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IMPROVED AUTOMATIC SMALL STEAM ENGINES.

We have from time to time, during the last few years, suggested that if some one should produce a really good small engine at a moderate cost, the sales would amply repay the outlay. Our suggestions have been responded to from every part of the country, and we are enabled, in this number, to present to our readers some fine illustrations of an engine which, although small apparently, possesses all the features of a first class motor. It is made self-acting as far as possible.

Fig. 1 is a vertical central section of one of these engines and its boiler. The latter is of the vertical tubular type with the fire box eccentric to the outer shell; from this fire box the products of combustion pass up through tubes, as shown by the arrows, into a space beneath the feed water heater, which is above the boiler, and thence through drop tubes and up the smoke stack, as shown in Fig. 2. Fig. 2 is also a vertical section, cut perpendicularly to the axis of the crank shaft and at right angles to the plane of Fig. 1. There are air spaces in the base which prevent the radiant heat from burning the floor, on which the machine may be placed with no other foundation. The engine is of the slide valve type, the cylinder being located in a large exhaust jacket, and that again in the feed water heater. The exhaust steam, therefore, not only prevents radiation and condensation in the cylinder, but also heats the feed water. There are two pipes for conveying the exhaust steam from the jacket. The pipe, H, extends to the bottom, and through this all the water of condensation may be removed, while the larger portion may be allowed if necessary to escape, through pipe, I, into the smoke stack, and force the draft. Dry exhaust steam is, therefore, always available to force the fire. The advantage of locating the feed water heater on top of the boiler, and making it a base for the engine, is obvious, as it protects the engine from the great heat of the boiler and saves all radiation from the top. The cylinder is 3½ inches in diameter by 4 inches stroke; the crank makes 300 turns per minute. The speed may, however, be changed at will by changing the tension of the governor springs. The feed pump is cast in the crosshead slide, and is inside of the frame, giving the engine a neat and uniform appearance, and it also enables the belt pulley to be placed very near to the pillow block bearing. It is provided with a safety valve, E, having a handle to turn the valve in its seat at each starting, thereby preventing it from ever becoming cemented down or stuck. Oil cups, gage cocks, and a glass water gage are also attached. The boiler pressure is kept uniform by an automatic damper regulator.

Fig. 1.

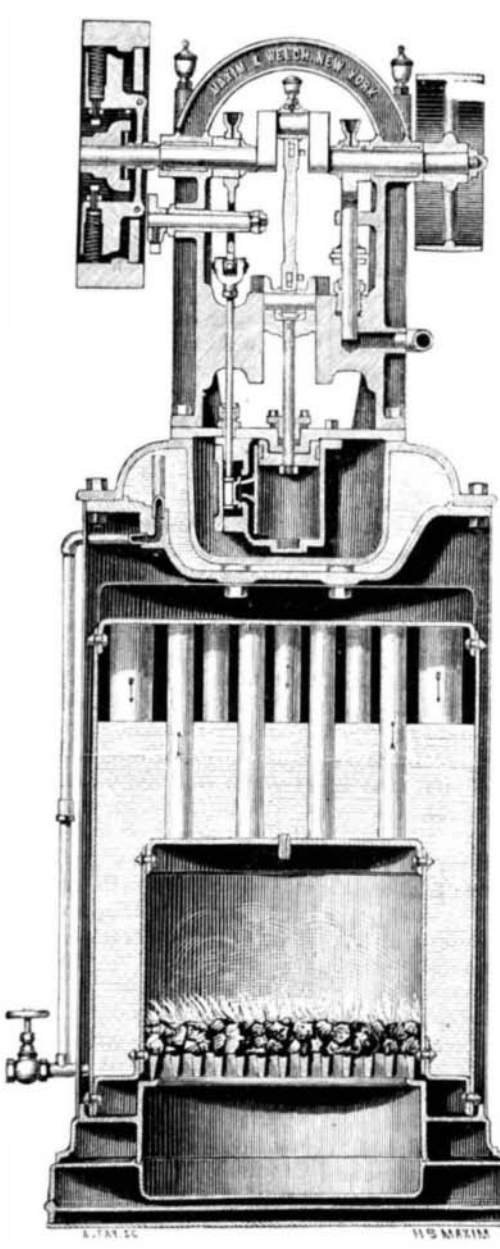
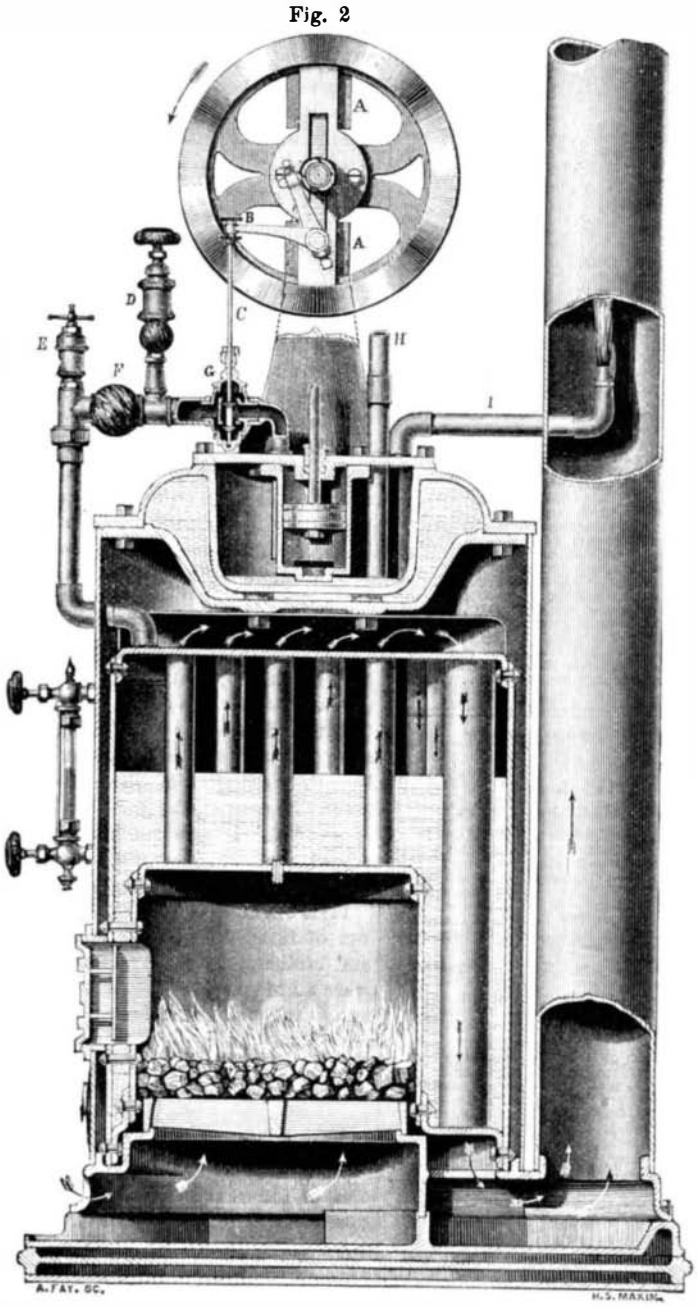


Fig. 2



MAXIM'S AUTOMATIC STEAM ENGINE.

A novel and important feature about this engine is its governor. We believe the present is the first instance of a small engine being provided with an automatic variable cut-off, the governor operating, as in the largest and best machines, directly on the point of cut-off. The economical advantages of this system are too well known to be recapitulated here. The object is attained in a direct and simple manner, no perishable belt being used. Two heavy weights, which constitute the balls of the governor, are placed inside of the fly wheel, and revolve with it, the centrifugal force being balanced with suitable springs, which may be adjusted at will, as shown in Fig. 1. The weights are attached to a bell crank, one end of which extends centrally and embraces a sliding cam, attached to the main shaft in such a manner that, while it is free to move in the direction of axis, it cannot turn on the shaft but rotates with it. This cam has two projections corresponding to the up and down stroke of the engine, as shown in Fig. 2. The advancing faces of these projections are parallel to the axis, and open the cut-off valve at the same time at any lateral position. The slide valve is made to cut off at ⅞ stroke, and the relation of the projection on the cam arc to the eccentric is such that, on the closing of the port by the slide valve, the balanced valve, G, is opened, and a full boiler pressure is let into the the steam chest, which is very small. The valve, G, only remains open during the time that the follower is resting on the projections. The terminations or receding faces of the cam projections are cut spirally in such a manner that, when the weights, A A, are thrown outward by a too rapid motion, it brings a shorter portion of the projections beneath the follower, and thus cuts off the steam at an earlier point of the stroke. Should the speed diminish, then the springs press the weight inward and allow the steam to follow the piston for a distance due to the work being done.

This governor may be applied to a larger class of engines, and would prevent wire drawing the steam and its attendant loss to a very considerable extent. Moreover, it is free from the dangers inherent to all governors requiring a belt to drive them, since the belt is liable to break, slip, or come off, and thus allow the engine to race, to the great danger to life and property, as many accidents attest.

One objection raised against small engines is the constant watching required to keep the right quantity of water in the boiler.

Fig. 3, page 290, is a view, partly in section and partly in elevation, of an ingenious automatic feed attached to these engines. The feed pump is of the ordinary solid plunger kind, with suction on one side and discharge on the other. There are two branches to the discharge, one of which passes to the boiler through the heater, and the other returns back to the tank from which the suction is taken. In this return pipe is placed a globe valve, E, with a sliding stem or spindle, which extends downwards and rests on the top of the shell, F. When the valve, E, is open, it is obvious that no water would enter the boiler, as it would discharge back to the tank; thus, when no water is being pumped into the boiler, the pump is not liable to become filled with air, but is always ready. The automatic part of the device relates wholly to the opening and closing of the valve, E. When the pump is working, it has to discharge its water somewhere; and if the valve, E, is closed, its only discharge is through the other branch and into the boiler. The shell, F, being full of water and oil and securely sealed, it forms a little boiler of itself; and steam is raised in it by the water falling in the main boiler and thus allowing the steam to displace the water in pipes, K and L, when the heat of such steam is rapidly communicated to the water in the shell; a pressure is raised, the elastic steel tap is expanded, which closes the valve, E, and the water at once enters the boiler; when sufficient water has entered, it closes the pipe, L, and soon fills the pipe, K. Then the shell, F, cools, a depression takes place, and the relief valve, E, is opened, which at once allows the water to return to the tank and not enter the boiler. When it is desirable to take water from mains which have a pressure in them, then the pipes, I and J, may be connected to allow the water to circulate when not going into the boiler. Should a larger amount of water be required in the boiler at any time than that due to the hight of the pipe, L, then the globe valve, B, may be closed; and the pump will throw its whole volume into the boiler, and it may be controlled in the usual way, by closing off, more or less, the angle valve, A. This feed water regulator is perfectly reliable, and in practice does not allow of a variation greater than the internal diameter of the pipe, L (¼ of an inch.)

Fig. 4, page 290, is a view of a noiseless, automatic pumping engine, using gas or coal as a fuel. It is automatic to a remarkable degree, the pressure, feed water, and fire taking care of themselves. They are highly finished and very neat in appearance, the boiler casing being 16 inches in diameter and 36 inches high; 25 cubic feet of gas per hour pump 250 gallons of water 100 feet high, or a larger quantity to a correspondingly less hight. This pump is very light running, and is practically noiseless, making less noise than a sewing machine. There is both an air chamber and a vacuum chamber; thus all noise from the impact of water and its disagreeable pounding in the pipe is avoided. With coal as a fuel, it is provided with a larger pump, and raises thrice as much water per hour as with gas. Fig. 5, page 290, is a vertical central section of the gas-burning pumping engine. The burner is a double argand, with 60 No. 60 holes, being the same size and once and a half the number used in a common argand as used for illumination. A represents the safety valve, B the heater, C C the boiler, D the counterpoise of float; E operates the boiler feed, G G are the pendent tubes, filled with water and forming a part of the boiler, H the burner, I the valve for automatically controlling the fire, by means of the piston, P, the lever, L, and spring, M; an inspection of the engraving will enable any one to comprehend the rest.

Fig. 6, page 290, represents a small oscillating engine, on

(*Continued on page* 290.)

Continued from first page.)

the boiler, (Fig. 5). The cylinder is 2 inches in diameter and has 2¼ inches stroke of piston. It is supplied with all the attachments used in large engines, the governor being inside the belt pulley, and operating directly on the point of cut-off, enabling a small amount of steam to do a large amount of work. The engine is ready to work in ten minutes from lighting the gas, and will run all day without any attention whatever. With a supply of gas and water, it is its own engineer and fireman. It is admirably adapted to the use of dentists, jewelers, tea merchants, and amateurs.

These engines were patented by Hiram S. Maxim, of New York city, December 22, 1874, and July 20, 1875. The engravings accompanying this article were photographed on the wood from Mr. Maxim's drawings, and represent the parts of the engine as they actually exist.

These engines are manufactured in six sizes, varying from 2 horse power downward, by Messrs. Maxim & Welch, of 176 Center street, New York city, who may be addressed for further particulars.

How it Happened.

The following explanation was recently given by an English bankrupt to his creditors. We find the account in the London *Grocer*. It is rather unusual for such unfortunate men in business here to take the trouble to explain the calamity in the candid manner which the English tradesman adopts towards his creditors. The statement bears upon its face truthfulness, and it is to be hoped that his friends accepted his statement and afforded him credit:

"Gentlemen; The fact of my having stopped payment being known to you, I wish to lay before you some of the reasons for doing so. I came into this business, as is well known, under very great disadvantages, the premises being in a very dirty and dilapidated state, connection gone, with the exception of a sprinkling of ready money and the tail end of an unsound booking trade; and on using every effort to get the thing in working order and recover the connection, I am, so to speak, for the moment come to the ground. When I came in I paid to the trustees of Nicholson's estate $4,350, $2,825 of which was for a drained out stock, $350 for horse, van, etc., not worth at the outside $125, having sold the horse for $35; trade utensils $150, consisting only of five counter scales, there not being a scoop or any other utensil in the place (which to a business man seems almost incredible, but such was the fact, so utterly had the thing throughout become a wreck); not even a canister for tea or coffee fit for use, or drawers in counter; also not a tap to draw treacle from, my predecessor usually knocking out the head of the cask and dipping it out with a biscuit tin: $1,050 for goodwill and fixtures not worth $200. You will thus see the disadvantages under which I came in. Add to this $225 for valuation and introduction to the business, and $105 paid Nicholson for house fittings, etc., removing furniture $125, thus making altogether nearly $5,000 before I could make a start; and finding the place in such an unworkable state, my preliminary and working expenses have of course been exceedingly heavy. I need not to have stopped, as I had the entire confidence of my creditors, but on taking stock found that my position was not satisfactory, and deemed it prudent, rather than abuse the confidence of my creditors, to stop payment at once, which I did immediately. You are, doubtless, aware that I left a firm of high standing (after being with them sixteen years, fourteen and a half of which I had the entire management and buying of their grocery department, the returns of which were large) to come here, working day and night under great mental anxiety, being of a naturally high, nervous temperament, and now find myself utterly ruined. I came here, saw, and in some unaccountable manner was, so to speak, captivated; I rushed into it without legal or private advice on my part, and the result would be, were I to go out now, without further expense in getting rid of all assets, that I should leave behind between $5,500 and $6,000: this through no fault (as is well known, except the fact of my coming here) of my own, but my misfortune.

"As one of the disadvantages which have to encounter, I must not forget to mention the fact of my predecessor (who had been here for years underselling everyone, thereby gaining popularity) having again re-opened premises just below me, and of course, as a natural consequence, taking part of his old connection, thus weakening the already drained out wreck."

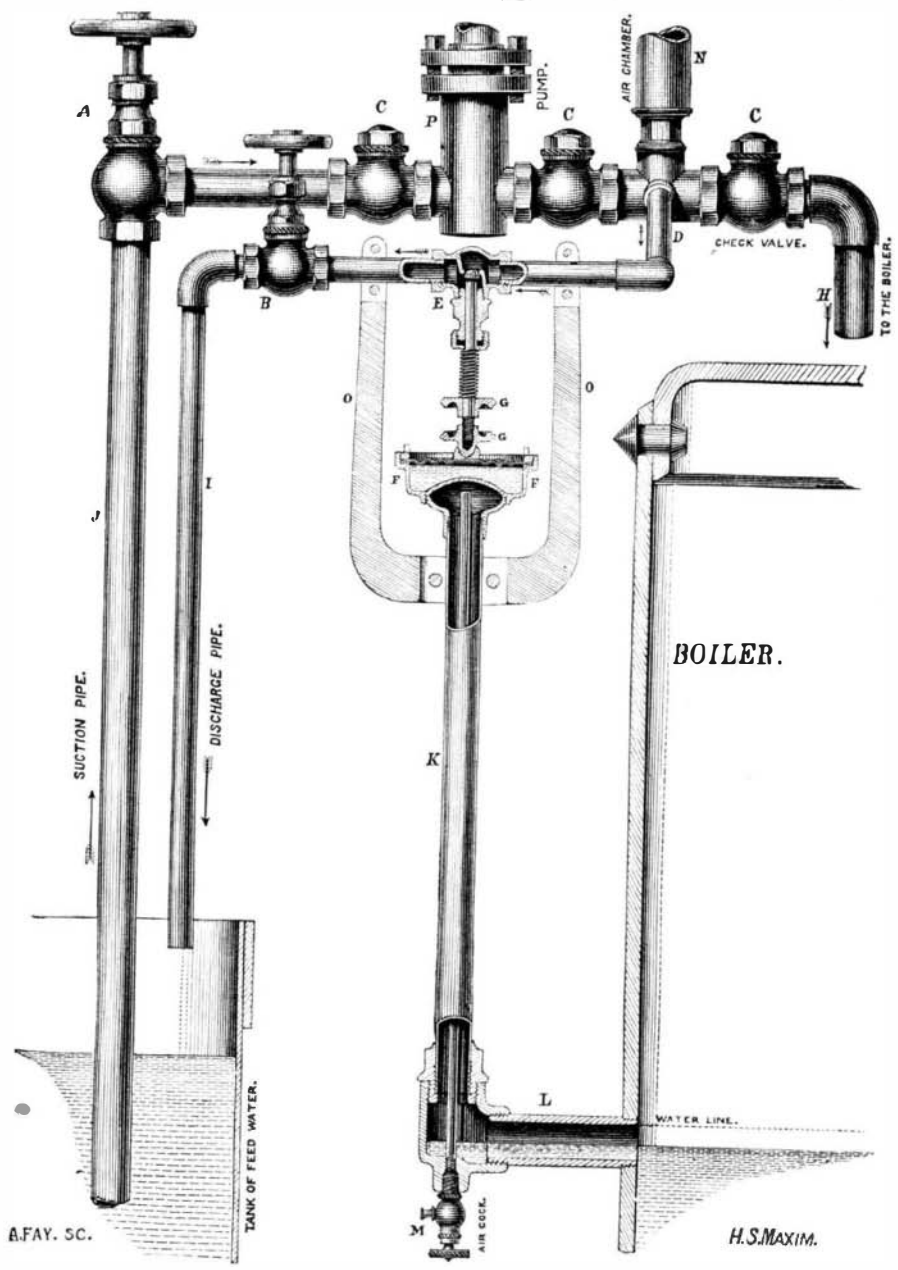


Fig. 3.—MAXIM'S AUTOMATIC ENGINE FEED PUMP.

FOR mending valuable glass objects which would be disfigured by common cement, chrome cement may be used. This is a mixture of 5 parts gelatin to 1 of a solution of acid chromate of lime. The broken edges are covered with this, pressed together, and exposed to sunlight, the effect of the latter being to render the compound insoluble even in boiling water.

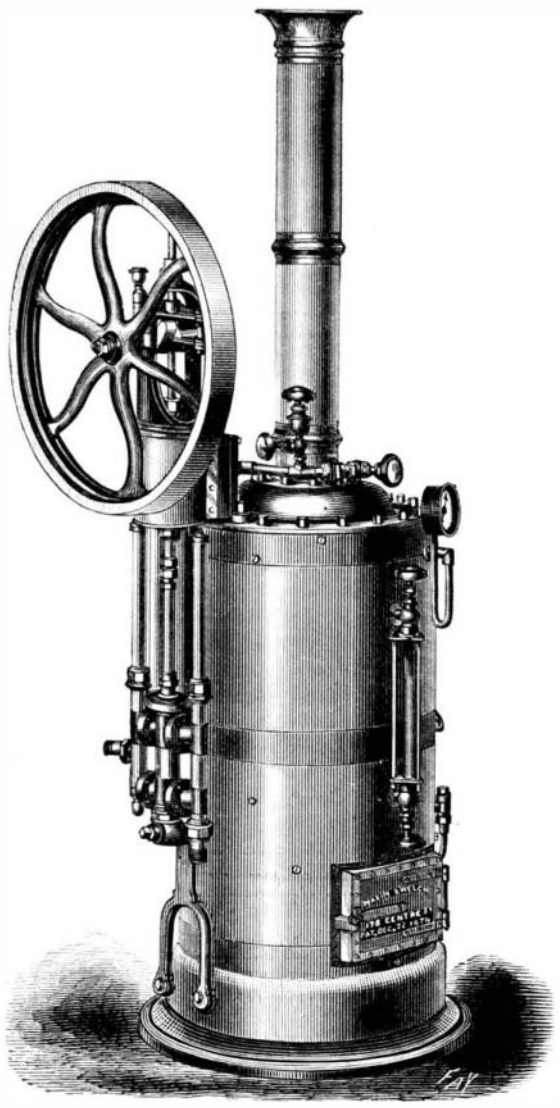


Fig. 4.—PUMPING ENGINE.

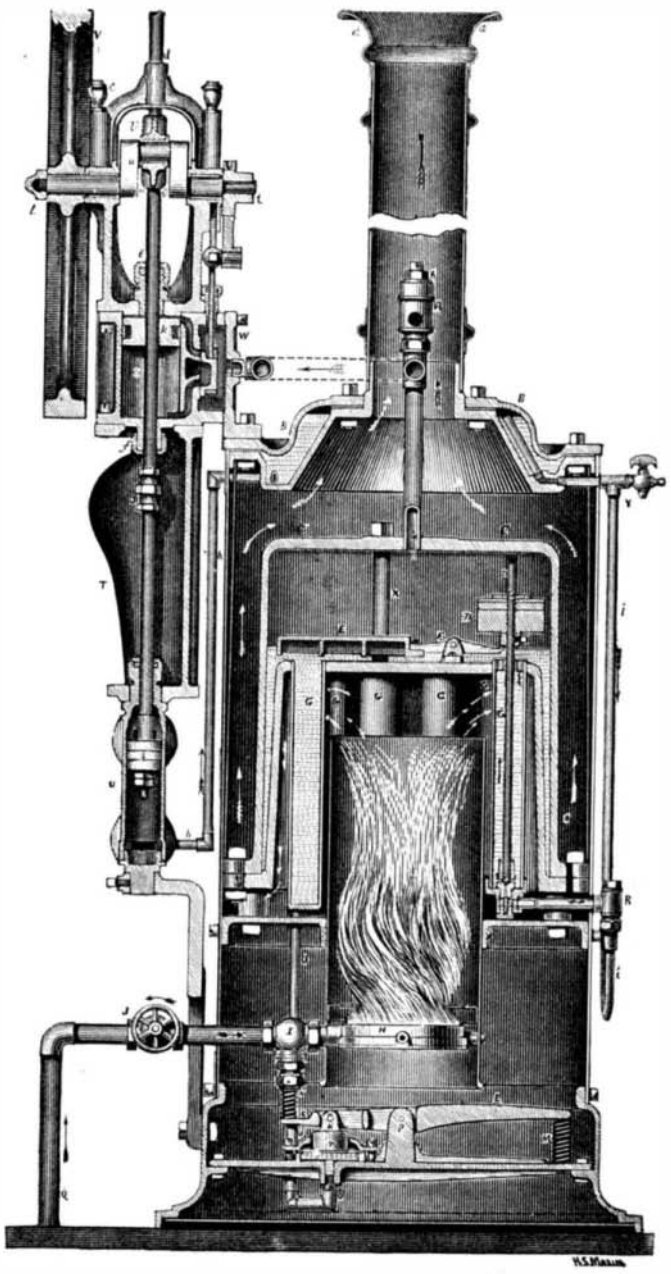


Fig. 5.—SECTION OF PUMPING ENGINE.

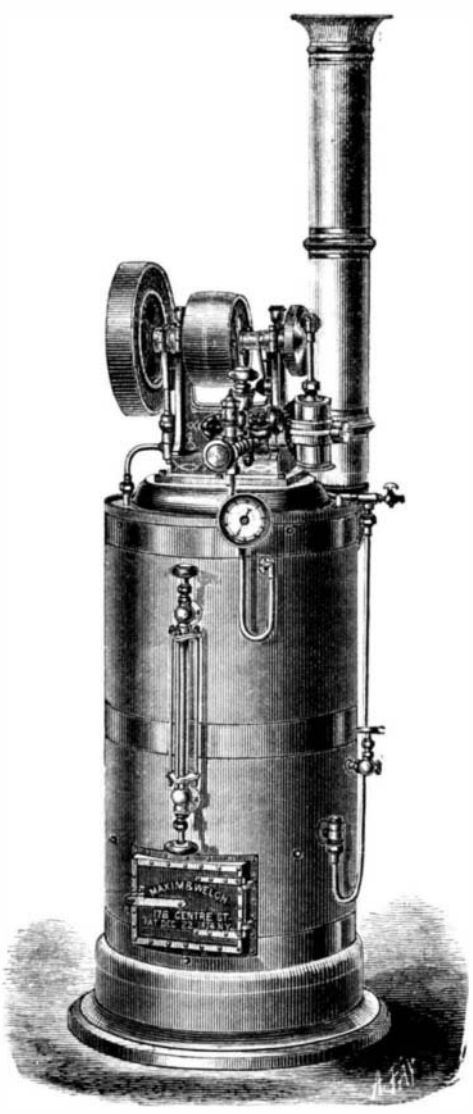


Fig. 6.—OSCILLATING ENGINE.

MAXIM'S AUTOMATIC STEAM ENGINE.