R. T. NEWTON & I. M. UPPERCU.

INTERNAL COMBUSTION OR EXPLOSIVE ENGINE.

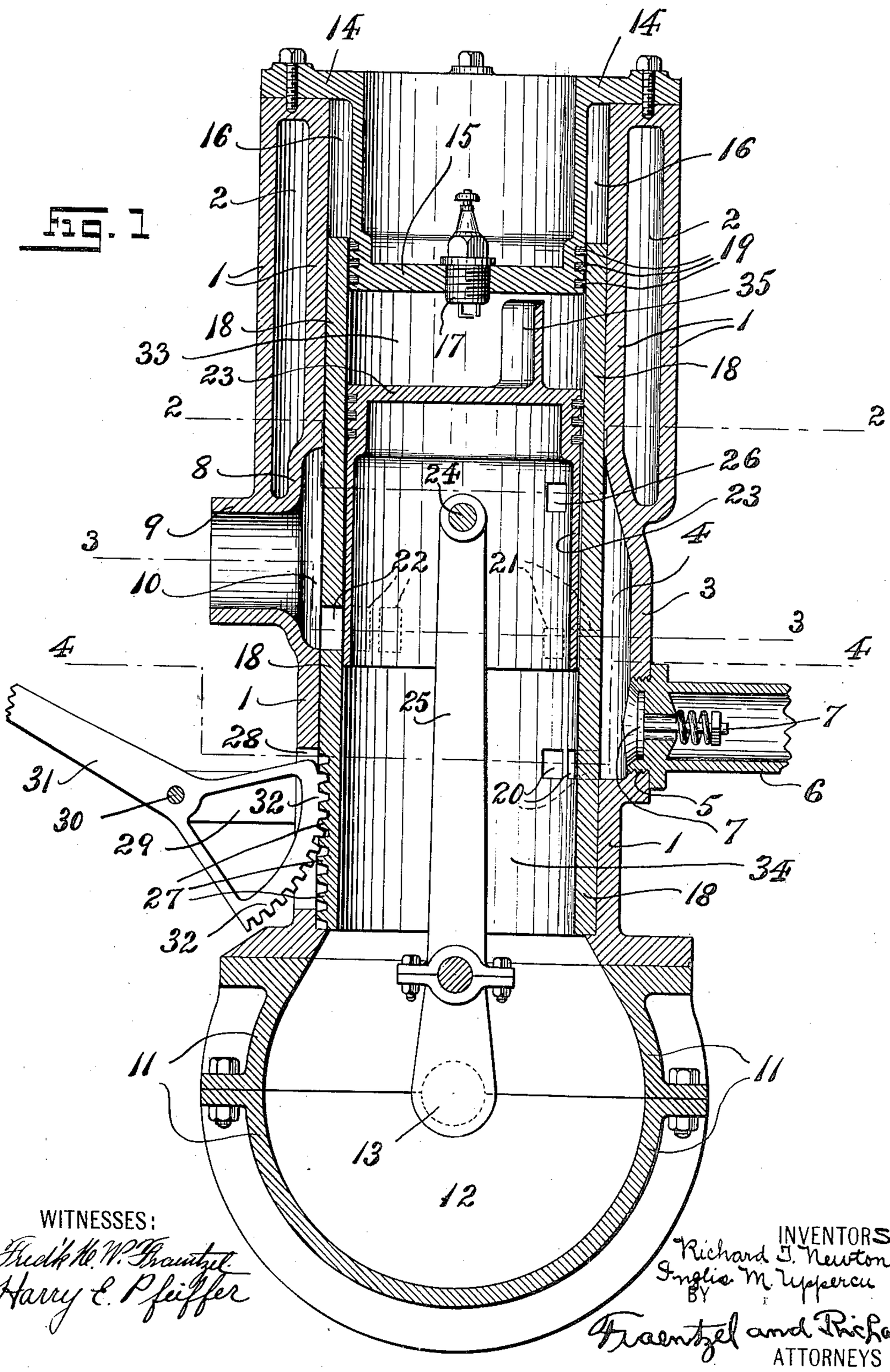
APPLICATION FILED NOV. 27, 1912.

1,125,375.

Patented Jan. 19, 1915.

3 SHEETS—SHEET 1.

Fig. 1



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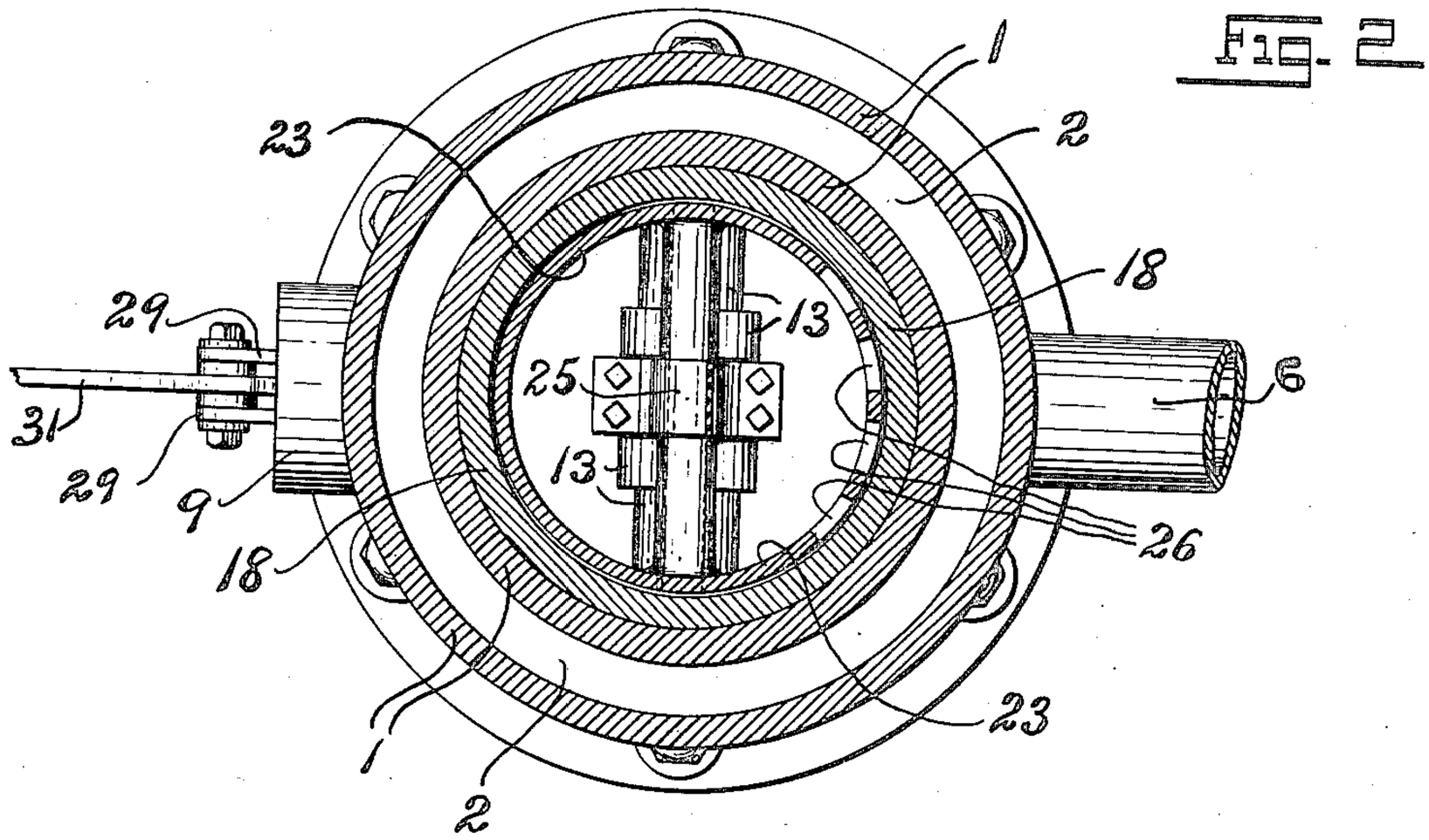

Fig. 2

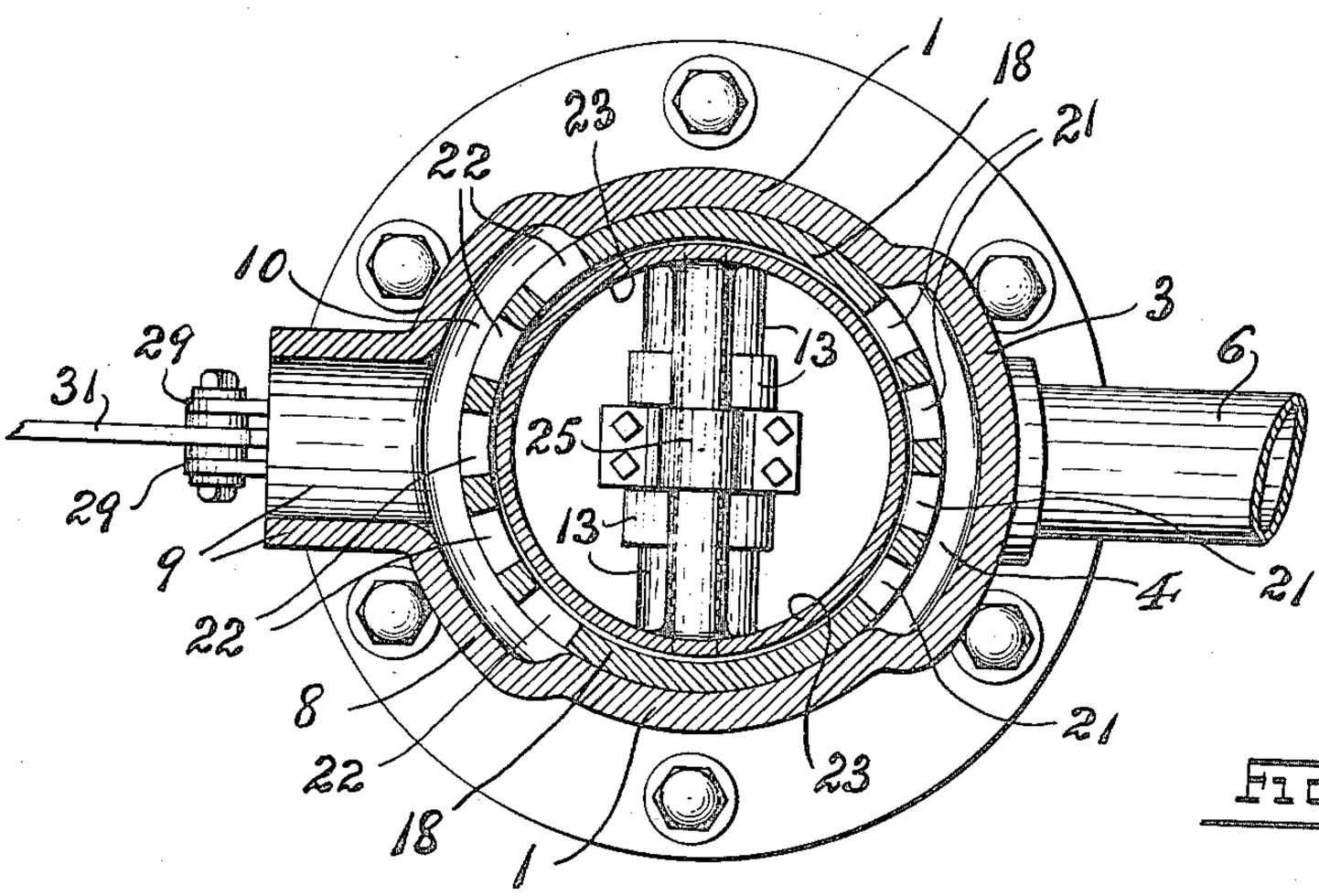

Fig. 3

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3 SHEETS—SHEET 3.

Fig. 4

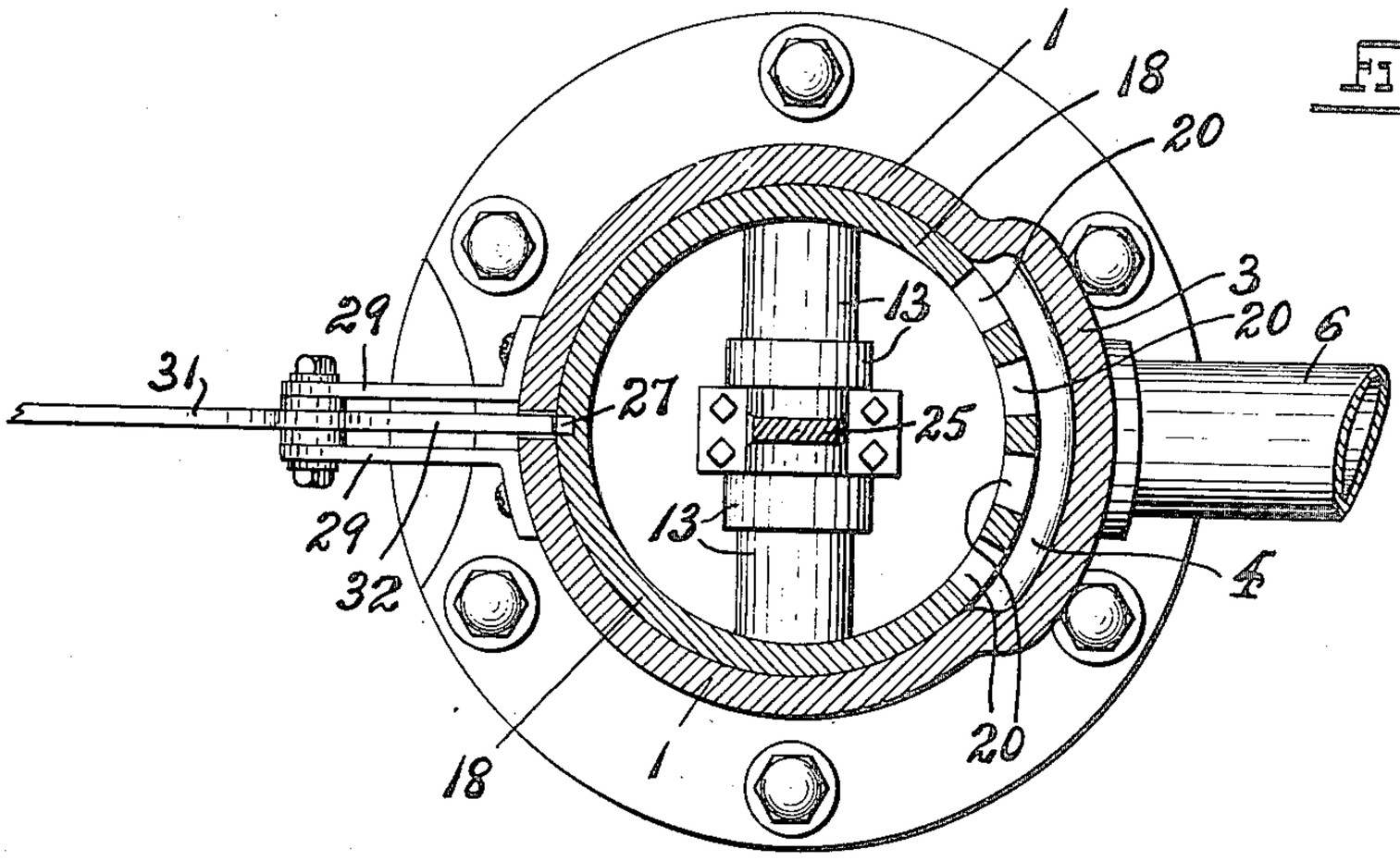
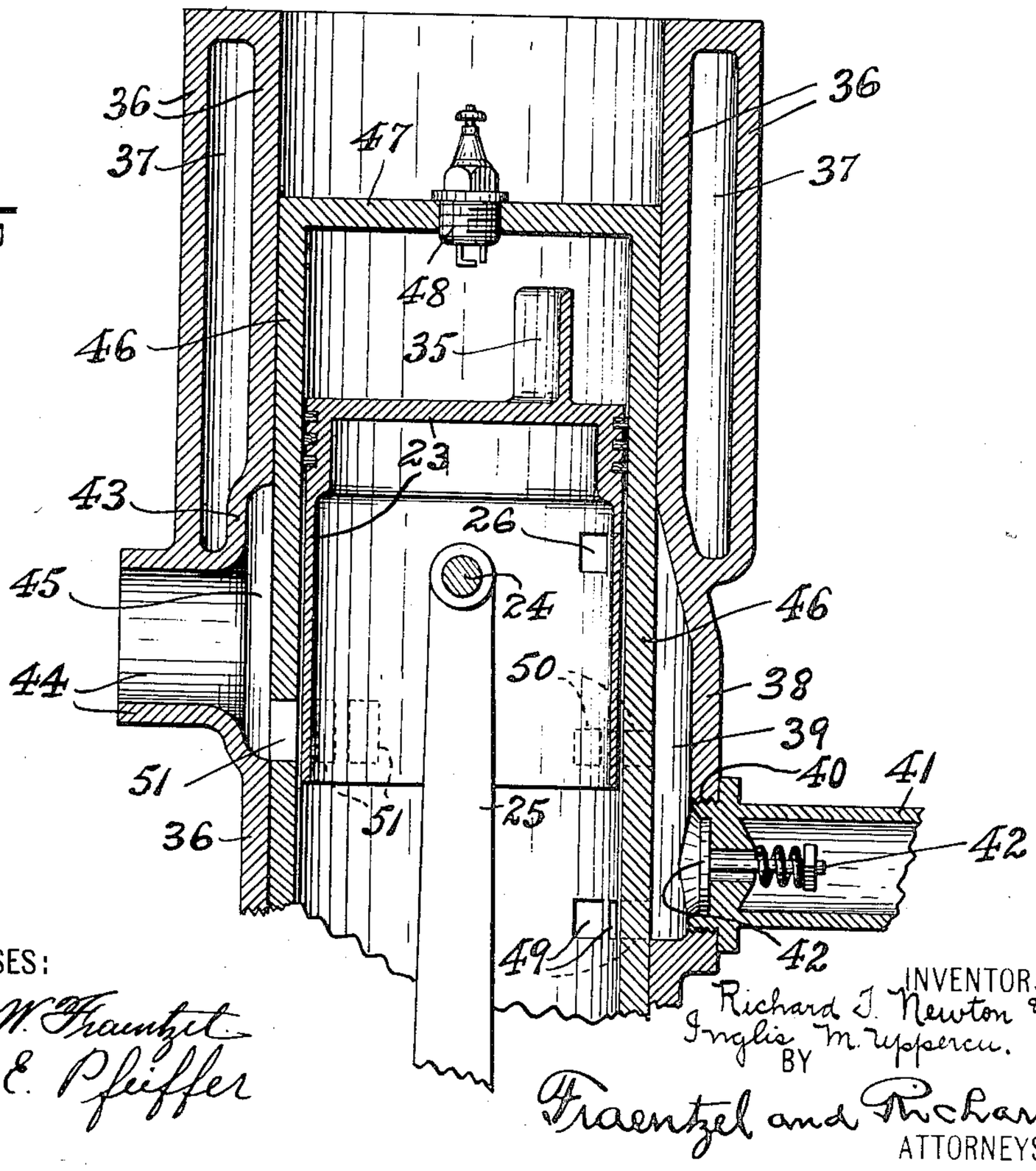


Fig. 5



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UNITED STATES PATENT OFFICE.

RICHARD T. NEWTON AND INGLIS M. UPPERCU, OF NEWARK, NEW JERSEY.

INTERNAL-COMBUSTION OR EXPLOSIVE ENGINE.

1,125,375. Specification of Letters Patent. Patented Jan. 19, 1915.

Application filed November 27, 1912. Serial No. 733,775.

To all whom it may concern:

Be it known that we, RICHARD T. NEWTON and INGLIS M. UPPERCU, citizens of the United States, residing at Newark, in the county of Essex and State of New Jersey, have invented certain new and useful Improvements in Internal-Combustion or Explosive Engines; and we do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to characters of reference marked thereon, which form a part of this specification.

The present invention has reference, generally, to improvements in internal combustion or explosive engines; and, the invention relates, more particularly, to improvements in the construction of explosive engines of the two-cycle type whereby a simple and easily controlled means is provided for regulating and varying the volume of gas admitted to the explosion chamber, at the same time regulating and varying the compression of said gas in the explosion chamber, and thus automatically regulating and varying the force of the explosion and causing the engine to run at a desired speed. By such means a wide scope of speed and power-regulation may be obtained with a very economical expenditure of gas.

The invention has for its principal object to provide a novel construction of explosive engine having a cylinder-casing, a cylinder movably related to said cylinder-casing and the piston operating in said cylinder, said cylinder having valve-ports permitting the entrance and exit of gas into and out of said cylinder, said valve-ports being arranged to be opened and closed by the movements of the piston, and all serving to accomplish the purposes above mentioned.

Other objects of the present invention not at this time more particularly enumerated will be clearly understood from the following detailed description of the same.

With the various objects of the present invention in view, the said invention consists, primarily, in the novel construction of explosive engine hereinafter set forth; and, the invention consists, furthermore, in the novel arrangements and combinations of the various devices and parts, as well as in the details of the construction of the same, all of which will be more fully described in the following specification, and then finally embodied in the clauses of the claim which are appended to and which form an essential part of this specification.

The invention is clearly illustrated in the accompanying drawings, in which:—

Figure 1 is a longitudinal vertical section of an explosive engine made according to and embodying the principles of the present invention. Fig. 2 is a horizontal transverse section of the same, taken on line 2—2 in said Fig. 1, looking downward. Fig. 3 is another horizontal transverse section of the same, taken on line 3—3 in said Fig. 1, also looking downward. Fig. 4 is still another horizontal transverse section of the same taken on line 4—4 in said Fig. 1, also looking downward. Fig. 5 is a detail longitudinal vertical section of a slightly modified construction of explosive engine made according to and embodying the principles of the present invention.

Similar characters of reference are employed in all of the above described views, to indicate corresponding parts.

Referring now to the said drawings, the reference-character 1 indicates a cylinder-casing, the same having the internal spaces 2 within its walls which provide for the circulation of water, or other cooling medium therethrough, for the purpose of keeping said cylinder-casing and the parts arranged within the same cool during the operation of the engine.

Formed in a proper location on one side of said cylinder-casing 1 is a boss or bellied portion 3 providing an internal space which forms a transfer port or by-pass 4. Said boss or bellied portion 3 is provided with an internally screw-threaded opening 5 by means of which a gas-intake pipe 6, provided with a suitable puppet-valve 7, is connected in communication with said transfer-port or by-pass 4. Formed in proper location on the other side of said cylinder-casing 1 is a boss or bellied portion 8 provided with an outwardly extending tubular extension 9 which communicates with its internal space or passage 10 so as to provide a gas-exhaust or outlet. Connected with the lower flanged end of said cylinder-casing 1 is a crank-casing 11 providing the interior chamber 12. Journaled in said crank-casing 11 is a suitable crank-shaft 13.

Secured to the upper end of said cylinder-casing 1, by any suitable means, is a cylin-

der-head cap 14. Said cylinder-head cap 14 is provided with a centrally disposed downwardly extending cylinder head 15. Said cylinder head 15 is of smaller diameter than the diameter of the bore of said cylinder-casing 1, so that as the same penetrates within said cylinder-casing, a space 16 is provided between the side-walls of said cylinder-head and the walls of said cylinder-casing. Said cylinder-head 15 is preferably made hollow in form to reduce its weight. Centrally disposed in said cylinder-head 15, so as to penetrate through to the under or inner side thereof, is a spark-plug or terminal 17 adapted to be connected electrically with a suitable ignition system, whereby an exploding or firing spark may be produced to explode the charge of gas when operating the engine.

The reference-character 18 indicates a movable cylinder of tubular or hollow cylindrical form, the same being movable vertically within said cylinder-casing 1. The upper end of said movable cylinder 18 is slidably mounted upon or associated with the side-walls of said cylinder-head 15 in such a manner that the said cylinder-head 15 closes the upper end of said movable cylinder 18 at all times without regard to the position of said movable cylinder, as vertically adjusted. Mounted upon the side-walls of said cylinder-head 15 are suitable packing-rings 19 which operate to provide a gas-tight joint between said cylinder-head and said movable cylinder 18 as movably related thereto. On one side, said movable cylinder is provided in its walls with a series of lower port-openings 20 and a series of upper port openings 21, the same communicating with the transfer-port or by-pass 4. On the other side of said movable cylinder are properly located in its walls a series of exhaust port-openings 22. Slidably mounted within said movable cylinder 18 is a hollow piston 23, the same being provided with the transverse piston-pin 24 upon which is journaled one end of a connecting rod 25, the other end of which is journaled upon said crank-shaft 13, whereby said piston is operated. The side-walls of said piston are provided with a series of port-openings 26 which are adapted, at proper times during the reciprocal movements of said piston, to register with the lower port-openings 20 of said movable cylinder.

Formed upon one side of said movable cylinder 18, or otherwise affixed thereto, adjacent to its lower end are a series of rack-teeth 27. Said cylinder-casing 1 is provided with an elongated opening 28 which registers over said rack-teeth 27, and which permits access to said rack-teeth from the exterior of said cylinder-casing. Secured to the side of said cylinder-casing 1, adjacent to said opening 28, are a pair of bracket-arms 29 between which is journaled upon the fulcrum 30 a lever-member 31. Connected with the inner end of said lever-member 31 is a segmental gear 32, the teeth of which mesh with said rack-teeth 27 of said movable cylinder 18. When said lever-member 31 is operated the oscillation of said segmental gear 32, operating upon said rack-teeth 37, causes the movable cylinder 18 to be raised or lowered thereby shifting the position of its several series of port-openings with relation to the movement of said piston 23, so that the latter uncovers or opens said port-openings at an earlier or later period in the movement of said piston, as and for the purposes to be subsequently described. The said piston 23 divides the interior of said movable cylinder 18 into two chambers, a combustion or firing chamber 33 above the piston and a chamber 34 which combines with the interior chamber 12 of said crank-casing 11 to provide a gas-intake chamber. Secured to the upper surface of said piston 23 is a baffle or deflector-plate 35 which deflects the incoming gas to the upper end of the combustion or firing chamber.

Referring now to Fig. 1 of the drawings, the movable cylinder 18 is shown moved to its lowest adjusted position, thereby positioning the port-openings so that the same are uncovered or opened by the position at the lowest point of downward movement of the piston, thus allowing a full or maximum charge of gas to be delivered to the combustion or firing chamber, and timing the exhaust or discharge of the exploded gas at the end of the full working or power stroke of the piston. When the movable cylinder is thus positioned the engine works in the following manner: The piston moves upward creating a vacuum in the intake-chamber beneath the piston, so that when the piston passes the port-openings 20, a charge of gas is drawn from the intake-pipe 6 through the valve 7 into the transfer-port or by-pass 4, and thence through said port-openings 20 into said intake-chamber. As the piston descends, the gas in said intake-chamber is compressed and said port-openings 26 in the piston-walls are carried into registration with said port-openings 20 of said movable cylinder 18, thereby permitting the gas compressed within said intake-chamber to flow out into said transfer-port or by-pass 4, and thence through said upper port-openings 21 in said movable cylinder into the combustion or firing chamber, said upper port-openings having been uncovered or opened by the piston when the latter reaches the bottom of its downward stroke. At the beginning of the upward stroke of the piston, said piston passes over and closes the said upper port-openings 21 thus shut-

ting off communication between said intake-chamber and said firing chamber through said transfer-port. At the same time said piston also passes over and closes said exhaust port-openings 22, thus providing for the maximum compression of the full charge of gas in the explosion chamber. Said gas being then exploded forces said piston down on the power stroke, the momentum of the fly wheel on crank-shaft carrying the piston upward, and the cycle of operations is repeated with every up and down reciprocation of the piston after the manner of two cycle engines.

Assuming that it is desired to reduce the quantity of gas delivered to the explosion or firing chamber to a minimum and to reduce also to a minimum the compression of the same in said firing chamber, the lever-member 31 is operated to shift or move upwardly said movable cylinder 18, to the limit of its upward movement, thus changing the position of said port-openings 20 and 21, and shifting or advancing the exhaust-port openings 22 with relation to the reciprocating movements of the piston. The changed position of said movable cylinder 18 advances the position of the exhaust port-openings so that the same will be uncovered or opened at a far earlier period in the downward movement of the piston; and, in like manner, the delivery of gas through the port-openings 20 and 21 and the transfer port 4 is varied. When the movable cylinder is thus positioned the engine operates in the following manner. The piston moves upward creating a vacuum in the intake-chamber beneath the piston, so that when the port-openings 26 of the piston register with the upper port-openings 21 of said movable cylinder 18 a charge of gas is drawn from the intake pipe 6 through the valve 7 into said transfer-port 4 and thence through said registered port-openings 21 and 26 into said intake-chamber. As the previous gas charge in the explosion chamber is fired the piston descends, but reaches the exhaust-port openings 22 long before the piston completes its down stroke, thus opening the same at an advanced period of time and freeing the force of the explosion and burnt gases through the exhaust. As the piston descends under such explosive impulse the gas in the intake chamber is compressed, but does not pass into the explosion chamber through the port openings 26, 20, 21 and by-pass or transfer port 4 on the downward stroke, because the piston has not descended far enough to compress the gas in said intake-chamber sufficient to overcome the pressure resulting from the explosion in the firing chamber; but, as the piston continues to descend said exhaust-port-openings continue to remain open allowing the explosion chamber to scavenger itself, this scavenging continuing as the piston begins to rise again. The piston on its return or ascending movement again carries said port-opening 26 of the piston into registration with the lower port-openings 20 of the movable cylinder 18 whereby the gas from the intake chamber passes into said transfer-port 4, and thence through said upper port-openings 21 of said immovable cylinder 8 into said explosion chamber. When the gas is thus delivered, however, the piston has moved upward for a considerable portion of its stroke, and, therefore, is traveling fast so that the cutoff or closing of the port openings is rapid, and also it follows since the piston has moved upward some distance the volume of the explosion chamber, or the space therein for the reception of the gas has been greatly reduced from its full capacity, hence less gas is delivered to said explosion chamber. By the time the transfer-port communication is cut off or closed, the exhaust port-openings 22 are also closed so that the compression of the gas delivered to the chamber does not begin until after the piston has moved some distance on the return stroke, and therefore the compression stroke is reduced and consequently the compression of the gas is not as heavy. In other words, the operative or power stroke of the piston on its descent, and the compression stroke of the piston on its ascent has been greatly shortened and reduced to a minimum. Thus it will be apparent that the volume of gas delivered to the firing chamber is reduced, the compression thereof is lessened, and the power stroke of piston shortened, all of which accomplishments have the effect of throttling down the engine to decrease power and expediture of gas.

It will of course be evident that the movable cylinder 18 may be moved and positioned at any point intermediate of the above described maximum and minimum, whereby a variation of any intermediate degree of the results above described may be obtained. The lever-member 31 for operating said movable cylinder may be operated by hand, or, if desired, the same may be connected with any well known form of mechanical governor, whereby the throttling-like effects of shifting said movable cylinder 18 may be secured automatically.

Referring now to Fig. 5 of the accompanying drawings, there is illustrated therein a slightly modified construction of explosive engine embodying the principles of the present invention, and operating in the same manner to produce the effects above described. In this construction, the reference-character 36 indicates a cylinder-casing, the same having the internal spaces 37 within its walls which provide for a cooling water-

circulation. Said cylinder-casing is provided in proper location with the boss or bellied portion 38 providing the internal transfer-port or by-pass 39. Said boss or bellied portion is also provided with the internally screw-threaded opening 40 by means of which a gas-intake pipe 41, provided with a suitable poppet-valve 42, is connected in communication with said transfer-port or by-pass 39. Formed upon the opposite side of said cylinder-casing is another boss or bellied portion 43 provided with an outwardly extending tubular extension 44 which communicates with its internal space or passage 45 so as to provide a gas-exhaust or outlet. Said cylinder-casing is preferably open at the upper end, although a cap-plate may be secured across the said opening, if desired. The reference-character 46 indicates a movable cylinder, the same being slidably disposed within said cylinder-casing so as to be capable of vertical movement therein. Said movable cylinder 46 is provided at its upper end with a head-plate 47, or closing member, which may be formed integrally therewith, or affixed thereto so as to form a separable part. Secured in said head-plate is the spark-plug 48 which is connected electrically in a suitable ignition system. Said movable cylinder is provided with the suitably located lower port-openings 49 and the upper port-openings 50 in one side, which communicate with said transfer-port or by-pass 39, and on the other side with the exhaust port-openings 51 which communicate with said exhaust outlet of the cylinder-casing. The piston operating in said movable cylinder 46 is the same in construction as that shown in the engine construction illustrated in Figs. 1 to 4 inclusive of the drawings, and the same reference letters employed therein may be used to refer to its detail parts. The means for operating the said movable cylinder 46 is also the same as shown and described in connection with the engine-construction illustrated in Figs. 1 to 4 inclusive. By moving said movable cylinder 46 upward from its normal lower position, the positions of the gas-delivery port-openings and the gas-exhaust-port-openings may be advanced with relation to their opening and closing movements, as governed by the movement or strokes of said piston, thereby accomplishing the results of engine-operation hereinabove already described.

We are aware that some changes may be made in the general arrangements and combinations of the several devices and parts, as well as in the details of the construction of the same, without departing from the scope of the present invention as set forth in the foregoing specification. Hence, we do not limit our present invention to the exact arrangements and combinations of the various devices and parts as described in the said specification, nor do we confine ourselves to the exact arrangements or details of the construction of the said parts as illustrated in the accompanying drawings.

We claim:

1. In an explosive engine, a cylinder-casing, a crank-casing connected with one end of said cylinder-casing, a longitudinally movable cylinder slidably disposed within said cylinder-casing, a piston adapted to reciprocate in said movable cylinder, means connected with said cylinder-casing providing a transfer-port, said movable cylinder being provided with a lower port-opening and an upper port-opening, means for introducing a charge of gas beneath said piston, said piston having a port adapted to register with said lower port-opening of said movable cylinder during the movement of said piston to permit the charge of gas to flow from beneath said piston through said transfer-port and through said upper port-opening of said movable cylinder into the interior of said movable cylinder above said piston, means connected with said cylinder-casing providing an exhaust-passage, said movable cylinder being provided with an exhaust-port communicating with said exhaust-passage, said exhaust-port being adapted to be opened and closed by the passing piston, and means for raising and lowering said movable cylinder to shift the position of said lower and upper port-openings and said exhaust-port to open and close the same sooner or later during the piston movement, substantially as and for the purposes set forth.

2. In an explosive engine, a cylinder-casing, a crank-casing connected with one end of said cylinder-casing, a longitudinally movable cylinder slidably disposed within said cylinder-casing, a piston adapted to reciprocate in said movable cylinder, means connected with said cylinder-casing providing a transfer-port, said movable cylinder being provided with a lower port-opening and an upper port-opening, means for introducing a charge of gas beneath said piston, said piston having a port adapted to register with said lower port-opening of said movable cylinder during the movement of said piston to permit the charge of gas to flow from beneath said piston through said transfer-port and through said upper port-opening of said movable cylinder into the interior of said movable cylinder above said piston, means connected with said cylinder-casing providing an exhaust-passage, said movable cylinder being provided with an exhaust-port communicating with said exhaust-passage, said exhaust-port being adapted to be opened and closed by the passing piston, and means for raising and lowering said movable cylinder to shift the posi-

tion of said lower and upper port-openings and said exhaust-port to open and close the same sooner or later during the piston movement, said means comprising rack-teeth on the side of said movable cylinder, a segmental gear meshing with said rack-teeth, and a pivoted lever-member for operating said segmental gear, said cylinder-casing being provided with an elongated opening permitting the passage therethrough of said segmental gear into contact with said rack-teeth.

3. In an explosive engine, a cylinder-casing, a crank-casing connected with one end of said cylinder-casing, a longitudinally movable cylinder slidably disposed with relation to said cylinder-casing, a piston adapted to reciprocate in said movable cylinder, means connected with said cylinder-casing providing a transfer-port, said movable cylinder being provided with a lower port-opening and an upper port-opening, means for introducing a charge of gas beneath said piston, said piston having a port adapted to register with said lower port-opening of said movable cylinder during the movement of said piston to permit the charge of gas to flow from beneath said piston through said transfer-port and through said upper port-opening of said movable cylinder into the interior of said movable cylinder above said piston, means connected with said cylinder-casing providing an exhaust-passage, said movable cylinder being provided with an exhaust-port communicating with said exhaust-passage, said exhaust-port being adapted to be opened and closed by the passing piston, and means for raising and lowering said movable cylinder to shift the position of said lower and upper port-openings and said exhaust-port to open and close the same sooner or later during the piston movement, substantially as and for the purposes set forth.

In testimony, that we claim the invention set forth above we have hereunto set our hands this 25th day of November, 1912.

RICHARD T. NEWTON.
INGLIS M. UPPERCU.

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