(No Model.) 2 Sheets—Sheet 1.

A. A. WILLIAMS.

GAS ENGINE.

No. 587,627. Patented Aug. 3, 1897.

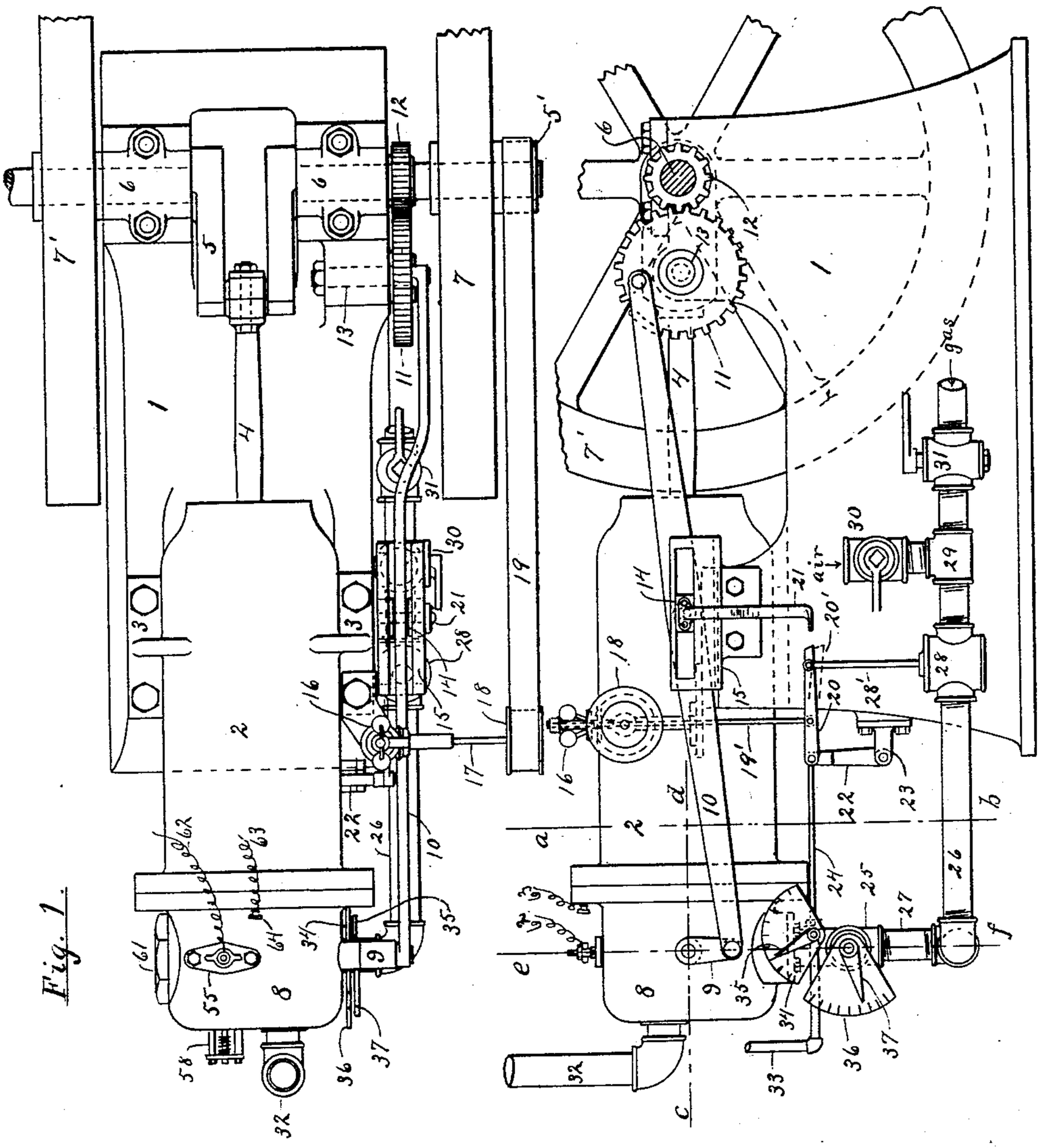

Fig. 1.

Fig. 2.

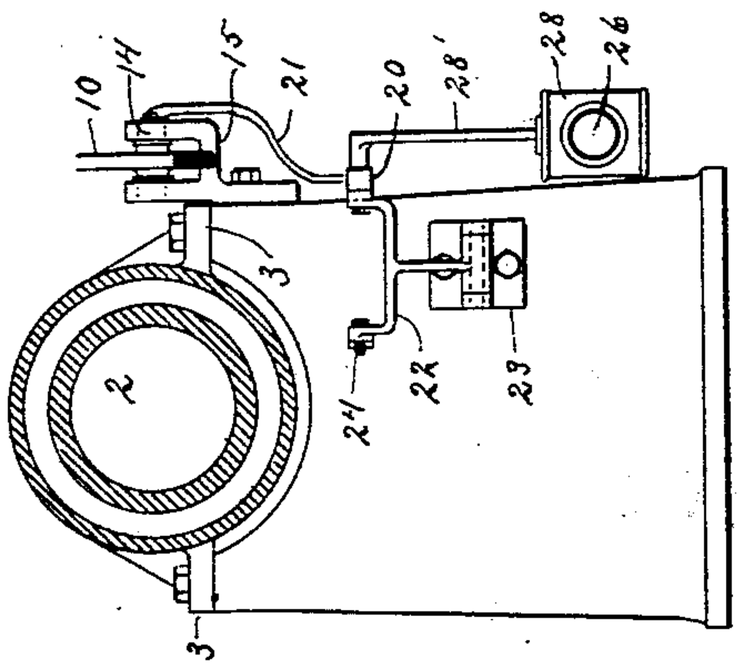

Fig. 3.

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(No Model.) 2 Sheets—Sheet 2.

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Fig. 4.

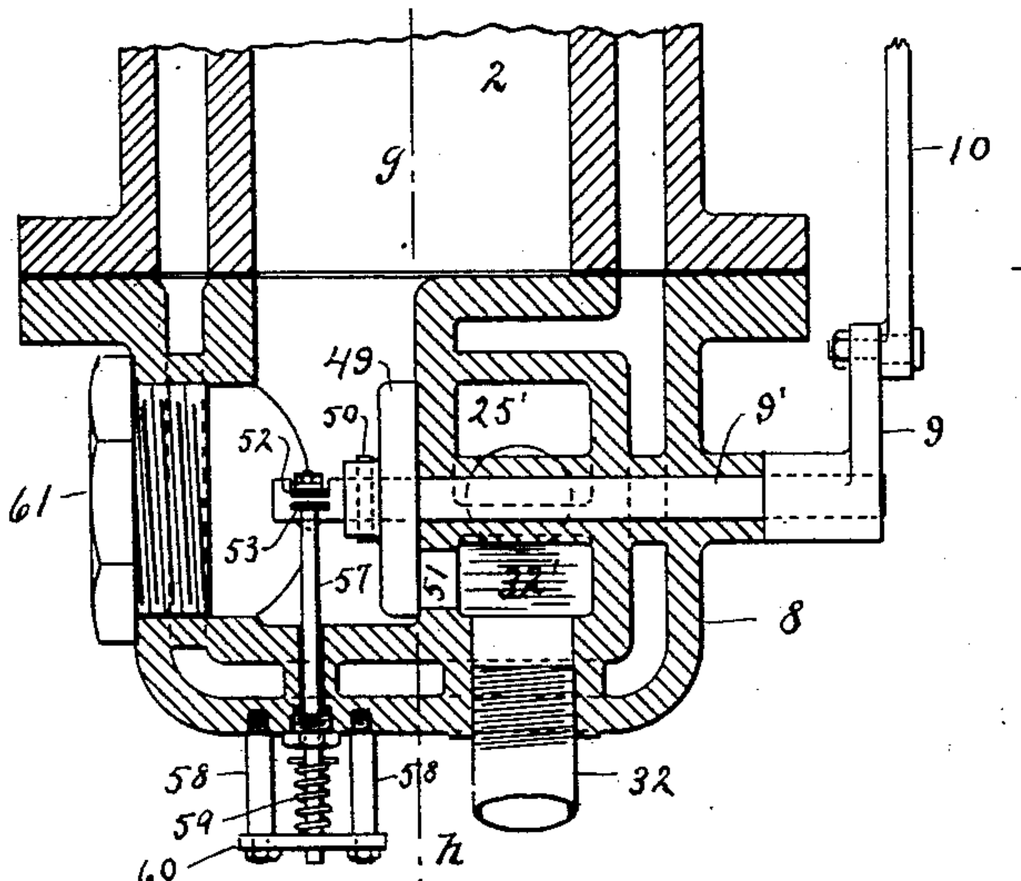


Fig. 6.

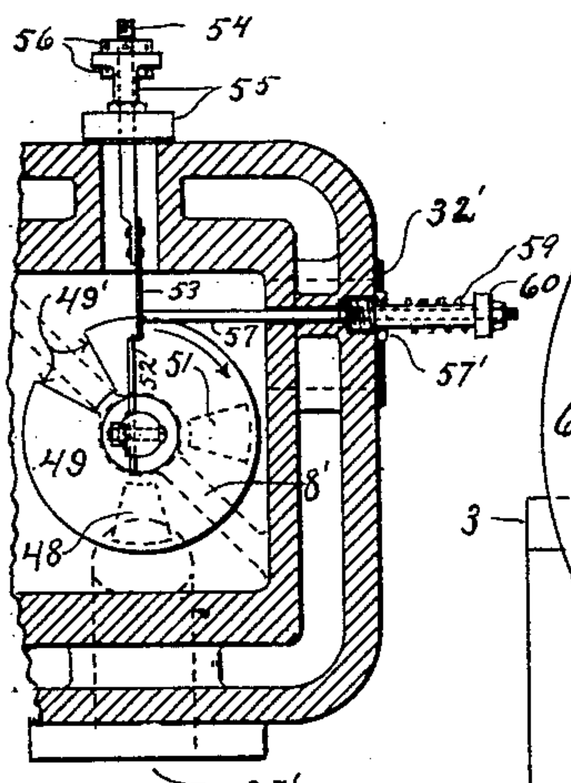


Fig. 5.

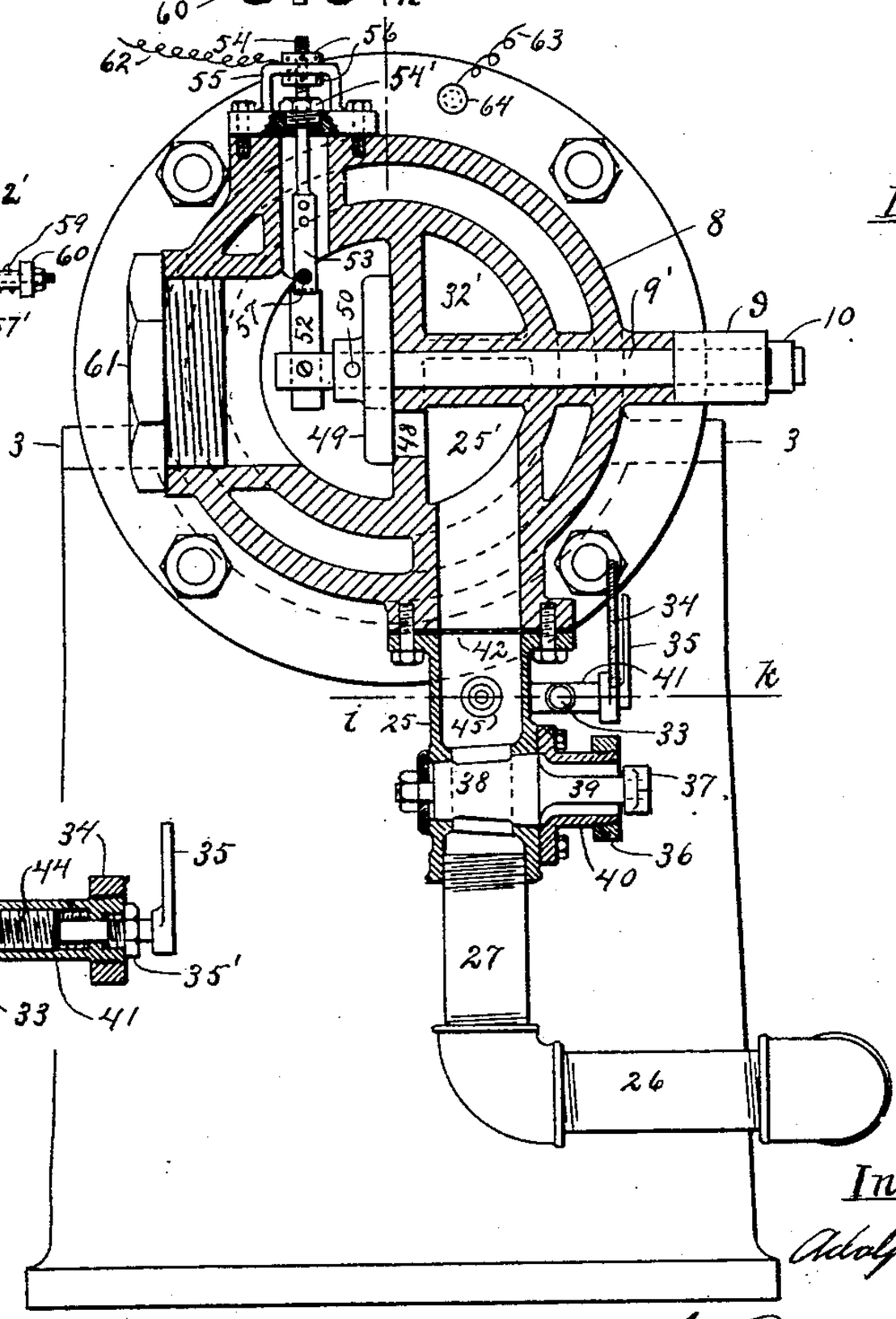
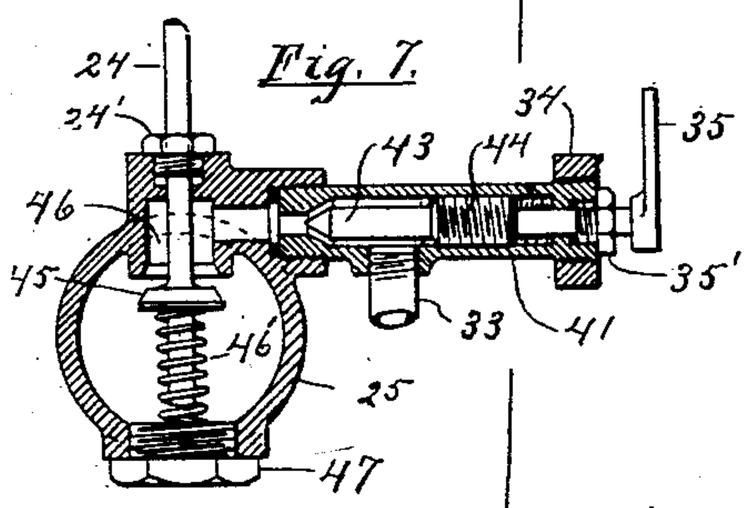


Fig. 7.



Witnesses.
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UNITED STATES PATENT OFFICE.

ADOLPH A. WILLIAMS, OF DULUTH, MINNESOTA.

GAS-ENGINE.

SPECIFICATION forming part of Letters Patent No. 587,627, dated August 3, 1897.

Application filed April 18, 1896. Serial No. 588,112. (No model.)

To all whom it may concern:

Be it known that I, ADOLPH A. WILLIAMS, a citizen of the United States, residing at Duluth, in the county of St. Louis and State of Minnesota, have invented certain new and useful Improvements in Explosive-Engines; and I do hereby declare the following to be a full, clear, and exact description of the invention, which will enable others skilled in the art to which it appertains to make and use the same.

The object of my invention is to produce a gas or other explosive engine which may be operated equally well either by gas or by oil, as desired, without changing the mechanism of the device.

Another object is to improve the present form of explosive-engine, to simplify and improve the valve and valve-operating mechanism, the igniting mechanism, and the governing devices, all as will be fully described hereinafter.

The engine I will describe is of the well-known form of horizontal one-cylinder single-acting four-cycle gas-engine, in which a mixture of gas and air is inclosed, compressed, and ignited in one cylinder.

The form of valve I prefer to employ rotates and receives motion from the moving parts of the engine by means of a connecting-rod pivoted near its center on a cross-head. This cross-head carries means for automatically controlling the throttle or oil-inlet valves. The igniting means I employ are electric, consisting of a fixed electrode within the explosive-chamber in intermittent contact with a movable electrode on the moving member of the valve.

My invention consists, further, of means for more thoroughly mixing and blending the charge of gas within the cylinder.

In order that my invention may be better understood, attention is directed to the accompanying drawings, in which—

Figure 1 is a top view of the complete engine. Fig. 2 is a side view of the same. Fig. 3 is an end section taken on the line *a b* of Fig. 2. Fig. 4 is an enlarged sectional view of the valve-chest and explosive-chamber, taken on the line *c d* of Fig. 2 and showing the exhaust-pipe and a portion of the igniting mechanism above the plane of the section. Fig. 5 is an enlarged section on the line *e f* of Fig. 2. Fig. 6 is a section on the lines *g h* of Figs. 4 and 5, and Fig. 7 is an enlarged section taken on the lines *i k* of Fig. 5.

In all of the above views like parts are designated by suitable figures of reference.

This engine is preferably constructed with a heavy cast-metal framework 1, having a horizontal water-jacketed cylinder 2, secured by bolts through flanges 3 to the same framework. A piston sliding within the cylinder operates a connecting-rod 4, which actuates the cranks 5 and shaft 6. 7 7′ are heavy fly-wheels mounted upon the said shaft and serving to impart steadiness to the motion of the engine.

The valve-casing and explosive-chamber 8 is flanged at its forward face and is bolted to a flange formed on the rear portion of the cylinder. This casing is open at its forward face and communicates with the cylinder.

The flat circular valve 49 is mounted on a stem 9′, having a crank 9 on its outer extremity. This crank is positively driven by means of a horizontal connecting-rod 10, pivoted to the crank and to a gear-wheel 11, driven in the opposite direction at half the speed of the engine, by means of a smaller gear 12 on the driving-shaft 6. The large gear is mounted on a shaft 13, secured to the side of the framework 1.

The connecting-rod 10 is further supported near its center by means of the cross-head 14, sliding in guides 15, bolted to an offset on one side of the cylinder. By means of this cross-head a sliding support for the connecting-rod will be provided, and the crank 9 will be prevented from stopping on the centers. Furthermore, the point of pivoting of the rod will be constant, and the movements of the crank 9 will be exactly in accord with the gear-wheel 11, although in the opposite direction. Such would not be the case if the connecting-rod passed through a fixed connection, such as a ring or swivel, as has been done, in which case its movements would be irregular and ununiform.

The valve-casing is divided into two parts by a vertical partition, one of which parts is again divided by means of an inclined partition 8′ into a gas-chamber 25′ and exhaust-chamber 32′.

49 is a disk-shaped valve mounted on the spindle 9′ and secured thereto by means of a pin or screw 50, the spindle passing through an opening within the partition 8′, and is provided with a crank 9 on its outer extremity, as described. The valve is provided with the port 49′, adapted to be brought opposite the exhaust-port 51 and gas-port 48, on opposite sides of the partition 8′.

The relative positions of the gas and exhaust ports to the valve-port are so proportioned that the ports will be opened and closed at the proper time to insure the proper operation of the engine.

The explosive-chamber is preferably provided with a manhole which can be closed by means of a screw-plug 61. This manhole is of use for the introduction of means for shaping and finishing the inside of the chamber and valve-casing, and will also be found of use for introducing the valve and igniting devices and for allowing of their proper adjustment.

The igniting mechanism is as follows: One contact 52 is secured to the inner extremity of the spindle 9′, outside of the valve, and revolves in the same direction with it. The contact may be secured directly to the valve, if desired. This contact is preferably made of spring metal. The second contact 53 is suspended from a yoke 55, upon the outside of the casing, and passes through an opening therein and is provided with a screw 54 and nuts 56 for adjustment.

54′ is a lock-nut which also serves the purpose of more securely closing the opening through which the contact is introduced.

57 is an auxiliary brace for the contact 53, consisting, preferably, of a rod passing through a stuffing-box 57′ in the side of the chest. The outer extremity of the rod 57 passes through the plate 60 of the yoke 58, and a spring 59 engages between the yoke and a pin in the rod, serving to press the latter into engagement with the contact 53.

The contact 53 is insulated from the body of the engine and connects, by means of the wire 62, to a source of electricity, as a battery or dynamo, the return being through the wire 63, binding-post 64, and cylinder and explosion-chamber to the contact 52.

In operation the valve and spindle 9′ will rotate the contact 52, which will engage with the contact 53 at the proper instant to explode the compressed charge in the cylinder and explosion-chamber.

The governing device consists, preferably, of a ball-governor 16, driven from the pulley 5′ by any suitable means, such as a belt 19, and operating a horizontal arm 20 by means of a link 19′. The arm 20 is provided with a yoke 22 at one extremity, pivoted to a short horizontal offset 23 upon the side of the framework 1. The opposite extremity of the arm 20 connects, by means of the rod 28′, with the throttle-valve 28 in the gas-supply pipe 26.

In operating an increase of speed will depress the arm 20 by the action of the governor, which will tend to close the throttle-valve and thus regulate the speed of the engine.

31 is a gas-valve, and 30 the air-valve, secured to the shoulder 29.

26 and 27 are portions of the gas-supply pipe.

In governing the feed of oil to the engine when gas is not used I employ an arm 21, depending from the cross-head 14 and reciprocating in a horizontal direction. This arm is provided with a short horizontal shoulder having a wedge-shaped face which will engage with the extremity 20′ of the arm 20. The yoke 22 connects with an oil-supply valve 45, adjacent to the explosive-chamber, by means of a rod 24, oscillated by the shoulder on the arm 21 striking the arm 20, whereby the valve will be immediately opened sufficiently to admit the proper quantity of oil and air to the engine. The extremity 20′ is beveled at an angle, as shown.

Upon the arm becoming depressed by an increase of speed of the engine the stroke of the arm will be lessened and will cease altogether if the arm is lowered below the path of the arm 21.

The oil-valve, Fig. 7, consists, preferably, of a puppet-valve 45, rigidly secured to the rod 24 and kept normally in engagement with its seat 46 by means of the spring 46′. This valve 45 is preferably located within the supply-pipe 25, as shown.

47 is a plug closing a manhole in the pipe 25, through which the valve may be introduced and adjusted, while 24′ is an adjusting-nut for the stuffing-box gland surrounding the operating-rod 24.

43 is the regulating-valve for determining the proper amount of oil entering the engine. This valve is needle-pointed and is inclosed in the casing 41, screw-threaded internally and engaging with the threads 44 of the valve.

35 is an adjusting-handle, and 34 an index for exactly indicating the position of the valve.

35′ is an adjusting-screw for the gland, through which the valve passes.

38 is an air and gas regulating valve consisting of a spindle 39, passing through the gland 40 and provided with an operating-handle 37.

36 is an indicator-segment similar to the index 34.

The velocity of the flow of oil and air can be accurately adjusted by means of these two valves. It will be seen that the amount of oil entering the explosive-chamber will be regulated by the valve 45, which will be opened at each revolution of the valve 49, unless the speed be so great as to depress the arm 20 entirely below the path of the arm 21, in which case the valve will remain closed until the speed decreases sufficiently to allow the action of the governor to raise the arm 20 until it will be struck by the arm 21.

42 is a screen secured within the pipe 25 immediately above the oil-valve 45. The oil passing through the screen will be minutely divided and will thoroughly mix with the air.

The operation of my invention is as follows: Assuming the device is used with gas, I disconnect the rod 24 from the yoke 22, so that the oil-valve 45 may not be affected. The engine being started a supply of gas and air is drawn through the pipes 26 and 27 into the chamber 25′. At this moment the port 49′ in the valve 49 is coincident with the opening 48, so that the supply of gas and air enters the cylinder and is drawn therein by the outward movement of the piston. Upon the return movement of the piston the gas and air are compressed, during which time the valve 49, by means of the intermediate mechanism before described, will have been moved to a position approximately that shown in Fig. 6, so that when the piston starts downward on its second stroke the contact 52 will come into engagement with the contact 53, thereby closing the electric circuit. The continued movement of the valve will almost immediately thereafter break this circuit, causing a spark, which explodes the charge and drives the piston downward. When the piston has reached the end of its second stroke, the valve 49 will have moved to a position to bring the port 49′ into coincidence with the passage 51, so that on the second back stroke of the engine the products of combustion will be expelled through the said passage 51 and thence out of the exhaust-pipe 32. At the same time the governor 16 will, by means of the connecting-rod 19′, link 20, and rod 28′, regulate the supply of air and gas to the engine by means of the regulating-valve 28, so that the speed of the engine will be constant.

When the engine is used in connection with oil, the rod 24 is connected to the yoke 22 and the rod 28′ is disconnected from the link 20. The regulating-valve 28 is opened so as to admit the proper supply of air to the engine.

When burning oil, the operation of the engine is substantially the same as in connection with gas, except that the means for supplying the oil differs from the means for supplying gas—that is to say, as the piston is making its second back stroke and is expelling the products of combustion from the cylinder the finger 21 comes into contact with the inclined end of the link 20 and carries the same backward, so as to open the valve 45. This will allow vaporized oil to pass through the valve 43 into the pipe 25, so as to allow vaporized oil and the proper supply of air to be drawn by suction into the cylinder as the engine commences to make the next outward stroke. The subsequent compression, explosion, and exhaustion of the oil-vapor are the same as when gas is used.

Having now described my invention, what I claim as new therein, and desire to secure by Letters Patent, is as follows:

1. In an explosive-engine, a rotating valve, a driving-shaft, a valve-operating connecting-rod driven from said shaft, supported at its center on cross-heads sliding on ways, a governor operated by the driving-shaft, a pivoted arm capable of being deflected by the action of the governor, a connection between said arm and the supply-valve, and a depending finger movable with the cross-heads and adapted either to strike or miss the extremity of the arm at each stroke of the cross-head, substantially as set forth.

2. In an explosive-engine, a driving-shaft, a pinion on the driving-shaft, a second pinion engaging therewith and rotating at half the speed of the first pinion, a rotating valve, a connecting-rod between the valve and the said second pinion, supported at its center on cross-heads sliding on ways, a governor operated by the driving-shaft, a pivoted arm capable of being deflected by the action of the governor, a connection with the oil-supply valve, a depending finger secured to the point of support of the connecting-rod and adapted to either strike or miss the extremity of the arm at each stroke of the piston, substantially as set forth.

3. In an explosive-engine, the combination of the positively-driven pinion 11, the rotating valve 49, the crank 9 for rotating the same, the rod 10 connecting the crank 9 and pinion 11, and supported adjacent to its center by a cross-head 14, sliding in ways 15, the pivoted arm 20, the oil-valve 45, connections between said pivoted arm and said oil-valve, the governor 16 for adjusting the position of the pivoted arm, and the finger 21 movable with said cross-head for engaging with said pivoted arm, substantially as set forth.

4. In an explosive-engine, an igniting device consisting of a fixed spring-contact, movable contact, carried with the cylinder-valve, and an elastic auxiliary support for the fixed contact, substantially as set forth.

5. In an explosive-engine, an igniting device consisting of a fixed spring-contact, a movable contact carried with the cylinder-valve, an auxiliary support for the fixed contact and extending at right angles thereto through the cylinder-walls, and a spring for said auxiliary support outside of the cylinder-walls, substantially as set forth.

6. In a combined gas and oil engine, the combination with a cylinder, of a valve-chest, a valve therein for regulating the supply and exhaust to the cylinder, a governing-valve for regulating the supply of gas, an oil-valve for regulating the supply of oil, a governor, and connections between said governor and said regulating-valve and oil-valve, substantially as set forth.

This specification signed and witnessed this 21st day of January, 1896.

ADOLPH A. WILLIAMS.

Witnesses:
GEO. F. DAVIS,
FRANK HAYES.