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Fig. 1.

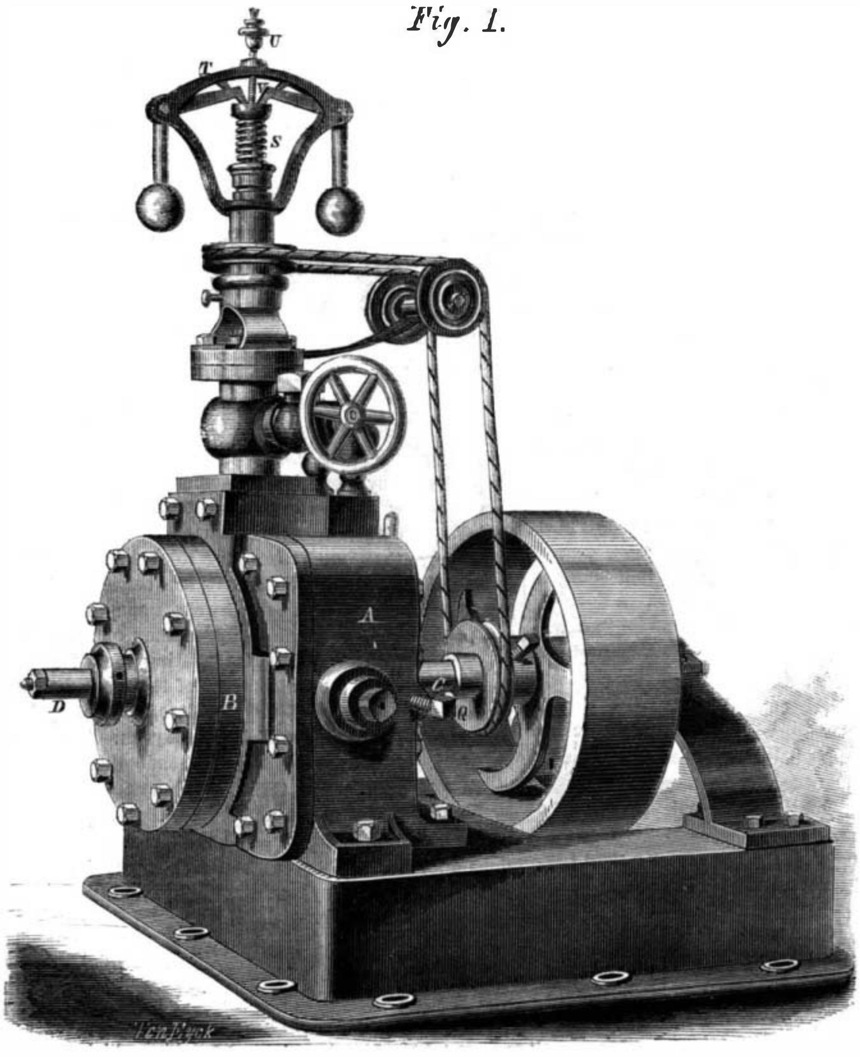


Fig. 2

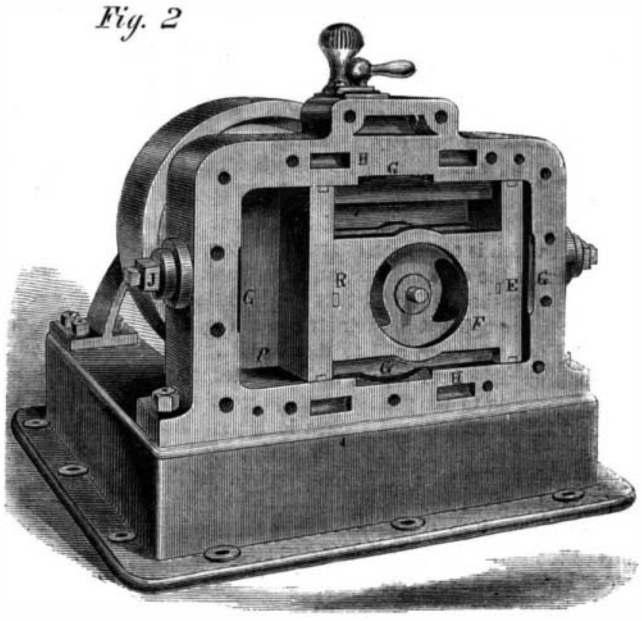


Fig. 4

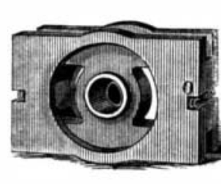
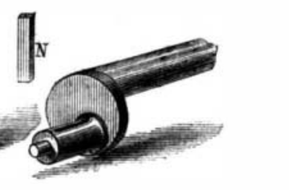
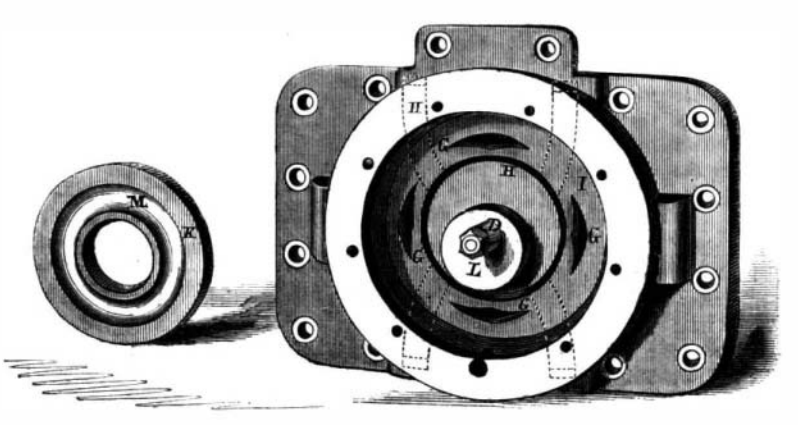


Fig. 5



ROOT'S NOVEL RECIPROCATING STEAM ENGINE.

Fig. 3.



On page 212, Vol. IX. (new series), of the Scientific American, we published an article entitled "A Novel Steam Engine," wherein is described a new and useful steam engine lately invented by Mr. J. B. Root, of this city; it is asserted in the article mentioned that this engine, illustrations of which are given herewith, has a combined piston area which is equal to that in an ordinary engine of 22-horse power, under the same conditions of steam pressure and piston speed. It is possible that some persons have obtained a false impression from this assertion which was not intended to be conveyed by us. There are two pistons in this engine, the combined area of which is equal to 32½ inches; the dimensions of a single one being 6½ inches long by 2½ inches wide; these pistons act in unison, so that the measure of the power is the area of the pistons multiplied by the pressure of steam and speed per minute. With this explanation, which will be amplified further along in our article, let us commence our detailed examination of the engine itself, which is the very essence of simplicity.

In Figure 1 we have a perspective view from the valve chest side. In this figure, A is the case, or what may be called the cylinder, and B is the valve chest; C is the main shaft, and D is the valve stem, which has a rotary motion; the other external parts are not peculiar with the exception of the governor, which is. In Fig. 2 we have given a side elevation of the steam cylinder, A, with the valve face removed. This valve and face is shown in Fig. 3, while the piston and its crank shaft are depicted in Figs. 4 and 5; thus the main parts, constituting nearly the whole engine, are presented in this number.

In Fig. 2, E is one piston and F is the other; they are both right-angled and parallelograms in shape; the inner one, F, is hung directly on the crank pin, and slides up and down in the other one; it will thus be seen that one piston has a vertical motion while the other works horizontally. Steam is admitted to both of these pistons at once through the openings in the valve face, and clearance is given in the cylinder, as shown at G; the openings, H, are for the four exhausts. These exhaust and steam passages are shown clearly in Fig. 3; in it the valve face is marked I and the steam ports G; the exhaust, H. These latter, where they issue from the annular passage common to the whole are shown in dotted lines; from these the steam passes into the cylinder which is cored out all around, so that the exhaust steam may be taken out at either of the two points closed by the screw plugs shown in the engravings. The valve itself is a simple metallic ring, shown isolated at K, fig. 3; the central orifice fits the eccentric L, and this eccentric is driven by the stud on the end of the crank pin, so that when the shaft is turned around, the valve has an epycycloidial movement over the valve face; opening and closing each port alternately in its passage. This is a very beautiful movement and permits the lead on each piston to be adjusted to any required degree of nicety. The hollow M, in the under side of the valve, is the exhaust passage.

The packing of these pistons is a very simple point, and yet with all its simplicity it is perfectly performed. We are assured that no leakage whatever is visible in the engine when at work. In Fig. 4, where the piston is shown separately, the packing is also shown, and requires but little explanation; the mechanical reader can see that the steel bar N, fits in the slot, O, and is forced out by the spiral springs placed therein. There is also a side plate, which is shown at P, in fig. 2; this is forced inward by wedges behind it; the wedges themselves being attached to a frame which is worked by the set-screw, Q. This plate in connection with the packing, R, makes the pistons perfectly steam-tight against the cylinder cover, and yet easy working in all of their parts.

In Figures 4 and 5, the inner piston, or one on the crank-pin which is of the same area, however, on its steam face as the external one, and the crank shaft, are shown detached. The pistons waste little or no steam at the completion of their stroke, as they work snugly up to each other, and to the cylinder. There are no projecting bolt heads, and the steam ports open directly on to the pistons, thus preventing the waste of steam which occurs when long ports have to be filled with live steam at every stroke. It is difficult to conceive of a more compact or efficient steam engine than this in the same space. There are no "centers" or "dead-points" to the crank, as each piston moves the crank alternately through one-half of its circle, consequently there is never that mechanical loss which is experienced in ordinary single engines between the times of shutting off the steam during one stroke and opening the valve for another. In this engine, we have always nearly an equal pressure upon the crank, depending, however, wholly upon the distance to which the live steam follows before it is shut off. The speed of the piston in feet is not great, as the stroke is so short, but the engines run at an average rate of 150 revolutions per minute,

One of these engines is now working a pile-driver in this city. It raises 2,200 pounds (or one tun) 36 feet in 6 seconds; taking 33,000 pounds raised one foot in a minute as a standard horse-power, the engine in question develops over 22 horse-power; for 33,000 pounds raised one foot in one minute are equal to 550 pounds raised one foot in a second; and 2,200 pounds raised 36 feet in 6 seconds are equivalent to 360 pounds in one second. One-fifth of 550=110 pounds, and three-fifths=330 pounds, or three-fifths of a horse-power for every foot of distance. The whole distance being 36 feet, it is easy to see that by this rule this engine has a power exceeding 22 horses minus friction. The pistons are 56 inches area by 5 inches stroke.

The governor of this engine is peculiar and constructed on proper principles, as it is obvious that if the arms of the governor hang vertically, and are formed at right angles with each other, the movements are positive, and no loss is experienced as is the case with the old-fashioned regulator, where the balls move perceptibly before the throttle valve is changed.

This governor runs at a high speed, and has a short screw-rod at the top which connects with the valve in the chest below; there is also another nut for altering the tension of the spiral spring, S. These nuts enable the speed of the engine to be easily controlled; for by running the nut, U, up or down on the rod, V, the spring is relaxed, or set up so that more centrifugal force is required to affect the balls, and the speed of the engine increases to make up this force; when the spring is relaxed, the reverse occurs. The governor-valve, in the chest before-spoken of, is also changed in its position in a manner not necessary to describe at present.

This engine was patented through the Scientific American Patent Agency in Sept. 1863, by J. B. Root, of New York; a patent is now pending on the governor.

These engines are made by Benjamin, Root & Co., at Jackson Iron Works, 167 East 28th street, New York, and they can be seen in operation at 155 Duane street, where all further information may be obtained.

The Invention of the Card-making Machine.

WHITTEMORE—1797.

We do not rank the card-setting machine among "the most important American discoveries and inventions," and yet we cannot omit it from our account, for it is generally regarded as coming nearest in its movements to the acts of intelligence of any piece of mechanism that has ever been devised. Two delicate needles dart forward and punch the leather; the wire is drawn in from the reel and cut off at the proper length; a fork sweeps forward and bends the wire into the form of the letter U; a pair of pincers seize the bent wire and thrust it deftly into the holes prepared for it; and finally a press rises on the opposite side of the leather and bends the wire at the proper angle to make a perfect card. All of these varied movements go on automatically and continuously, and if a crooked or imperfect tooth is made, the machine instantly stops of its own accord. This last, the stop-motion, is the only material improvement made in the machine from the form in which it was originally devised by its first inventor.

A few years since a manufacturer of these machines, a Mr. Earle, of Leicester, Mass., had a very fine machine on exhibition at the Mechanics' Fair in Boston, when the Rev. Mr. Pierpont came along with a friend and stopped to look at it.

"Here," Mr. Pierpont remarked, "is the machine that more than any other impresses me with the feeling that it must be endowed with thought."

At that time the stop-motion had not been invented, and great efforts were being made to devise it. With this in his mind, Mr. Earle replied:—

"Yes, all it needs to be a perfect sentient being is a conscience."

In the course of that season the stop-motion was perfected, and when Mr. Pierpont passed through the next Fair, he reminded Mr. Earle of the previous conversation. Mr. Earle replied:—

"The defect is now remedied. The machine has got a conscience, and it does just what a conscience ought to do—it stops at the first wrong step."

We have heard a gentleman speak repeatedly of visiting a large card manufactory in New Jersey. While he was talking with the proprietor a man came out of the mill and went off to his house. Some 15 minutes afterward our friend went into the factory, and found a very large room full of machines in active operation, with not a single person in the building to attend to them!

The card-setting machine was invented by Amos Whittemore, who was born at Cambridge, Mass., April 19th, 1759. His father was a farmer, but Amos early showed a fondness for mechanical pursuits, and, on arriving at the proper age, he became an apprentice to a gunsmith. Long before the expiration of his apprenticeship his master confessed that he could teach him no more, and advised him to set up business for himself. Some years later he became interested, with his brother William and five others, in the manufacture of cotton and wool cards, conducting their business in Boston, under the firm of Giles, Richards & Co., and supplying nearly all the cards then used in the country. Amos attended to the mechanical department.

It soon occurred to him that if a machine could be devised to perform the operations, it would supersede a vast amount of hand-labor, and would be of great value. After long and patient meditation the plan had so far taken shape in his own mind that he was ready to communicate his idea to his brother William. This brother encouraged and assisted him to the utmost, and a chamber was set apart for the construction of a model. Here the enthusiastic inventor devoted himself to the perfecting and embodying of his plans with such zeal as frequently to neglect his food and sleep. In the course of three months the machine was so far advanced as to punch the leather, and to cut, bend, and insert the wire; but the bending of the teeth at the proper angle completely baffled his genius, and he began to despair of success. While his mind was on the stretch to overcome the obstacle, one night during his sleep the idea was presented to him in a dream. Rising early in the morning he hastened to his workshop, and, before he broke his fast, he was able to announce to his brother that the machine was perfected.

Steps were immediately taken to secure a patent, and this was obtained on the 2d of June, 1797. The brothers determined also that a patent should be taken out in England, and that the inventor should visit that country for the purpose. At that time but two vessels traded between Boston and London, and in one of these, the *Minerva*, Mr. Whittemore sailed in the spring of 1799. He was absent a year, his return voyage occupying 59 days.

On the 3d of March, 1809, the patent was extended by a unanimous vote of Congress, for 14 years from the expiration of the first term. In 1812, the Legislature of New York passed an act incorporating the "New York Manufacturing Company," with a capital of $800,000, of which $300,000 was directed to be employed in the manufacture of cotton and wool cards. On the 20th of July, 1812, this company bought of the Messrs. Whittemore their patent right and entire machinery for $150,000. In 1818, the company sold all of its manufacturing property to Samuel Whittemore, a brother of the inventor, who is reputed to have made a very large fortune in the manufacture of cotton and wool cards.

After the sale of his interest in his patent, Amos Whittemore purchased a pleasant estate in West Cambridge, and retired from active business. Here, after a pure and blameless life, he died in 1828, at the age of 69 years.

MISCELLANEOUS SUMMARY.

PROFITS OF TRANSATLANTIC STEAMSHIPS.—Very few people have any idea of the enormous profits realized by the screw steamship companies in the Atlantic trade. Notwithstanding its numerous losses (averaging more than one a year), the Montreal Steamship Company has made all those who are concerned in it independently rich. The underwriters may have suffered somewhat, although the premiums on a weekly line must go far towards compensating them for one loss, even a total loss, at the end of the year; but as regards the owners and stockholders, the enterprise has been profitable beyond all expectation. The constantly recurring accidents have made the line unpopular in Canada, but there is such a constant pressure of freight both out and home, that the vessels are always full. There are two other screw steamship lines in successful operation between Great Britain and the St. Lawrence, and the merchants of Montreal are starting a fourth.

HOTEL ELEVATORS.—It appears from the proceedings of the Institute of British Architects, that the principle of hydraulic lifts is being successfully applied in the place of steam-power in many cases. The Brighton Hotel contains a machine which, moved by the weight of water with a sufficient head, raises the visitors and luggage from the lower story to the upper, which is seventy-seven feet from the ground. The elevator in the Fifth-avenue Hotel is operated by steam. At the Grand Hotel in Paris, the elevators are put in motion by means of Lenoir's gas-engine, which is said to perform its office with economy and cleanliness, and requires very little attention.

HUMBUG GOLD STORIES.—A correspondent of the Chicago *Tribune* has seen a reliable gentleman just from Idaho, and he says the story about that fifteen millions in gold awaiting transportation is all bosh; and adds that there is not gold enough dug out in the whole territory to pay the expense of getting the emigrants back home, and that all the big stories telegraphed from St. Paul and New York, just before spring opens, are the fabrications of speculators to get up a rush of deluded emigrants.

THE Portland Sugar House was established in 1845. From small beginnings the business has year by year increased, until this is now the largest molasses house in the country, with a capacity of three hundred barrels of sugar daily, giving employment, when in active operation, to over three hundred men, with a monthly pay-roll of $7,000. During the last year 34,582 casks of molasses were consumed, and the sales of sugar amounted to 53,730 barrels, or 13,611,855 lbs.