the justifying-stick, and is justified with spaces taken from a case containing channels for the different spaces and the hyphen, the lowest of which are pushed partially out by ejectors worked with a treadle.

The lines of type, when ready for distribution, are inserted in the grooves of the distributing-cylinder from a special galley by means of a slide, with which a whole line at a time is pushed bodily into a groove.

It is claimed that this machine will distribute and set at the rate of six thousand ems per hour, doing, with three persons, the work of six men working in the ordinary way. Considering the purpose for which the machine is intended, the construction is simple, and there appears to be no difficulty or hitch in the working.

It should be remarked, that, by manipulating the keys in one direction only, several keys may be touched simultaneously without risk of the characters becoming transposed. In working the opposite way, each key must be touched separately. The machine is driven from a shaft by two small belts. One belt transmits motion to the revolving disk below the type-setting cylinder and to the type-lifter; while the other belt, by means of a tightening-pulley and ratchet-gear, produces the step-by-step motion of the distributing-cylinder.

## THE STEAM-ENGINE, ITS PRINCIPLES, ITS DEVELOPMENT, ITS PRESENT CONDITION, AND ITS FUTURE PERFECTION.[1]

IN this lecture will be found, stated in a very compact form, the fundamental principles of the steam-engine, and a history of its development. Some of the statements at first glance seem very startling, but they are so supported by the records that surprise is overcome by conviction. One of these statements is, that "for a generation after James Watt's death the art of producing power from fuel by the intervention of a steam-engine retrograded ; so that less power was usually obtained from a pound of coal consumed than had been obtained by the use of methods invented and fully explained by James Watt."

This is illustrated by the following: "Founded upon these principles, the steam-engines which were made by Mr. Watt and his associates and pupils before 1830, produced a horse-power with less than two pounds of coal an hour. These engines are known as the Cornish pumping-engines; and, if you will look into the history of these machines, you will find them reported as doing more than a 'hundred millions of duty,' which is a technical phrase, intended to express the fact that a hundred million pounds of water were lifted a foot high for a hundredweight of coal consumed. Turning that into horse-power, it means about two pounds of coal an hour a horse-power. This result was produced by cutting off steam in the cylinders at one-sixth or one-eighth of the stroke, and allowing it to expand six or eight times. The engines of that day, of course, were very imperfectly constructed, and great losses occurred from leaking pistons and from defective boilers; but, notwithstanding that loss, the result was equal to two pounds of coal an hour a horse-power."

In a note on the subject, reference is made to the authorities showing the "duty" of Cornish engines before 1830 to be more than a "hundred millions," or, what is the same thing, a horse-power with less than two pounds of coal an hour. Perhaps the contrast between the engines did not attract much attention, because the Cornish engine's economy was always stated in terms of weight lifted, whereas economy in other engines was stated in terms of coal an hour a horse-power.

The lecturer, on this subject, makes this statement: "When steamships came to be built in England in 1840, and afterwards, notwithstanding the fact that high expansion with great economy was in constant operation on James Watt's Cornish engines and on Wolff's compound engines, no attempt was made to work the marine engines under high expansion; and as a consequence all the earlier steamships, for more than thirty years, were running at a cost of at least four pounds of coal an hour a horse-power; while, at the same time, compound engines had been well known for a generation, and were in actual use, making a horse-power for about two pounds of coal an hour. The Cunard Company, however, were making money in their business; and they considered that a sufficient answer to any suggestion that their fuel account was enormously expensive."

It is certainly a very remarkable fact that for a generation steamship-owners did not use high expansion on their ship-engines, when it had been in use on shore for thirty years, both in single and in compound engines.

The fact, perhaps, is not generally known, as stated by the lecturer, that "in 1825 several steamboats on the North River worked by double expansion engines, were built by Mr. Allaire in this city, — the 'Henry Eckford' for one; and the 'Sun,' which made the trip to Albany in about twelve hours, for another. At that time the subject was not well enough understood, and economy in fuel was not considered of so much consequence as the first cost of construction, and these engines were not largely reproduced. One of these double expansion engines made in England was brought to this country in 1830, and for many years was used in the oil-factory of Judd's Sons, giving very economical results. When they needed more power, a half-stroke cut-off engine was made for that factory and added to the other, but its results were vastly inferior to that of the compound engine."

The explanation is probably the true one, that the greater original cost of compound engines was of more consequence in those days than subsequent economy; and so the compound engines were neglected and lost sight of, till attention was again called to them by Mr. Jameson in 1860, when it was necessary to save a steamship company on the Pacific Ocean from ruin, because of the high cost of fuel there; and he adopted the very obvious remedy of reducing coal-consumption one-half by the use of the old compound engines, which had been disregarded for years.

One very interesting fact brought prominently forward is thus stated: "The astonishing fact exists to-day, that, on an average, every steamboat running on the waters of New York is wasting certainly not less than fifteen per cent of all the fuel consumed, by leaking through the valves; and almost any one of them will run at the rate of four or five miles an hour without ever opening the steam-valves at all, and simply by the leakage through those valves; and yet that leakage is only the difference between what leaks in through the steam-valves and what leaks out through the exhaust-valves. Some of these steamboat-engines are so constructed that the engineer can 'unhook' the steam-valves without unhooking the exhaust-valves; so that, as the engine moves, the exhaust-valves are working, and the steam-valves are shut. That is particularly true of some of the steamboat-engines on the New Haven line; and when the pilot rings the slow-bell, as he frequently must do in going through the crowded thoroughfares, the engineer simply unhooks the steam-valves and lets them drop shut, and the steamboat moves on at a fair rate of speed from the leakage alone; whereas, if those steam-valves were tight, the engine would be stopped in half a revolution. This tremendous loss is not appreciated, because it is a case of internal hemorrhage, and no visible sign appears. The steam leaks into the condenser, and is pumped overboard with the condensing water; but, as far as I have observed, it has not raised the temperature of Long Island Sound at all, and therefore has not produced any effect on climate; and there is no advantage gained by that tremendous expenditure. The remedy, of course, is very simple, and that is to go back to James Watt, which would mean at least fifteen per cent of saving in the coal-bins."

A note very fully explains how this loss occurs, and why it escapes observation. All the earlier steamboats used the single puppet-valves of James Watt, which are necessarily perfectly tight

[1] Abstract of a lecture delivered by Edward N. Dickerson, LL.D., before the Electric Club of New York, Jan. 17, 1889.