No. 676,523. Patented June 18, 1901.

M. L. WOOD.

GAS ENGINE.

(Application filed Nov. 3, 1899.)

(No Model.) 2 Sheets—Sheet 1.

Fig. 1.

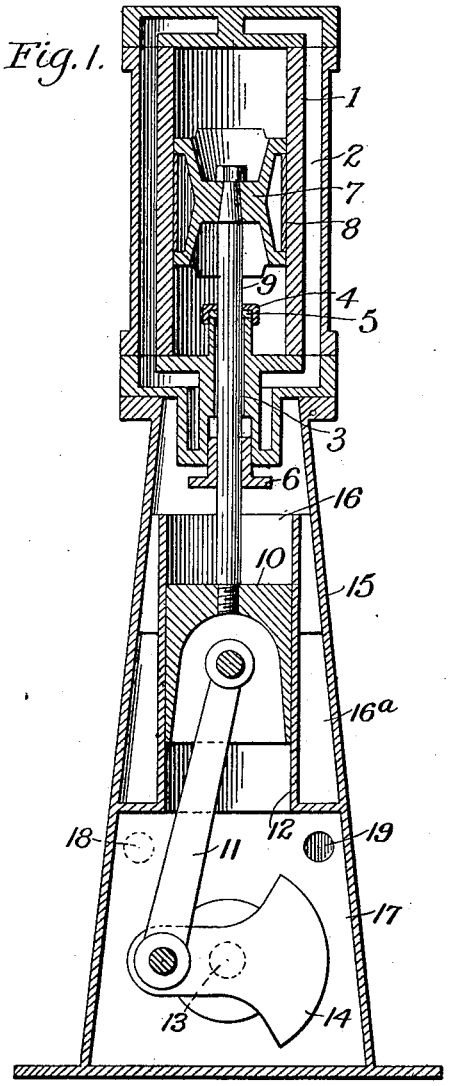

Fig. 2.

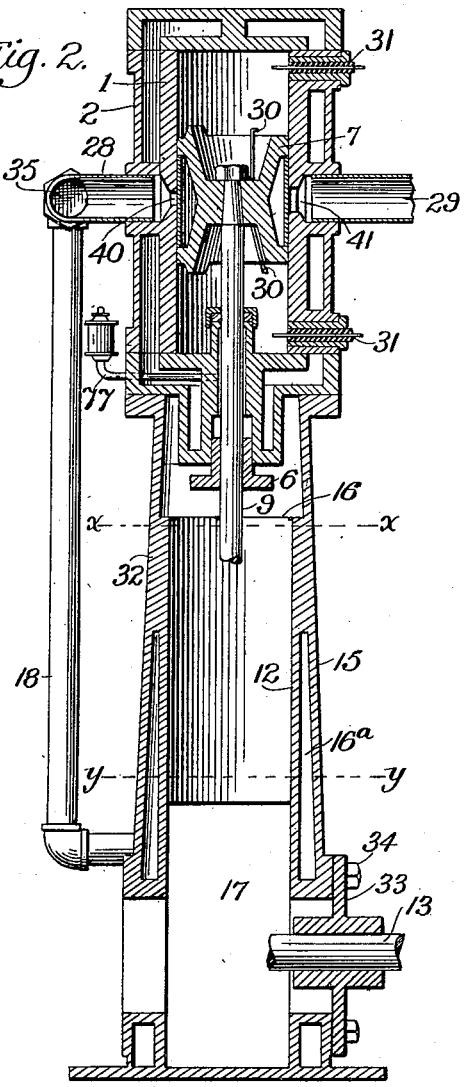

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Fig. 3.

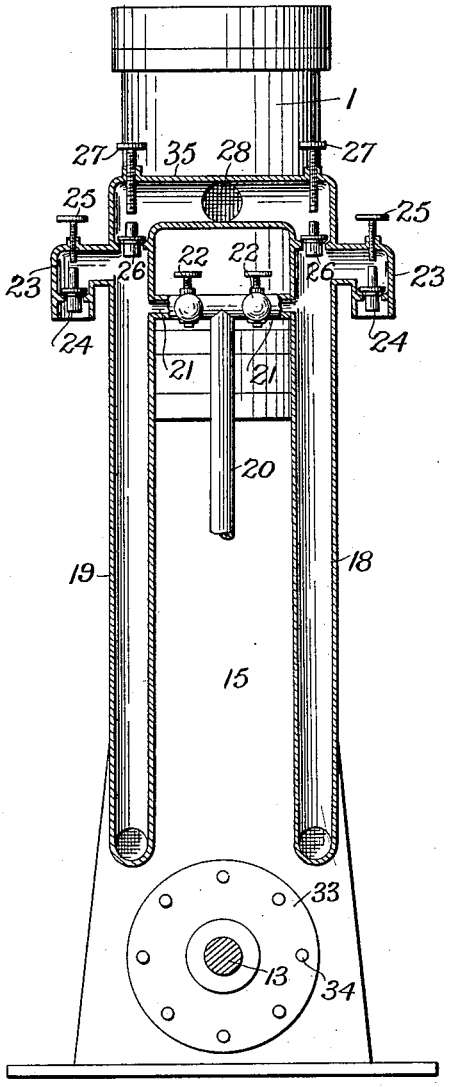


Fig. 4.

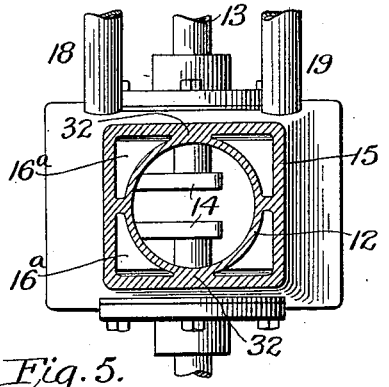
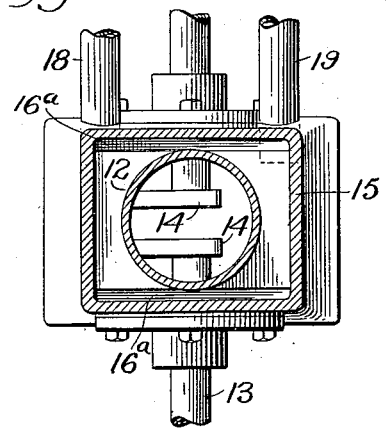


Fig. 5.



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MARSHALL L. WOOD, OF MONTPELIER, VERMONT.

GAS-ENGINE.

SPECIFICATION forming part of Letters Patent No. 676,523, dated June 18, 1901.

Application filed November 3, 1899. Serial No. 735,670. (No model.)

To all whom it may concern:

Be it known that I, MARSHALL L. WOOD, a citizen of the United States, residing at Montpelier, in the county of Washington and State of Vermont, have invented certain new and useful Improvements in Gas-Engines, of which the following is a specification.

My present invention relates to certain improvements in gas-engines, the object being to secure a gain in the way of economy and efficiency and at the same time provide an engine having as few parts and as simple a construction as possible; and it therefore consists in the construction, arrangement, and combination of mechanical elements, substantially as will be hereinafter described and then more particularly pointed out in the claims.

The main feature of my improved gas-engine consists in the peculiar combination and construction of the cross-head, which serves likewise as a pump for charging the cylinder. The engine is designed to give an impulse at each stroke, and it is believed that the advantages of a motor which furnishes an impulse at every stroke are decidedly superior to those possessed by other gas-compressing motors.

In the accompanying drawings, illustrating my invention, Figure 1 is a vertical section of my improved gas-engine. Fig. 2 is a vertical section taken at right angles to the section of Fig. 1. Fig. 3 is a vertical section of the exteriorly-arranged piping or tubing for supplying the explosive mixture, the frame of the engine being shown in elevation. Fig. 4 is a cross-section on the line $x\ x$ of Fig. 2. Fig. 5 is a cross-section on the line $y\ y$ of Fig. 2.

Like numerals of reference designate corresponding parts throughout all the different figures of the drawings.

1 denotes the cylinder, in each end of which the impelling explosions occur, said explosions taking place alternately, first in one end and then in the other, and thus applying the force of the explosion to the propulsion of the single piston therein, which is thereby caused to reciprocate back and forth within said cylinder. The cylinder 1 is provided with the usual water-jacket 2 to keep it cool. 7 designates one form of piston, which is presented here as a sample of piston that may be successfully employed, the same having a piston-rod 9, which projects through the lower end of the cylinder at the point where the stuffing-box 6 is located for the purpose of making a tight joint. The piston-rod extends below the cylinder 1 and is secured to the cross-head 10, which is a cylindrical block, to which is pivoted the connecting-rod 11, likewise pivoted to the crank or cranks 14 of the crank-shaft 13, which is supported in suitable bearings in the base of the engine-frame. The cross-head 10 reciprocates vertically in a cylindrical guide 12.

The form of piston shown at 7 in the drawings consists of a block which is circumferentially recessed to receive a sleeve 8, of thin spring metal, arranged somewhat similarly to the arrangement of a packing-ring and having the function of making a tight joint for the piston in its movements through the cylinder and especially in its reciprocations relatively to the inlet and outlet ports, which will be presently explained. It may be further stated, in additional explanation of the location and function of the sleeve 8, that the piston 7 has upper and lower external circumferential flanges, between which is a lateral recess, in which the sleeve 8 fits, and thus fills the cylinder. In the lower head of the cylinder 1, at the point where the rod 9 passes through said head, there is an opening large enough to allow the rod 9 to pass loosely therethrough and leave an annular chamber 3, adapted to receive and contain a certain amount of oil or other lubricating matter furnished thereto through the pipe 77, carrying on its outer end a suitable lubricator. The lower end of the annular chamber is closed by the stuffing-box 6, hereinabove mentioned. The upper end is closed by means of a screw-cap 4, fitting down over the upper end of a boss that projects upwardly into the interior of the cylinder 1 from the lower head thereof, a brass ring 5 being introduced between the cap 4 and the end of the boss. This lubricating-chamber 3 keeps the piston-rod 9 well lubricated and prevents any coating or injury from the effects of the explosion to that part of the rod which slides through the stuffing-box 6, so that said part of the rod is always clean and bright.

The guide 12, to which I have already re-

ferred, is preferably formed integral with the casting that constitutes the main standard 15 of the engine-frame, and as the cross-head 10, which performs the function of the plunger of a double-acting pump, moves up and down within said cylindrical guide 12 it acts upon the explosive mixture (or upon the air only) contained within a lower pump-chamber 17 and an upper pump-chamber 16. Between the wall of the cylindrical guide 12 and the wall of the standard 15 are certain openings or passages 16ª, which form a part of the upper chamber 16 of the pump. It will be noted, however, that chamber 17 is entirely distinct from and is not in connection with the chamber 16, and I reserve the liberty of making the said chambers in any desired shape, size, or form, and consequently of molding the casting of the main frame in such a manner as may best suit the purpose of its construction. Access is had to the lower chamber 17 through an opening in the wall of said chamber, which is closed by means of a cover or plate 33, securely fastened to the side of standard 15 by means of bolts 34. (See Fig. 2.) At the center of the plate 33 is a horizontal bearing, in which the main crank-shaft 13, heretofore referred to, is journaled, said shaft having another bearing on the opposite side of the frame, which is not herein shown or described, as it is unnecessary for the purpose of giving a lucid explanation of the vital points of the present invention.

The supply of air and of gas or a mixture of combined air and gas may be furnished to the cylinder 1 in any desired manner, and I do not wish to be restricted to any particular arrangement of pipes and conduits for the purpose. One system of such pipes is, however, shown in the drawings in order to exhibit an example of the arrangement, the same consisting of a gas-supply pipe 20, leading from a vaporizer, oil-tank, or other source of supply. Pipe 20 enters a pipe 21 at right angles thereto. Pipe 21 is furnished with valves 22 22, situated on each side of the coupling-point of pipe 20, said valves being check-valves. 18 and 19 designate two supply-pipes, one of which, as 19, enters the lower pump-chamber 17, while the other pipe 18 connects with the upper pump-chamber 16, the entry of said pipe, for convenience of mechanical construction, being preferably into the angular passage 16ª, which forms a part of the chamber 16, as hereinabove explained, so that in this way it will be seen that the pipes 18 and 19 are coupled to the chambers 16 and 17 at points in the same horizontal plane. The pipes 18 and 19, as shown in Fig. 3, are entered near their upper ends by the valved gas-pipe 21. Each of the pipes 18 and 19 is provided with a lateral elbow or inlet pipe 23, through which air is supplied, air-inlet valves 24 being situated in the ends of these elbows 23, said valves 24 being automatic and opening inwardly, but closing outwardly, the extent of their inward movement when opening being regulated by means of the adjusting-screws 25. The upper ends of the pipes 18 and 19 are connected by a cross-tube 35. Valves 26 are located at the junction of the cross-tube 35 with the said pipes 18 and 19, which valves are adapted to open for the purpose of permitting air or gas or a mixture of the two to pass from pipes 18 and 19 into cross-tube 35, but to prevent any return from cross-tube 35 into the aforesaid pipes, and the size of the openings of the valves 26 is regulated and adjusted by means of the screws 27.

At the middle point of the length of the cylinder 1 is situated an inlet-port 40, and diametrically opposite said port is an exhaust-port 41, the latter being larger than the former. A branch pipe 28 leads from the center of the cross-tube 35 to the gas-inlet port 40, and an outlet-pipe 29 leads away from the exhaust-port 41 to permit efflux of the exhaust therethrough.

Any convenient sparking device may be employed for producing ignition of the mixture at the ends of the stroke of the piston. One form that I have adopted consists of contact-points 30 30 on the piston 7, adapted to strike the electrodes 31 31, which enter through the wall of the cylinder 1 into the interior thereof near the opposite ends, said electrodes 31 being properly insulated at the points where they pass through the cylinder-wall and being connected with any suitable battery.

I will now explain the operation of the engine. On the first stroke assume that the plunger 10 is moving upward, thereby causing a mixture of air and gas to be drawn into the chamber 17 through the pipe 19, which, as we have seen, receives its air-supply through valve 24 and its gas-supply through valve 22, and hence the chamber 17 will be filled with the impelling fluid. At the next or downward stroke of the plunger 10 the mixture within said chamber 17 will be compressed, for the valves 24 and 22 will be closed against the entrance of any more air and gas into chamber 17 at this time, while at the same time one of the valves 26 will be opened to allow a forcing of the mixture through the pipe 28 to port 40, through which, at the moment that the piston drops low enough to pass the port 40 the mixture will enter into the upper end of cylinder 1 and above the piston 7. At the same time that the plunger 10 is thus descending air and gas will be drawn into the chamber 16 through the pipe 18 in consequence of the automatic movement of the air-valve 24 and gas-valve 22, with which pipe 18 is provided, and thus the chamber 16 will be filled with the impelling fluid. When the plunger 10 next ascends, the fluid within chamber 16 will be forced into the lower end of the cylinder 1 at the time when the piston 7 in its upward movement uncovers the inlet-port 40. It will be observed that as the pis-

ton 7 in this upward movement acts upon the charge previously introduced above the same it will compress said charge, and when the electrodes contact with each other and produce a spark the piston will be driven forcibly downward to the other end of its stroke. As the piston descends under the force of the explosion above it the spent product of this explosion will begin to pass out through the exhaust-port 41 the moment the edge of the piston begins to open said port. This opening of the exhaust-port takes place slightly in advance of the opening of the inlet-port on the other side of the cylinder by reason of the larger size of the exhaust-port, but as soon as the inlet-port does open at a point of time slightly later than the opening of the exhaust-port the inrushing charge of the fluid will drive out all or a greater part of the products of the previous explosion which may not yet have escaped through the exhaust-port, and thus the upper end of the cylinder will be filled with the new charge of gas. The same operations of compressing, explosion, and exhaust take place on both sides of the piston and in each end of the cylinder, and the action of the pump-plunger in filling by suction the two chambers 16 and 17 and in forcing the contents of said chambers into the cylinder is exactly the same in each instance, the impelling fluid, as we have seen, being delivered through valves suitably arranged. If any charge should not be combustible, it simply passes through the cycle with but a slight loss of power, as it gives back in expanding nearly all of the power taken in compressing it.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In a gas-engine, the combination with a cylinder, of a piston working within the same, inlet and outlet ports in said cylinder, the outlet-port being of larger diameter than the inlet, a piston-rod connected with the piston and having a plunger connected with its other end, a main casting connected with the cylinder, a guide for the plunger formed in the same, a plurality of pump-chambers formed in the same, means for delivering the impelling fluid to the chambers, and means for carrying the fluid from the chambers to the opposite sides of the piston, substantially as described.

2. In a gas-engine, the combination with a cylinder, of a piston working within the same, inlet and outlet ports in said cylinder, a piston-rod connected with the piston and having a plunger connected with its other end, a main casting connected with the cylinder, a guide for the plunger formed in the same, a plurality of pump-chambers formed by said guide in the main casting, means for delivering the impelling fluid to the chambers, and means for carrying the fluid from the chambers to the opposite sides of the piston, substantially as described.

3. In a gas-engine, the combination with a cylinder, of a piston working within the same, inlet and outlet ports in said cylinder, a piston-rod connected with the piston and having a plunger connected with its other end, a main casting connected with the cylinder, a crank-shaft journaled in the same, cranks connected to said shaft, a connecting-rod connecting the cranks with the plunger, a guide for the plunger formed in the main casting, a plurality of pump-chambers formed by said guide in the main casting, means for delivering the impelling fluid to the chambers, and means for carrying the fluid from the chambers to the opposite sides of the piston, substantially as described.

4. In a gas-engine, the combination with a main standard having a cylinder and a plurality of pump-chambers formed in the same, of a piston-rod having a piston upon one end and a plunger on its other, said piston working in the cylinder, inlet and outlet ports for the cylinder, tubes connecting the pump-chambers with the atmosphere and with a gas-supply pipe, said tubes having communication with the inlet-port of the cylinder, valves for controlling said pipes, means for regulating the valves, a guide for the plunger formed in the main standard and acting to form the upper and lower chambers of the same, and passages formed between the wall of the plunger-guide and the main standard, substantially as described.

In testimony whereof I affix my signature in presence of two witnesses.

MARSHALL L. WOOD.

Witnesses:
H. T. FRENIER,
F. I. PITKIN.