No. 607,903. Patented July 26, 1898.

W. J. WRIGHT.

GAS ENGINE.

(Application filed Apr. 26, 1897.)

(No Model.) 2 Sheets—Sheet 1.

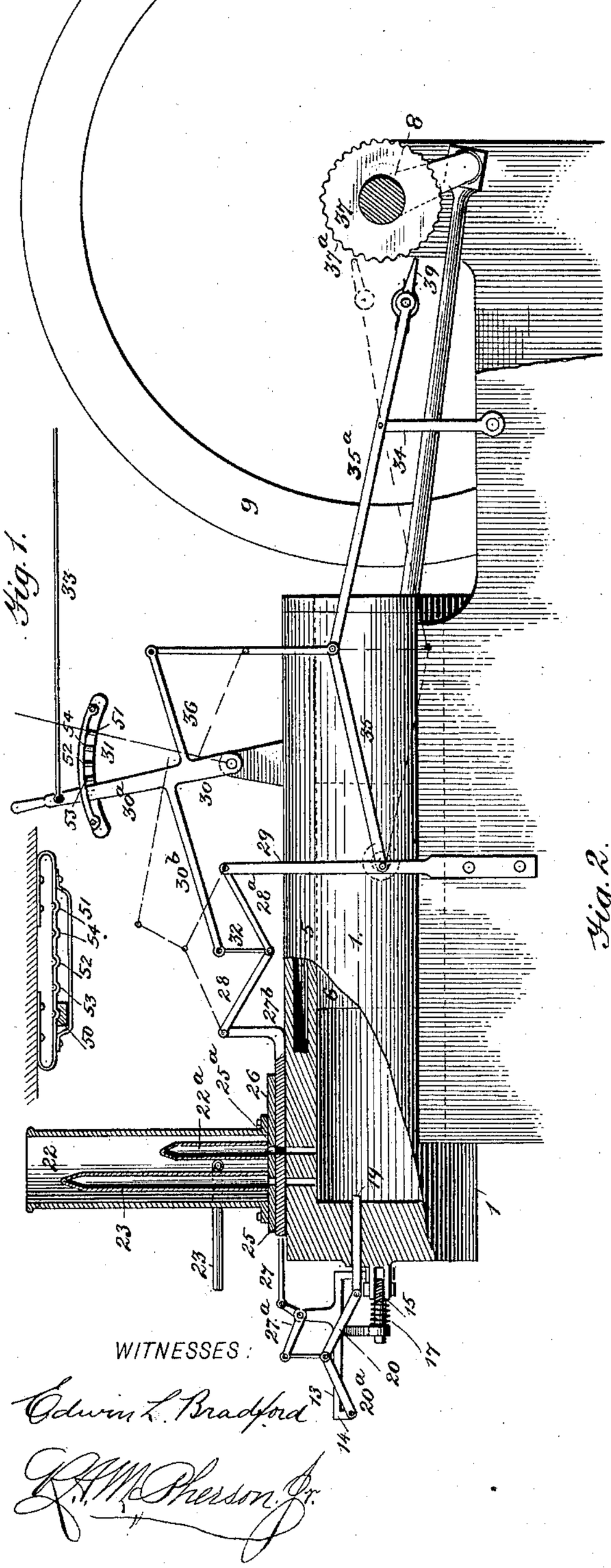

Fig. 1.

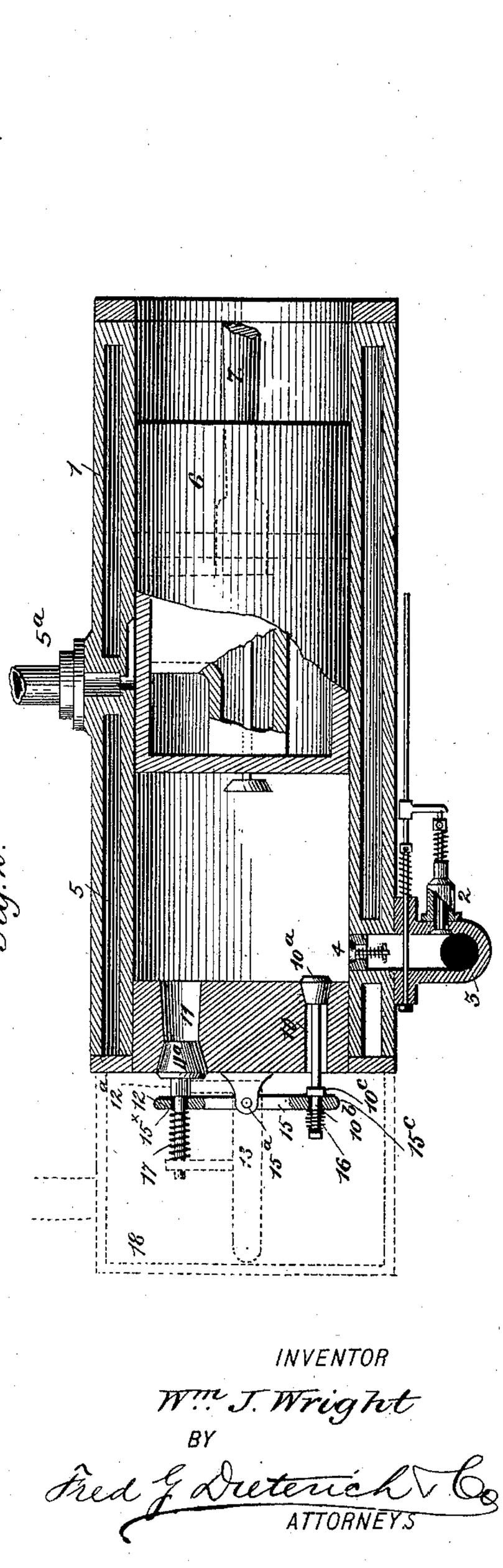

Fig. 2.

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Fig. 3.

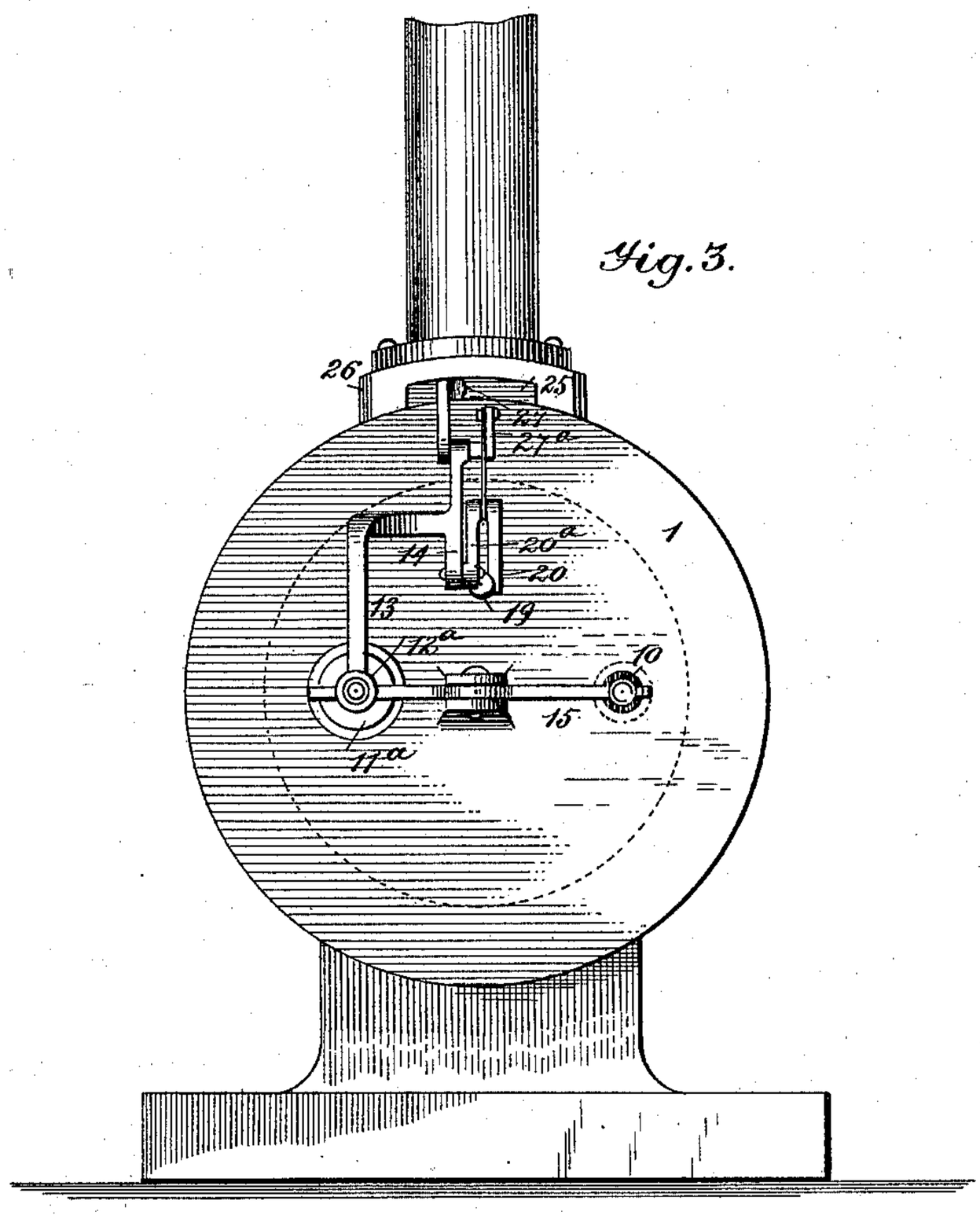


Fig. 4.

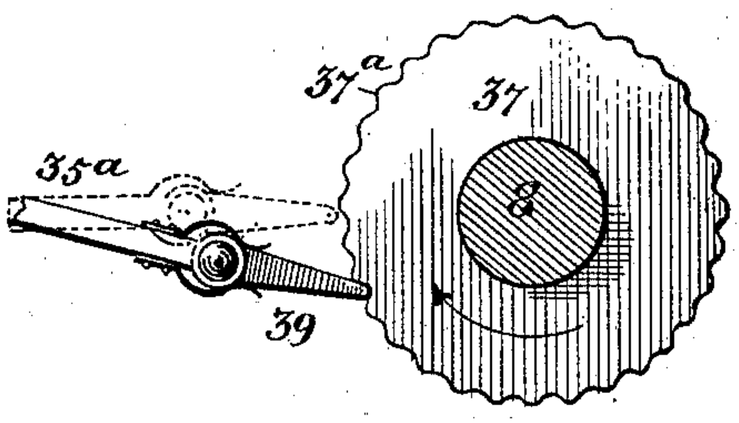
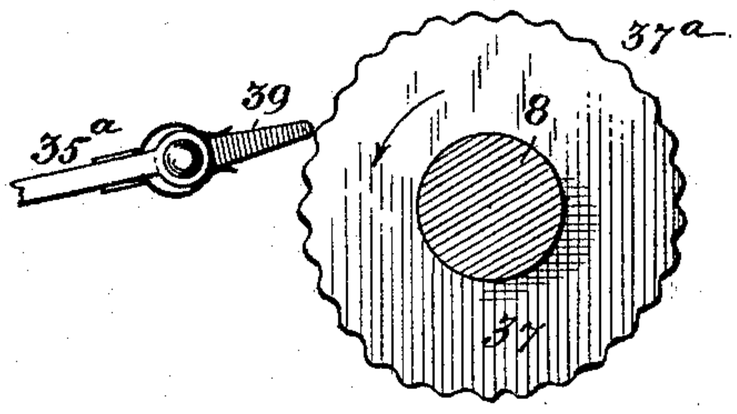


Fig. 5.



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UNITED STATES PATENT OFFICE.

WILLIAM JAMES WRIGHT, OF PITTSBURG, PENNSYLVANIA.

GAS-ENGINE.

SPECIFICATION forming part of Letters Patent No. 607,903, dated July 26, 1898.

Application filed April 26, 1897. Serial No. 633,951. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM JAMES 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.

My invention primarily has for its object to provide a gas-engine (which in its essential features of construction may be of any well-known form) having attachments whereby the motion of the engine can be quickly and effectively reversed without stopping the same.

My invention also seeks to provide a gas-engine having means for automatically reversing the motion and having peculiar and novel igniting means regulated by the operation of the reversing mechanism whereby the explosive mixture can be ignited almost immediately on the beginning of the return or forward stroke of the piston to thereby exert a back thrust on the crank-axle before it passes forward beyond the vertical axis of its circle movement whereby to the more effectively arrest the forward movement of the piston and thereby cause it to quickly move backward or in a reverse direction.

Another object of this invention is to provide certain novel exhausting means governed by a direct action of the piston-head thereon to quickly clear the explosion-chamber of the residuum whereby to admit of a quick filling of such explosion-chamber with a pure mixture of air and gas and thereby provide for a quick and full explosive action of the new mixture to obtain a full explosive force thereof.

My invention also seeks to provide a reversing mechanism or attachments for gas-engines of a very simple and economical construction which can be easily manufactured and which is capable of being connected with the ordinary forms of engines having the reciprocating piston and which can easily be adjusted and set in an operative condition.

With other objects in view, which will hereinafter be referred to, my invention consists, essentially, in the means hereinafter set out generally in the description and specifically in the appended claims, reference being had to the accompanying drawings, in which—

Figure 1 is a side elevation, partly in section, of a gas-engine with my improvements applied. Fig. 2 is a sectional view, on an enlarged scale, illustrating the exhaust-valve mechanism. Fig. 3 is an end view of the quick-exhausting valve devices, and Figs. 4 and 5 illustrate the trip devices for automatically shifting the lever devices to set the main igniting-tube in communication with the combustion-chamber after the movement of the engine has been reversed.

While I have shown my improvements applied to an engine of the White and Middleton type, having a horizontal reciprocating piston, I desire it understood that the same may be applied to other forms of engines, as the change necessary to such engines to admit of the attaching of my improvements are confined entirely to the end in which the explosion chamber or chambers is situated. I also desire it understood that the detailed arrangement of devices effecting the reverse movement of the piston may also be varied and modified, as the detailed construction of the machine to which they are to be attached may make necessary, the only essential relation of the parts being such that the lever-operated devices after being released from a locked position by hand be connected with the drive-axle or a rotary member operated thereby, whereby the movement thereof will serve to automatically set the said lever devices in position to operate the piston in the usual manner.

Referring now to the accompanying drawings, 1 indicates the cylinder, provided with the usual gas and air inlets 2 3, automatically-operated valve devices 4, the cooling-jacket 5, and the foul-mixture-exhaust devices 5^a, through which the foul mixture escapes when the machine runs in the ordinary manner. 6 indicates the piston, 7 the rod, 8 the crank-shaft, and 9 the fly or balance wheels, all of which may be of any approved construction, excepting the rear end of the combustion-chamber, which has a special form of exhaust valved openings, the construction of which is best illustrated in Fig. 2, by reference to which it will be seen two exhaust-openings 10 11 are provided, one of which, 11, is of a larger diameter than the other, 10. These openings have valve-seats arranged to receive reversely-operating valves

10ª and 11ª—*i. e.*, the valve 11ª is arranged to open outward by an extreme piston-head-action pressure of the exploded mixture as it is compressed by the backward movement of the piston and by the direct action of the piston-head when the parts are set for a quick exhaust, while the other opens inward and is controlled by the outward movement of the valve 11ª.

The valve 11ª has a shank 12, provided with an enlargement 12ª adjacent its rear face, to which is connected a bracket 13, having an angle member 14 at the outer end, the purpose of which will presently appear.

By connecting the bracket 13 to the valve-shank such bracket will have a limited free movement when the valve is opened by the piston action in a manner hereinafter described.

15 indicates a rock-lever pivotally secured at 15ª to the rear of the cylinder, one end being slotted at 15ˣ to move freely on the shank 12, while its other end is also slotted to freely move on the shank 10ᵇ of the valve 10ª, which is also provided with an enlarged hub 10ᶜ, against which the end 15ᶜ of the lever is held by the spring 16, the other end of the said lever being held against the collar 12ª by the spring 17, the action of spring 17 on the lever serving to force the end 15ᶜ thereof in a position to normally hold the lower valve closed, while the spring 17 performs the same service for the valve 11ª.

The object in arranging the double exhaust-valves in the manner shown is to provide for a uniform and quick exhaust of the exploded mixture when it is desired to reverse the engine, which operation is effected by a direct action of the piston-head and the compression of the exploded mixture, which will serve to force the valve 11ª outward, which in turn forces the valve 10ª inward, and in consequence opens the smaller exhaust-port, thereby admitting of a positive exhaust of the residuum before the piston starts back to draw a pure mixture into the combustion-chamber and before it starts back to compress the same preparatory to its explosion, thereby greatly increasing the explosive power, as every charge is practically an entirely fresh one.

The valve devices at the rear of the cylinder in practice are cased in, as indicated at 18, such casing being provided with an off-take for the foul mixture.

19 indicates a short plunger-rod held to slide in a stuffing-box in the rear wall of the cylinder. This rod is pivotally connected to a link 20, which in turn is connected to a similar link 20ª, pivotally connected to the end of the angle member 14 of the bracket 13.

22 indicates an igniting-chimney which has an igniting-tube 22ª of the usual height and is connected with a gas-supply pipe 23 or other source of heat. This igniting-tube 22ª is of a somewhat shallow height and has practically the ordinary position relatively to the combustion-chamber, so as not to explode the mixture until the piston has fully compressed the same. 23 is another igniting-tube, held within the chimney 22 or a separate chimney, if desired. These tubes are arranged to be alternately brought into communication with the combustion-chamber by the valve mechanism presently described.

Both the igniting-tubes connect with a casing 26, held on the top of the cylinder, in which is held to slide a valve-plate 25, having an opening 25ª, which when the valve is in one position registers with the short igniting-tube and when in the other position registers with the long or inner tube, the action of such valve being to alternately bring either igniting-tube in communication with the explosion-chamber. A rod 27 is connected to the rear end of the valve-plate, which has a crank member 27ª, which connects with the arm 13, as most clearly shown in Fig. 1, such plate 25 also having a forwardly-projecting rod 27ᵇ, to which is pivotally joined a second set of link-arms 28 28ª, which has the end 28ª pivotally connected to the upper end of a standard 29, secured to the frame of the engine.

30 indicates an angle-lever which has a vertical arm 30ª, adapted to engage detent devices 31, provided with end spring-catches 50 51, a central catch 52, and intermediate catches 53 54, whereby the lever can be set at different positions. The horizontal member 30ᵇ has a pendent arm 32, which pivotally connects with the meeting ends of the members 28 and 28ª, as shown.

33 indicates an operating-rod for setting the lever 30, which extends forward to a convenient point for operation.

34 indicates a swinging lever arranged parallel with and in line with the standard 29, which is connected to the lever 29 by the double pivoted link members 35 35ª, the meeting ends of which are also pivotally connected to a bell-crank arm 36, in turn fixedly connected to the lever-arm 30ª at a point above its fulcrum, as shown. One end of the arm 35ª is extended and has a pivoted tripper 39, which is adapted to engage the corrugated periphery 37ª of a disk 37, secured upon or rotated by the drive-shaft, such tripper being so arranged as to engage with the corrugations of the disk 37, when the rotation is reversed and moved to a position to automatically set the lever mechanism to a reversing operation and cut out the large igniting-tube and bring the small tube in communication with the combustion-chamber after the movement of the engine has been reversed.

The manner in which my improvements operate in connection with the engine is best explained as follows: When the parts are in the position shown in Fig. 1, the piston moves to its full stroke rearward, the rod being at this time drawn back to a position out of reach of the piston-head, the short igniting-tube being at this time in condition to ignite the mixture and the tripper 39 out of engage-

ment with the disk 37, and thereby leave the several lever devices in an inoperative position. When operating in this manner, the exploded mixture passes out of the regular exhaust 5^a in the usual manner. To reverse the movement of the engine, the operator pulls the lever 30^a over to the center catch 52, which moves the several lever devices in such a manner as to bring the links 20 and 20^a in a straight line to force the rod 19 some distance into the explosion-chamber, so that the piston-head will engage the rod, push it back, and thereby quickly exhaust the residuum of the last explosion through the valve-openings 10 11 and at the same time shift the valve 25 to bring the opening 25^a in line with the tall igniting-tube, such movement of the lever also bringing the trigger in contact with the corrugated disk to ride freely thereon, as shown in Fig. 4. The valves, with the bracket, are brought to their normal position by the valve-springs as soon as the piston recedes. At this point it should be stated the intermediate detent-catches 53 54 are provided to stop the movement of the lever 30^a at points between the central and end catches, so as to make but a partial throw of the lever devices and the valve 25, and thereby cut out both tubes from the combustion-chamber and leaving the said chamber supplied with an explosive mixture ready to be ignited whenever the valve 25 is shifted sufficiently to bring either igniting-tube in communication with the said combustion-chamber. As the large tube has a greater heat area than the shallow tube, it is manifest that it will the more quickly ignite the mixed charge. Thus after the piston has moved backward to force out the exploded mixture and has traveled forward its full induction stroke, owing to the relation of the large igniting-tube to it the charge will be exploded before the piston has traveled far enough back for the crank to pass the vertical axis of its circle, the explosive force thus imparting a backward propulsion on the piston, which though it may not be sufficient to effect a positive reverse motion to the engine at the first retarding-explosion will slow up the momentum sufficient to allow the next successive retarding-explosions to cause the drive-shaft to move in a reverse direction. At the first reverse movement of the shaft the trigger will become fixedly engaged with the disk 37^a and turned to a reverse position, as shown in dotted lines in Fig. 4. This operation will force the several lever members 35 35^a 28 28^a to assume a position reverse to that shown in Fig. 1 (see dotted lines) and through them, movement of the lever 30, and the slide-plate 25 bring the short igniting-tube in operative condition and at the same time restore the rod 19 and members 20 and 20^a to their normal position, and thereby permit the piston to run its full and uniform stroke in the ordinary manner. To again reverse the motion of the engine-shaft, the several lever devices are again adjusted to effect the same operation of reversing as before, the lever 30 being set in an opposite direction.

While I have shown my devices applied to an engine in which the exhausting is accomplished on the return or back stroke of the piston, the same may be used in connection with a cylinder having the exhausting means arranged at any point through which the residuum is drawn off in the regular rotation of the crank-shaft in either direction.

In all forms of machines to which my improvements are applied the supplemental exhaust-valves are so arranged that the prematurely-exploded mixture is exhausted the moment the piston reaches the end of its forward stroke, (when the crank of the drive-axle has forced the piston to the limit of its forward stroke.) Thus the effect of the exploded mixture is that of a retarding agent only during the time the motion of the drive-shaft is being continuously slowed up, it being understood, however, that as soon as the speed has been sufficiently retarded a premature explosion will occur which at once checks the piston, prevents its passing the vertical center, and in consequence, through the expansion force of the said prematurely-exploded charge, the motion of the engine is reversed, such last prematurely-exploded charge at this time escaping through the regular exhaust. When it is desired to effect the reverse movement, the shifting devices are so set that the pin 19 projects into the cylinder so the piston engages it every time it reaches the limit of its forward thrust and through it opens the valves 10^a and 11^a.

I desire it understood I do not confine my improvements to an engine constructed as shown, nor do I limit myself to the particular form of lever and shifting devices shown, as these may be modified and varied without departing from the scope of the appended claims. Furthermore, the supplemental exhaust-valves may be connected to any part of the combustion chamber or cylinder as the character of the engine may make most desirable.

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

1. The combination, with the working cylinder and piston, the working agent supply and exploded mixture regular exhaust, of a reversing mechanism comprising means for exploding the charge on the inward movement of the piston, and exhausting the exploded mixture as the piston reaches the limit of its stroke, all being arranged substantially as shown whereby, when the piston has been sufficiently slowed up, such premature explosion will serve to drive the piston back and reverse the motion of the crank-shaft.

2. In a gas-engine, having the usual exhaust and supplemental exhausting valves in the combustion-chamber, shifting devices con-

nected with the supplemental valves, including a member adapted to be projected in the path of the full back stroke of the piston, igniting means, adapted to ignite at different points of the combustion-chamber, and valve devices for such igniting means, of lever mechanism connecting such valve devices and the shifting devices, said lever mechanism including a hand-operated member for setting the lever mechanism, igniting-valve and piston-engaging member in one direction and members adapted to be connected with and operated by the reverse rotation of the drive-shaft to automatically reverse the movement of the several lever mechanisms after the same have been set by hand, all being arranged substantially as shown and for the purposes described.

3. The combination with the cylinder, the piston, the crank-shaft and the exhausting means at the rear end of the cylinder, of a shifting device having a member projected into the end of the cylinder, means for moving such member in position to be engaged by the piston before it reaches the limit of its rear stroke, and igniting-tubes disposed at a point near the front end of the combustion-chamber, having a cut-off valve and means for shifting such valve at a predetermined time, automatically operated by the movement of the crank-shaft, all being arranged substantially as shown and described.

4. In a gas-engine, having a reciprocating piston and supplemental exhaust-valves, of a duplex igniting means, consisting of two igniting-tubes, a cut-off valve mechanism common to both, but arranged when shifted in alternate directions to alternately place such tubes in communication with the cylinder, shifting means connected to the valves and the igniting-tube cut-off, a lever mechanism, connected to the said cut off valve having a trip device adapted to be automatically moved into a piston engagement with a part of the crank-shaft, said lever devices being hand-operated to one position and automatically operated by the movement of the said trip device to another position substantially as shown and for the purposes specified.

5. In a gas-engine, the combination with the cylinder, the igniting devices and the piston-shaft, said cylinder having a pair of exhaust-ports, said ports having reversely-arranged valve-seats, one of such ports being of a larger diameter than the other, of the oppositely-movable valves for engaging the ports the larger valve being movable outward, means for holding such valves to their seats, and a connecting mechanism joining such valves, whereby as the larger valve is moved outward by an abnormal compression of the exploded mixture or by direct piston action, the smaller will be moved inward to open its ports, all being arranged substantially as shown and described.

6. The combination with the cylinder, the exhaust ports and valves, the piston and the shaft, of a double set of igniting devices, one tube of which is in advance of the other and made of a greater height, whereby to retain a greater heat volume, a cut-off for alternately bringing either tube into communication with the combustion-chamber and shifting devices for positively opening the exhaust-valves and for setting either of the igniting devices into communication with the combustion-chamber, as specified.

7. A reversing mechanism for gas-engines, comprising means for positively exhausting the explosion-chamber, and for exploding the new mixture before the piston reaches its full rear stroke, and connections operated by the crank-shaft for effecting a continuation of the reverse movement substantially in the manner and for the purposes described.

8. The combination with a gas-engine having the usual cylinder, piston, air and gas inlets, and means for exhausting the exploded mixture, and a reversing mechanism, comprising means for exploding the mixture on the inward motion of the piston, before its crank-axle reaches its vertical axis, and means for exhausting the prematurely-exploded mixture as it is compressed by the continuation of the impeded forward stroke of the piston, as specified.

9. A gas-engine provided with shifting devices for setting the exhaust-valves and the igniting devices, whereby to effect a reverse movement of the piston before it reaches the limit of its forward stroke, the said shifting devices including means for holding such valves at intermediate points whereby to close off the igniting devices from the cylinder and maintain a charge within the cylinder, substantially as shown and for the purposes described.

WILLIAM JAMES WRIGHT.

Witnesses:
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