No. 711,454.

Patented Oct. 14, 1902.

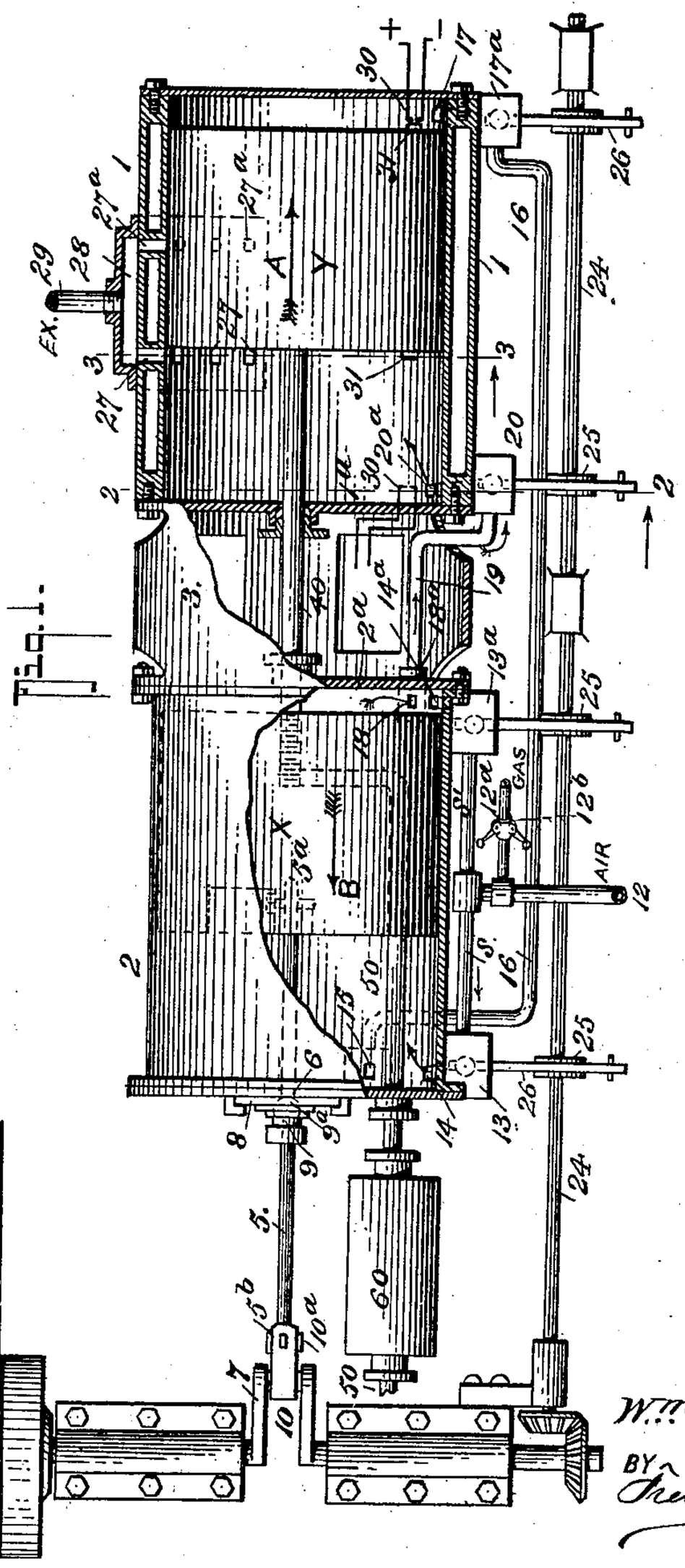
W. J. WRIGHT.

GAS ENGINE.

(Application filed July 16, 1900.)

(No Model.)

2 Sheets—Sheet 1.



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(No Model.) 2 Sheets—Sheet 2.

Fig. 2.

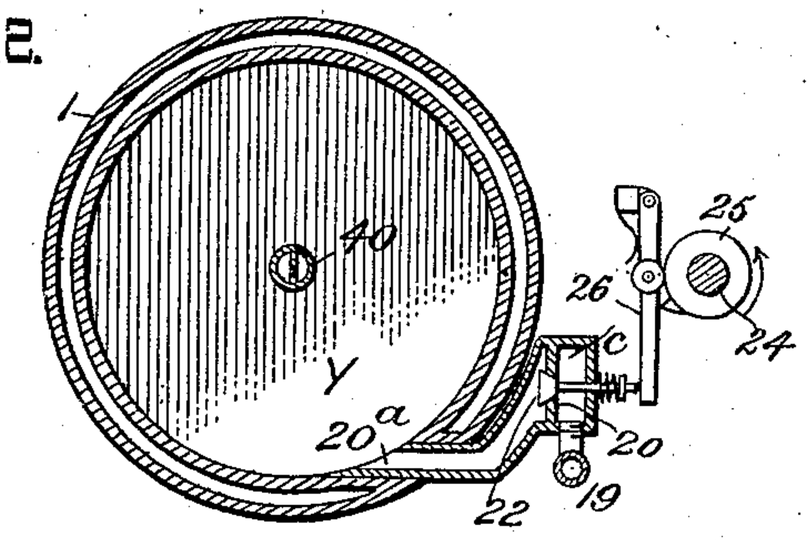


Fig. 3.

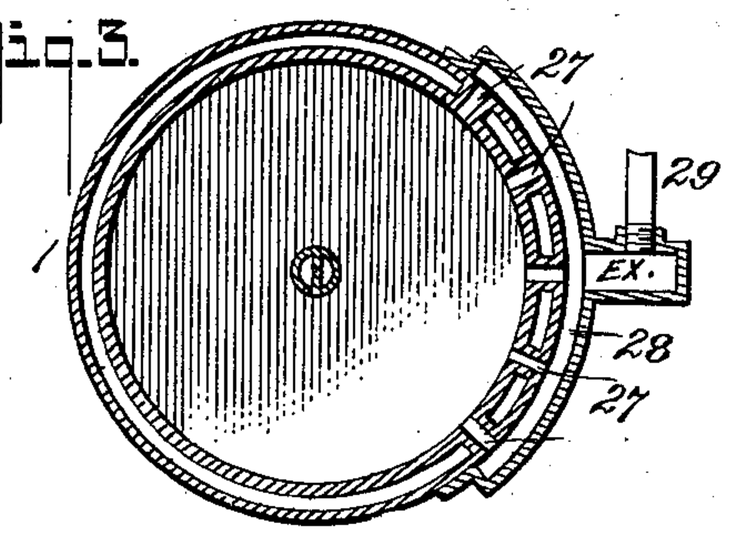


Fig. 4.

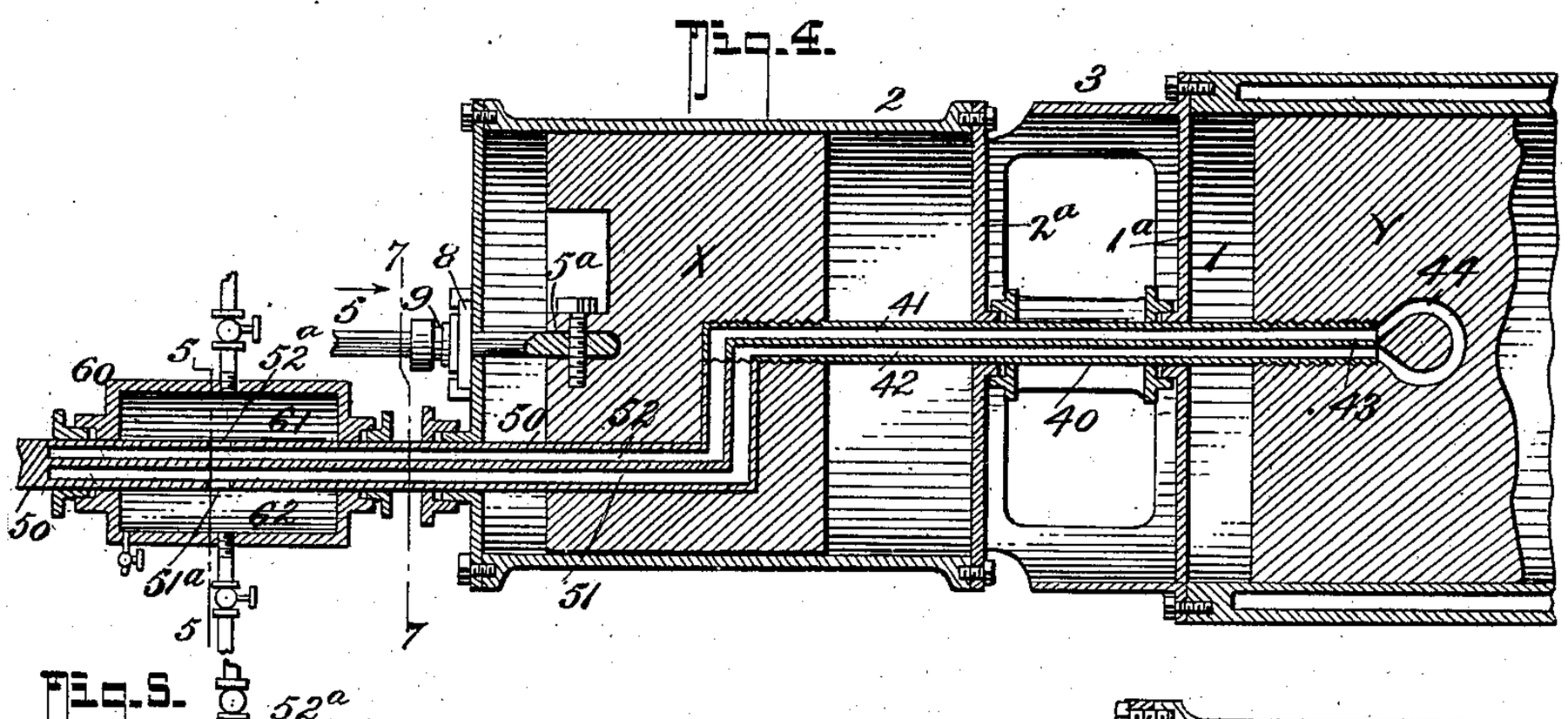


Fig. 5.

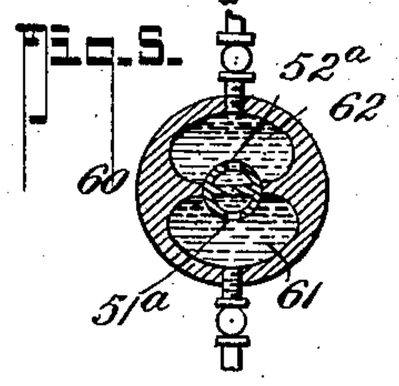


Fig. 6.

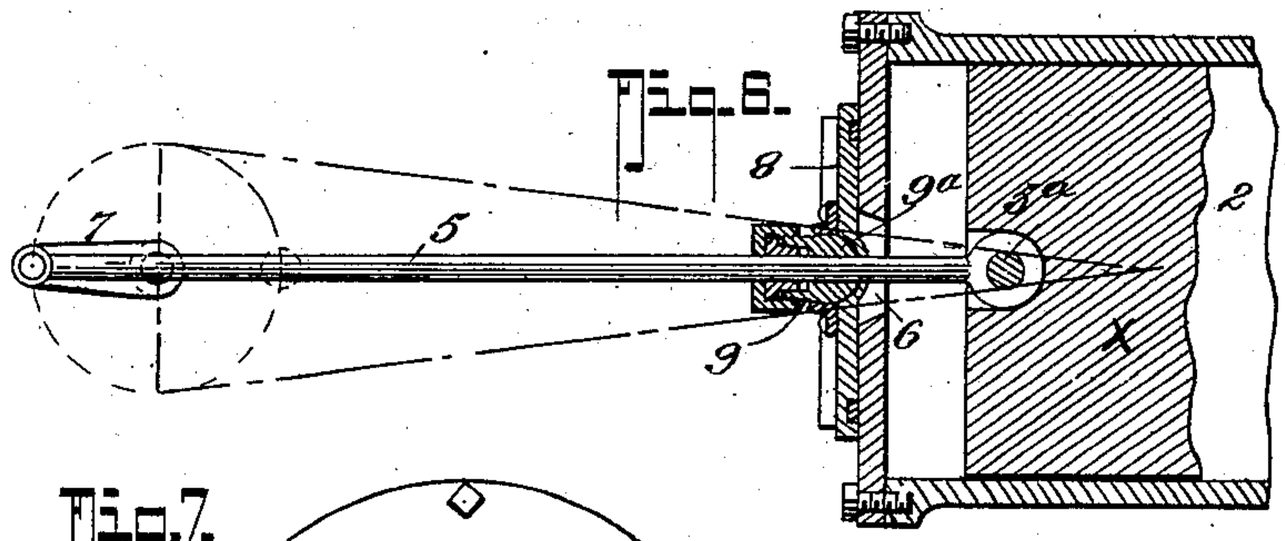
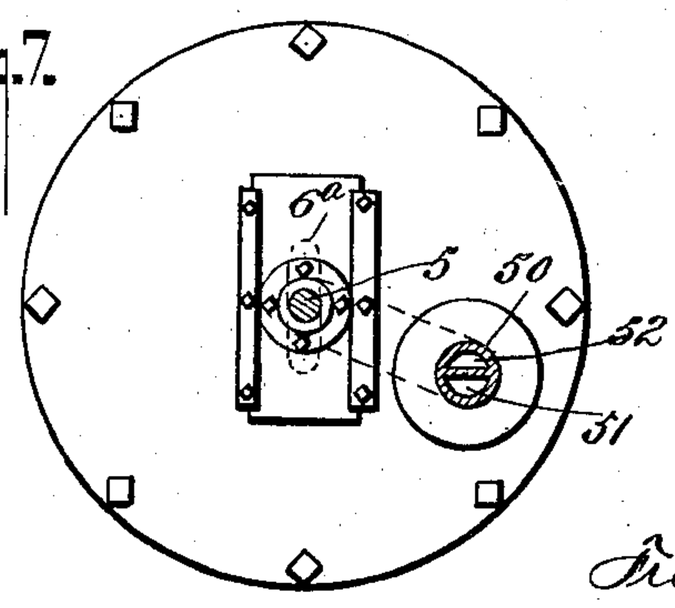


Fig. 7.



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UNITED STATES PATENT OFFICE.

WILLIAM J. WRIGHT, OF PITTSBURG, PENNSYLVANIA, ASSIGNOR OF THIRTEEN THIRTY-SECONDS TO JOHN F. McKIBBEN, J. W. LEE, AND FRED J. GALLOWAY, OF PITTSBURG, PENNSYLVANIA.

GAS-ENGINE.

SPECIFICATION forming part of Letters Patent No. 711,454, dated October 14, 1902.

Application filed July 16, 1900. Serial No. 23,709. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM J. WRIGHT, residing at Pittsburg, in the county of Allegheny and State of Pennsylvania, have invented certain new and useful Improvements in Gas-Engines, of which the following is a specification.

This invention relates to improvements in that class of explosive-engines in which a pumping means for supplying the working agent to the explosion-cylinder is used; and it seeks to provide a simple and compact arrangement of the pumping and explosion chambers whereby the cost of manufacture will be materially reduced and in which the several parts have such direct connection and are coöperatively so arranged as to effect a positive, easy, economical, and effective operation.

In its more generic sense my present invention comprehends such a combination of the several parts that the pump will operate to draw in a charge of the working agent into its cylinder at one end as the exploded mixture at the back of the working piston is being exhausted, and a new charge of the working agent is driven by the pump into the chamber from which the burned mixture is exhausting, as it (the pump) advances in the same direction the working piston moves within the explosion-cylinder.

This invention also seeks to provide certain improvements in the manner of constructing the pumping and explosion cylinders whereby to produce a stable and compact arrangement of said parts and also provide for conveniently connecting the several parts when setting up the engine.

Again, my present invention seeks to provide a novel means for mechanically operating the several valves that govern the inflow of the working agent to the opposite ends of the pump and working cylinder and which operates to effect a quick and positive action of such valves at proper predetermined intervals.

With other objects in view, which hereinafter will be fully brought out, this invention in its more subordinate nature consists in certain features of construction and combination of parts, which I shall first describe in detail and then point out specifically in the appended claims, reference being had to the accompanying drawings, in which—

Figure 1 is a plan view, parts being in section, of my improved engine, the valve-shifting devices being diagrammatically shown. Fig. 2 is a cross-section taken on the line 2 2 of Fig. 1 looking in the direction of arrow *a*. Fig. 3 is a cross-section taken on the line 3 3 of Fig. 1. Fig. 4 is a detail horizontal section of the pumping-cylinder, a part of the working cylinder and its piston, and illustrating the water-circulating means hereinafter referred to. Fig. 5 is a detail cross-section taken on the line 5 5 of Fig. 4. Fig. 6 is a detail view illustrating the sliding-bearing and sliding-plate devices for closing the elongated piston-rod aperture in the cylinder-head; and Fig. 7 is a front elevation of the said head, illustrating the correlative positions of the said sliding-plate and stuffing-box devices and the distributing-cylinder for the cooling or water-circulating means presently referred to.

In its practical construction my improved explosive-engine comprises a working cylinder 1, held in a longitudinal plane with the pumping-cylinder 2, the two cylinders being preferably of the same diameter, and each has a length suitable to provide for the proper stroke or travel of the pistons and for compressing the working charges.

As will be clearly seen by referring to Fig. 1 of the drawings, the two cylinders 1 and 2 have the adjacent ends held up close to each other to permit of using a short length of bed or base therefor, and the two ends 1^a 2^a constitute parts of a cylindrical shell 3, of substantially the same diameter as the two cylinders, said shell having its ends made fast to the adjacent open ends of the two cylinders 1 and 2. By thus connecting the two cylinders 1 and 2 a very compact arrangement of parts is provided, in which the strain is distributed more uniformly over the entire structure than would be possible were the two cylinders 1 and 2 independently mounted upon the bed, such arrangement also being advantageous, as the cost of connecting and

bracing the entire structure is minimized and rendered very durable.

X designates the piston in the pumping-cylinder 2, the stroke of which is of such degree that at its limit in opposite directions it reaches the inlet and discharge ports disposed in each end of the said cylinder and presently referred to.

To further provide for a compact and economical construction, I connect the piston-rod 5 directly to the crank-shaft 7, the piston end being pivotally joined to the piston, as indicated at 5^a in Fig. 1, and to provide for the oscillatory movement of the rod 5 as it is reciprocated the aperture 6 in the cylinder-head is elongated, as indicated at 6^a in Fig. 7.

To maintain a fluid-tight closure of the elongated slot 6^a, through which the piston-rod 5 oscillates, I provide a plate 8, held to slide over the outer face of the slotted head, the said plate being mounted upon the rod 5 to oscillate therewith, and to provide a tight packing for the rod where it passes through the plate 8 a stuffing-box 9 is used, having a head 9^a, which fits a correspondingly-shaped seat in the plate 8 and is held to rock in a vertical plane, said box 9 having the usual cap-plate. To provide for fitting the plate 8 and box 9 on the rod 5, the outer end 5^a of such rod is detachably joined with the block 10^a of the crank-head 10, as shown in Fig. 1.

By joining the piston-rod directly to the piston and the crank-shaft and providing an oscillatory stuffing-box and gate or slide for constantly closing the slot in the cylinder-head, through which the rod 5 passes, I dispense with the usual cross-head and crank-pitman devices, and thereby render the construction of my engine very compact, and thereby obtain the maximum effect of the transmitted power as the same is imparted direct from the piston-rod to the crank-shaft without such lost energy as is incident in the use of cross-heads and kindred mechanisms.

12 designates the air-feed pipe, and 12^a the gas-feed pipe, which join and discharge through a union and mixing laterals or pipes s s' into valve-boxes 13 13^a, that discharge through the inlet-ports 14 14^a in the outer and inner ends, respectively, of the pumping-cylinder 2. The gas-feed pipe 12^a has a governor-valve 12^b of any approved construction for regulating the inflow of the gas to the mixing-pipes s s'.

15 designates a discharge-port in the outer end of the cylinder 2, which empties into the pipe 16, that leads from said port 15, and discharges into a valve-box 17^a, that empties through the inlet-port 17 into the outer end of the working cylinder 1.

Adjacent the inlet-port 14^a in the inner end of cylinder 2 is a port 18, which discharges into a pipe 19, that empties into a valve-box 20, which discharges through the inlet-port 20^a into the inner end of the working cylinder.

All of the valve-boxes and valves contained therein are constructed alike, and one of said boxes is shown in detail in Fig. 2, by reference to which it will be seen the valve-box 20 has its inlet-chamber c normally cut off from the inlet-port 20^a by a spring-held valve 22, the stem of which projects exteriorly of the box 20.

In my improved construction of engine the same operates, as it were, as a single-cycle engine—that is, an explosion occurs at each reciprocal movement of the working piston—and hence as the explosions occur with great rapidity to insure a positive shifting of the valves to effect an interrupted explosive action of the engine at each movement of the working piston it is necessary that the valves positively operate at each shifting operation of the pistons. For this purpose I have found it desirable to operate the valves mechanically from the crank-shaft. Any suitable gear or cam operated devices may be employed for such service. On the score of economy in construction I arrange all of the valve-boxes in such manner that the valve-stems will extend in substantially the same longitudinal plane, whereby a single shaft 24, geared with the crank-shaft, as illustrated diagrammatically in Fig. 1, can be utilized, said shaft 24 at proper intervals having quick-acting cam-disks 25, one for each valve.

In the drawings I have shown each disk 25 as engaging with a pivoted lever 26, adapted to engage the stem of its coincident valve, as clearly shown in Fig. 2, by reference to which it will be seen the lever has a roller-bearing 26^a, with which the cam projection 25^a engages, it being understood that the several cams 25^a are so disposed relatively to each other as to effect a proper and predetermined opening of the valves, the reason of which will hereinafter appear.

The working cylinder 1 has the usual cooling-jacket, and in the present construction said cylinder has a set of escape-ports 27 at the inner part and a similar set 27^a at the outer part, the two sets being at equal distance from the center of the cylinder, and they discharge into a jacket portion 28, having an offtake 29.

30 indicates electric igniting-terminals, one for each end of the cylinder 1, and 31 31 designate contacts on the opposite ends of the working piston Y, which alternately close the terminals 30 for igniting the compressed charge.

So far as described the operation of my improved gas-engine is best expressed as follows: The parts being in the position shown in Fig. 1, the pistons X and Y being almost to the finish of their stroke in the direction indicated by the arrow A, the pump-piston is still drawing in a supply of the working agent from the pipe s, the valve in box 13^a being at this time closed. At this time the outlet 18 is still open and the piston X is forcing out the remaining part of the charge of the working agent which was drawn into that end of the cylinder in the prior movement of the

piston X in the opposite direction through the pipe *s'* and inlet 14ª, it being understood that the valve in box 13ª is at this time closed. The charge being forced out by the piston X passes through the pipe 19 into the box 20, in which the valve is open, and through said box and the inlet 20ª into the inner end of the cylinder 1, in which the last explosion occurred, said charge of the working agent by its expansive force now driving out the exploded mixture through the exhaust-outlets 27, it being understood, however, that as the working charge expands the atmospheric or back pressure in the exhaust will prevent the said working charge escaping. During the movement of the piston members X and Y under the explosive force the several valves are shifted, the valves in boxes 13 and 20 being closed, the valve in box 13ª immediately opened to allow the piston member to at once begin drawing in a new charge of the working agent, and the valve in box 17ª is opened the instant the piston Y uncovers the exhaust-ports 27ª. The piston X, now moving in the direction indicated by the arrow B, draws in a new charge of the working agent back of it from the pipe *s'* through inlet 14ª while the working charge in front of it is being compressed, which charge when compressed is forced out through the outlet 15, the pipe 16, and the open valve-box 17ª, when the valve in box 17ª opens into the outer end of the cylinder 1 and by its expansive force blows the residuum or burned mixture back of the piston out through the outlets 17ª. By reason of the arrangement of the parts shown and described an explosion occurs in each cycle of movement of the piston members X Y, thereby obtaining a great driving power of a uniform character with a minimum waste of energy and in which a charge is supplied alternately at the end of the working cylinder, while a prior charge at the other end is held under compression, the operation of charging, compressing, and exploding being practically a continuous one.

I deem it proper to state that in the practical construction of my engine the stroke of the piston is such and the shifting of the valves is so governed that the valve 17ª opens the instant that the exhaust-ports 27 or 27ª are opened and the piston Y is finishing its stroke forward, such construction of parts providing for the admission of a new working charge under pressure, which will serve to blow out the burned mixture during the entire time the said exhausts remain wholly or partly open, the valve in the box 17ª automatically closing the moment the exhaust-ports are closed in the return movement of the piston Y.

In its completed form my improved engine includes a means for cooling the working piston and the rod 40, that connects the two pistons, and generally such means (illustrated clearly in Fig. 4) consists in making the rod 40 tubular, dividing its interior into two distinct channels 41 42, its end 43, which connects with the working piston Y, abutting a divided channel 44, which may extend around or through the piston Y in any desired manner to produce a proper circulation of the fluid. One end of said channel 44 communicates with the channel 41 of the rod 40 and the other end communicates with the channel 42. That end of the rod 40 which connects with the piston X also communicates with a supplemental hollow rod 50, having two channels 51 52, said rod moving with the piston X and extending through a gland in that head of the cylinder 2 through which the piston-rod 5 passes. The rod 50 is made solid at its outer end; but its tubular portion is held to reciprocate in a cylinder feed-chamber 60, horizontally directed into upper and lower compartments 61 62, into one of which the feed-pipe 63 discharges, the other compartment having an outlet-pipe 64. The channel 51 of the pipe 50 has an inlet 51ª, that communicates with the compartment 62, and the channel 52 has an aperture 52ª, that opens into the part 61.

By providing cooling devices as described a water circulation can be readily maintained for cooling the piston and the piston-rod. While I have shown and described the cooling devices in this application, they *per se* are not herein claimed, as they form the subject-matter of a separate application.

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

1. In an explosive-engine of the character described; the combination with the pump and the working cylinder, arranged in tandem, the pumping-cylinder, having a valved inlet and a valved outlet, in each end, a feed-pipe connected with the said inlets, the working cylinder having a valved feed-inlet, in each end, coöperatively joined with the outlets of the pumping-cylinder, a double set of exhausts 27 27ª, arranged centrally in the working cylinder to discharge into a single offtake; of the connected pistons X and Y, the piston Y, being of such length relatively to the inlets and exhausts of the working cylinder as to uncover the exhausts thereof at its rear end just in advance of the ignition of the compressed charge in front of it, means for igniting the compressed charge, the drive-shaft linked with the piston X, the cam-shaft 24, geared therewith, and connections coacting with the cams of said shaft 24, for governing the valves for the inlets and the exhausts of the pumping-cylinder, and the feed-inlets of the working cylinder, all being arranged substantially as shown and for the purposes described.

2. An explosive-engine of the character described, comprising the following elements in combination; the pumping and working cylinders 2 and 1, arranged in tandem, the casing 3, intermediate the two cylinders and connected to the adjacent ends of said cylinder,

said casing having openings, the cylinder 2, having a valved inlet and a valved outlet at each end, the cylinder 1, having a valved inlet in each end, coöperatively joined with the outlets of the pumping-cylinder, a feed-pipe communicating with the inlets of the cylinder 2, an automatically-closing valve for each of the inlets and the outlets of the pump-cylinder, and the inlets of the working cylinder, the latter cylinder having a double set of exhausts 27 27^a, arranged to discharge into a single offtake, and igniting means for each end of the working cylinder, said means being alternately governed by the reciprocal movement of the working piston, the tripping-levers 26, the shaft 24, having cams 25, one for each tripping-lever 26, the connected pistons X and Y, the link 5, and the crank-shaft geared with the shaft 24, all being arranged substantially as shown and for the purposes described.

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