W. J. O. JOHNSON.

INTERNAL COMBUSTION ENGINE.

APPLICATION FILED JUNE 9, 1905.

973,048. Patented Oct. 18, 1910.

6 SHEETS—SHEET 1.

Fig. 1

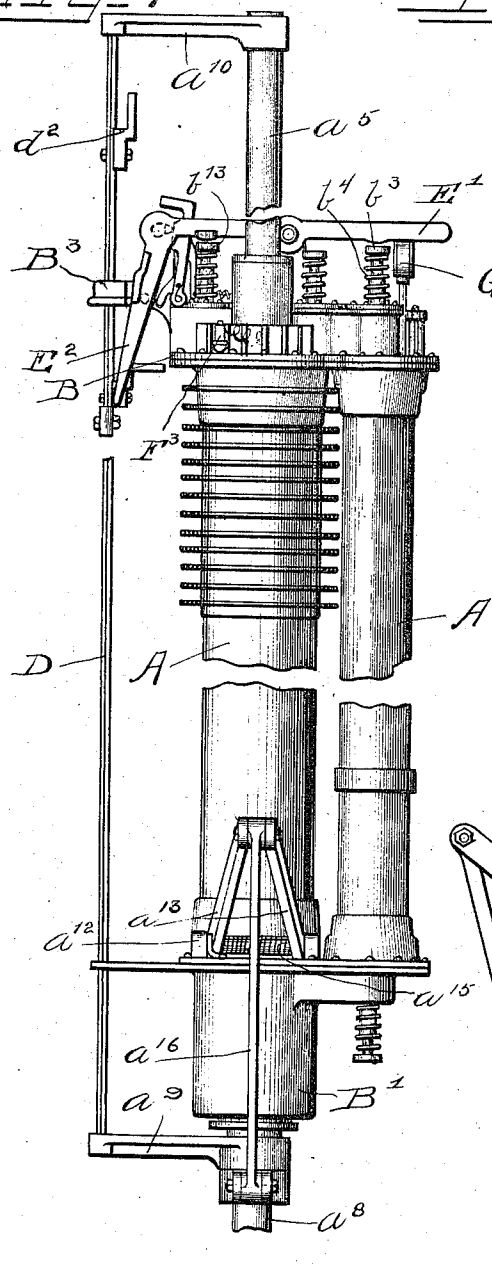
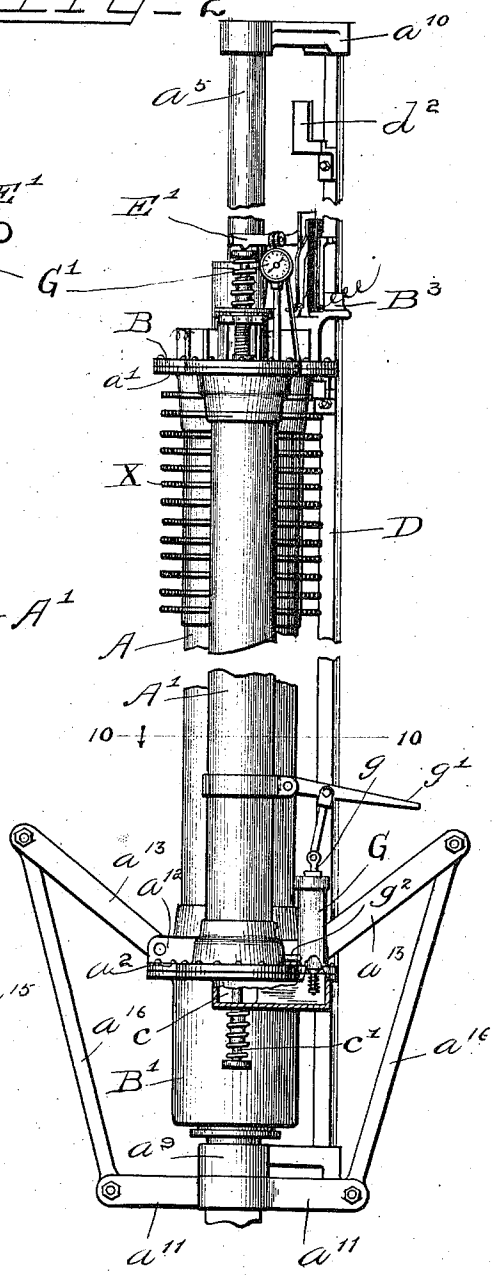


Fig. 2



Witnesses

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6 SHEETS—SHEET 2.

Fig-3

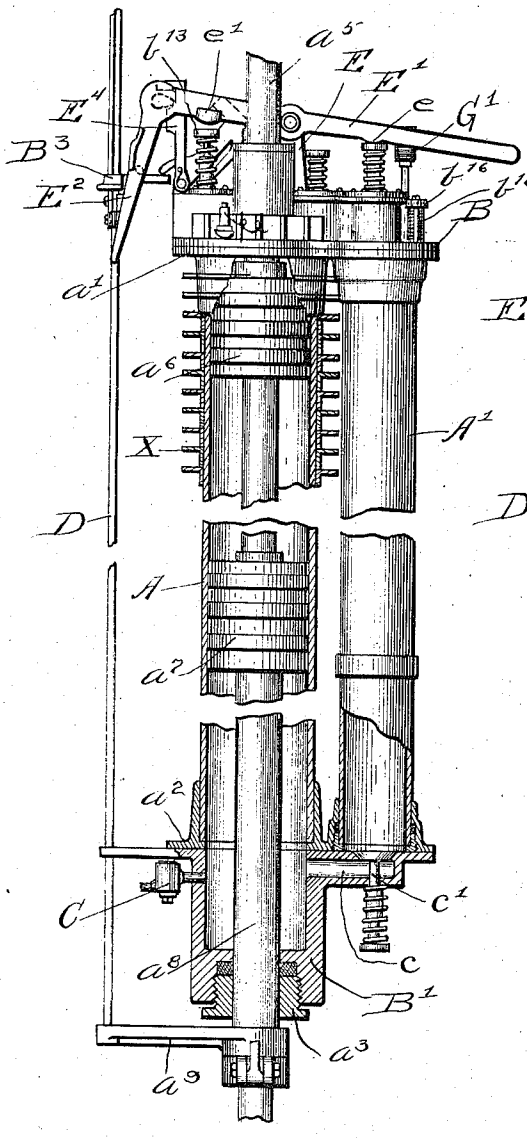
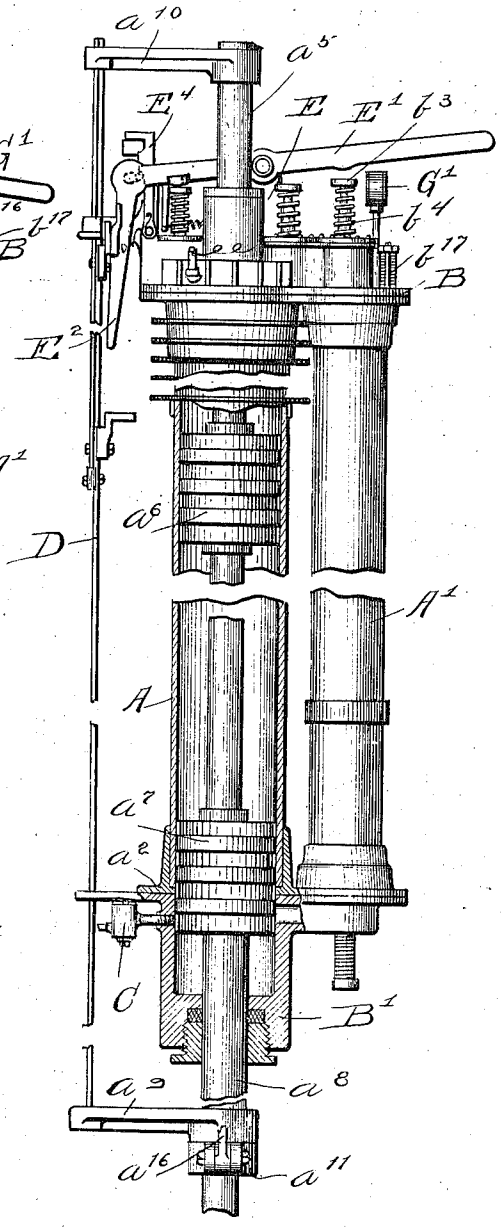


Fig-4



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6 SHEETS—SHEET 3.

Fig. 5

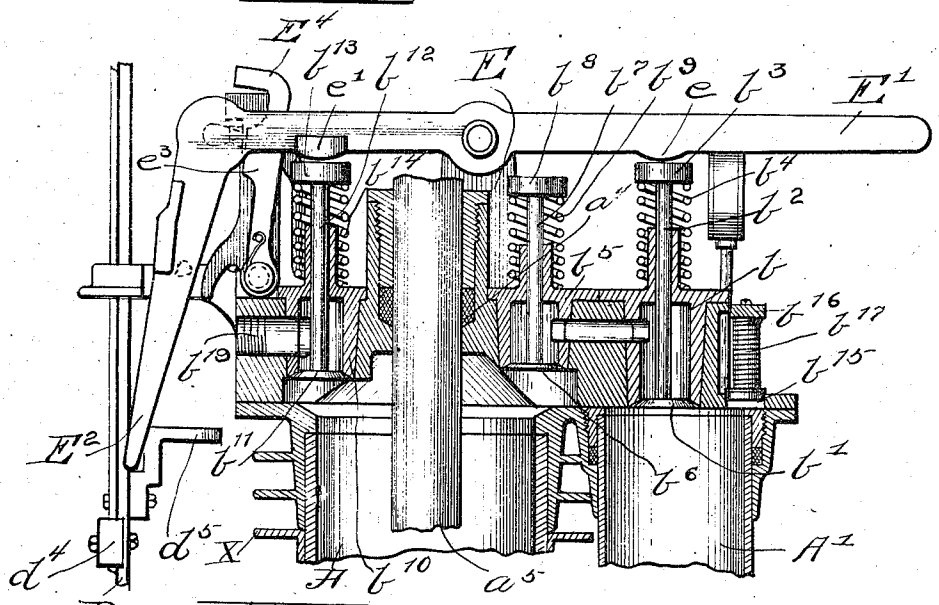
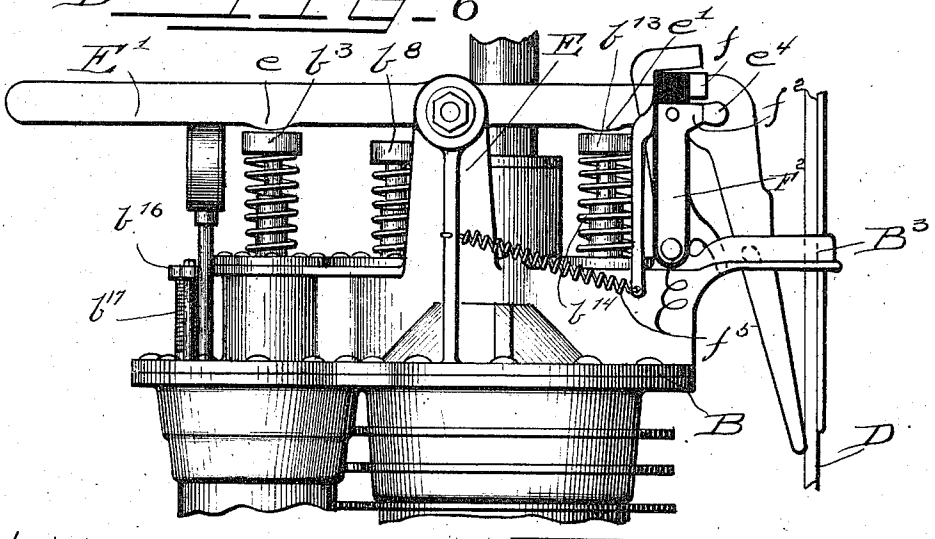


Fig. 6



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6 SHEETS—SHEET 4.

Fig. 7

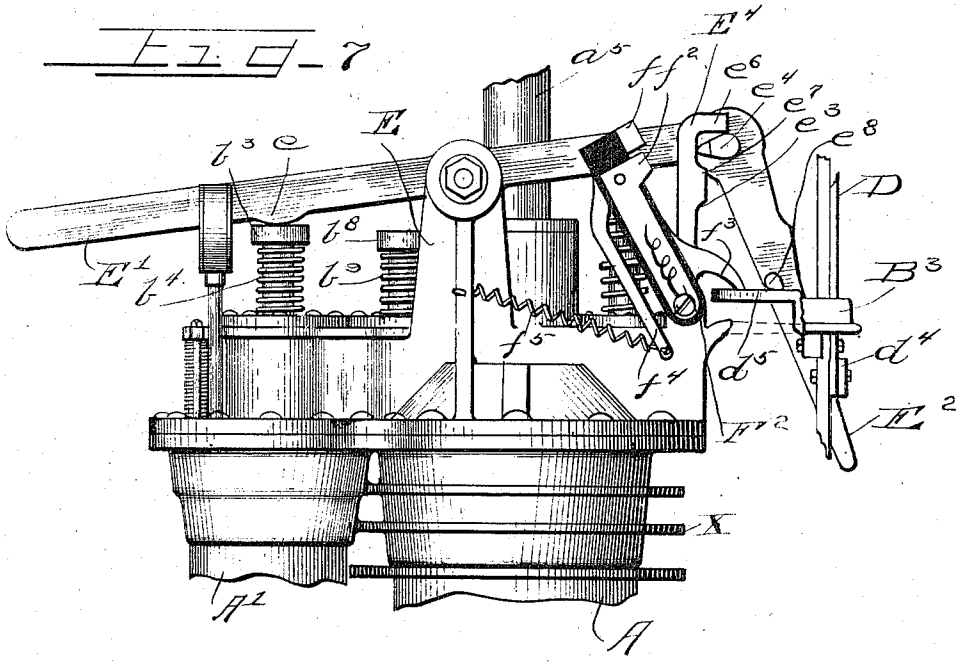
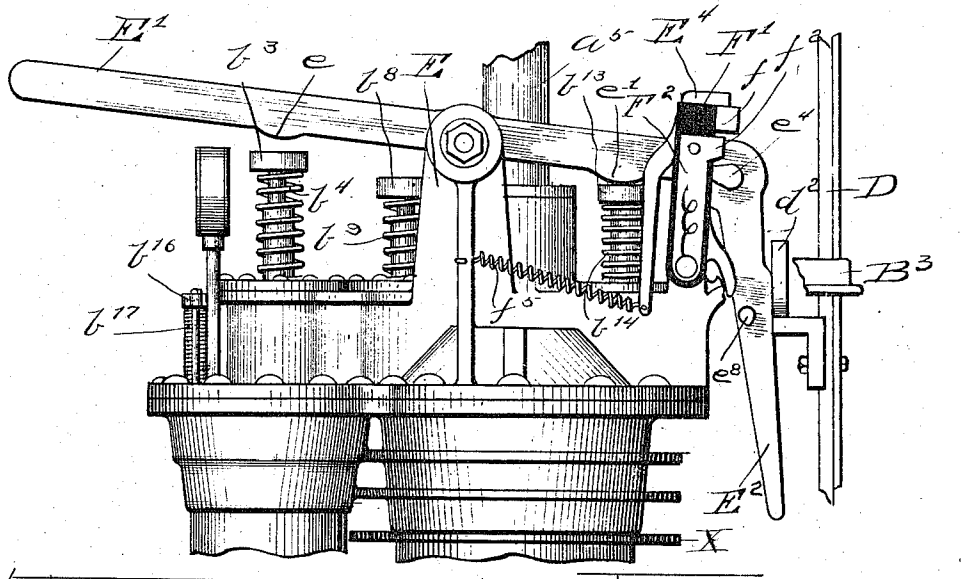


Fig. 8



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6 SHEETS—SHEET 5.

Fig. 9

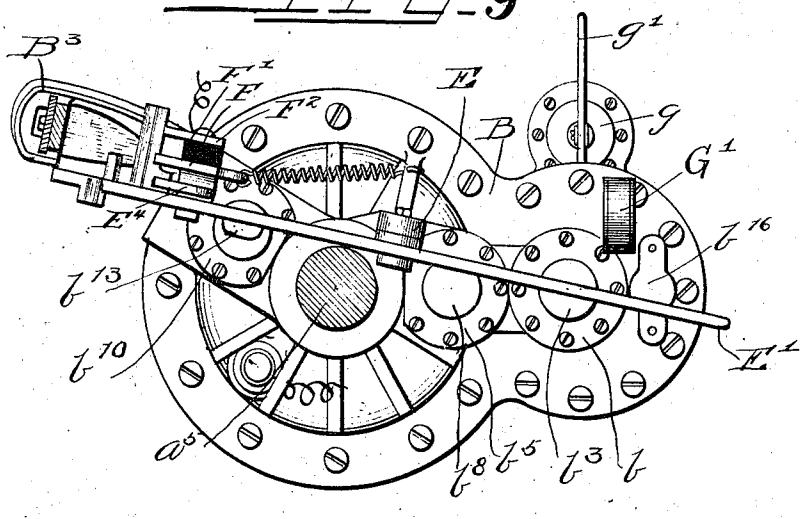
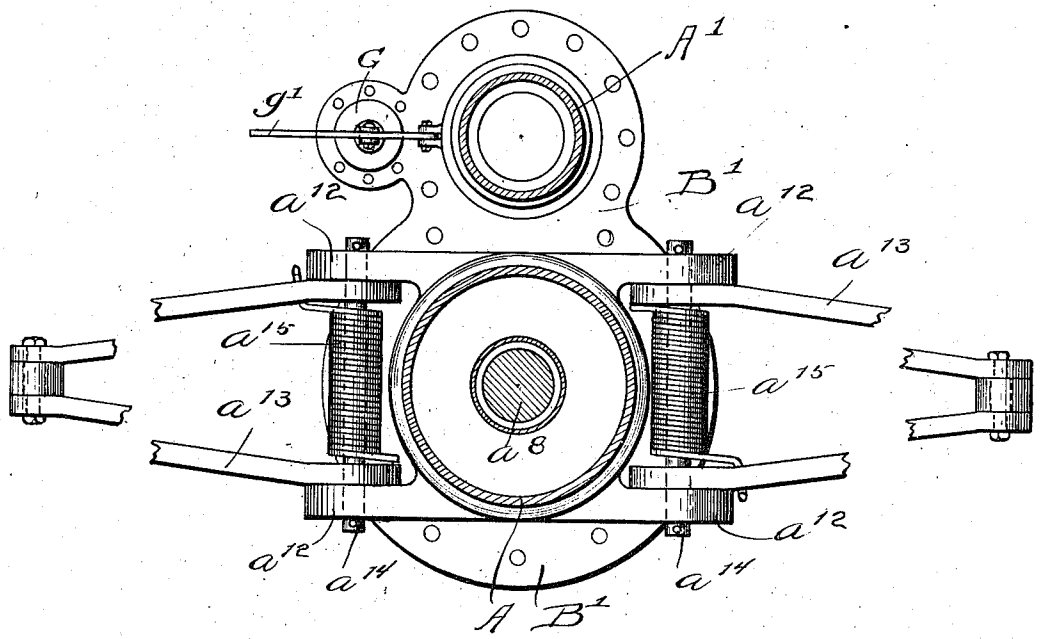


Fig. 10



Witnesses

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6 SHEETS—SHEET 6.

Fig. 11

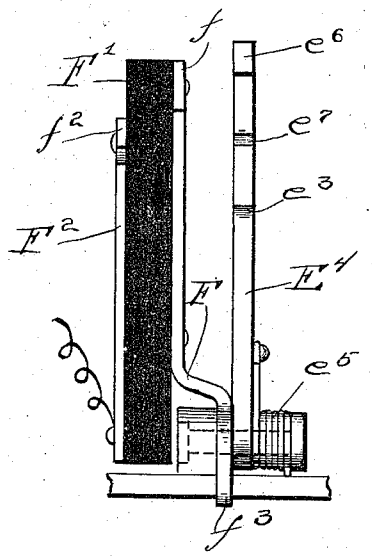


Fig. 12

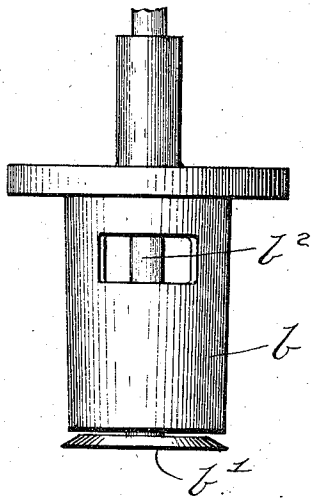
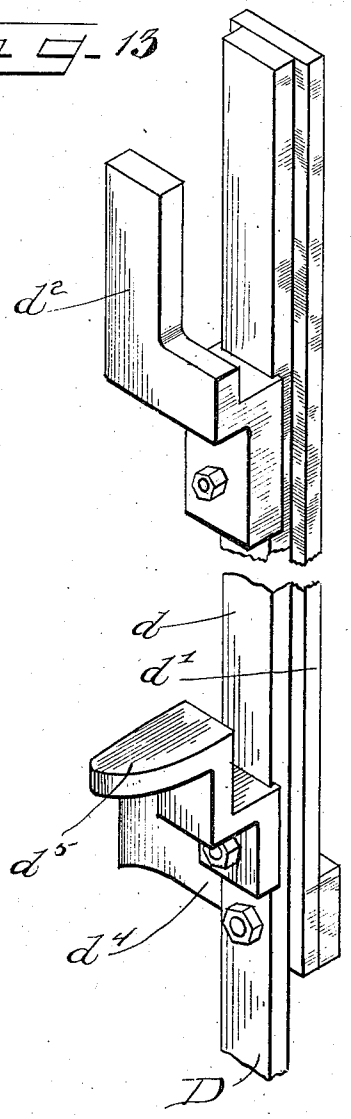


Fig. 13



Witnesses
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UNITED STATES PATENT OFFICE.

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INTERNAL-COMBUSTION ENGINE.

973,048. Specification of Letters Patent. Patented Oct. 18, 1910.

Application filed June 9, 1905. Serial No. 264,372.

To all whom it may concern:

Be it known that I, WALTER J. O. JOHNSON, a citizen of the United States, and a resident of the city of Chicago, county of Cook, and State of Illinois, have invented certain new and useful Improvements in Internal-Combustion Engines; and I do hereby declare that the following is a full, clear, and exact description of the same, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form a part of this specification.

This invention relates to improvements in internal-combustion engines.

In the drawings: Figure 1 is a fragmentary side elevation of a machine embodying my invention, showing the position of the parts when the explosion occurs. Fig. 2 is a fragmentary front elevation. Fig. 3 is a fragmentary view showing the cylinder partly in vertical section with the inlet valve stem depressed. Fig. 4 is a similar view showing the piston at the downward limit of movement and the exhaust valve stem depressed. Fig. 5 is an enlarged vertical section of the upper end of the cylinder and compression reservoir showing the position of parts at the moment the charge is ignited. Fig. 6 is a view in elevation of the opposite side of the valve mechanism. Fig. 7 is a fragmentary side elevation of the upper end of the cylinder and the valve mechanism showing the inlet valve stem in open position and the sparker thrown back. Fig. 8 is a similar view showing the inlet valve closed and the exhaust valve stem in open position. Fig. 9 is a top plan view partly in section of the cylinder the valve and the sparker mechanism. Fig. 10 is a section taken on line 10—10 of Fig. 2. Fig. 11 is an enlarged front view of the sparker and spring detent. Fig. 12 is an enlarged side elevation of one of the valve casings with the valve closure therein. Fig. 13 is a fragmentary enlarged perspective view of the valve actuating rod and the parts thereon for actuating the valve and sparking mechanism.

As shown in the drawings: A indicates a cylinder of any desired length which may be water jacketed or provided with radiating ribs X as shown in the drawings, for the purpose of radiating heat therefrom and which is provided at its upper end with a peripheral flange a' on which is secured the cylinder head B. At its lower end the cylinder is provided with a peripheral flange a^2 on which is secured the lower head B′ which affords a part of a compression chamber. Connected by means of the flanges a' and a^2 is a compression reservoir or tank A′ in which the compressed explosive mixture is forced on the down or compression stroke of the piston and is stored preliminary to admission into the power end of the cylinder. A carbureter of any desired kind indicated by C is connected in the lower head opening therethrough as shown in Figs. 3 and 4 and as shown a port c extends through said lower head and opens into the compression tank A′ through an inwardly opening valve c' which is any suitable spring controlled valve adapted to be lifted by the pressure from the compression chamber. Stuffing boxes a^3—a^4 are provided respectively in the lower and the upper heads of said cylinder and a piston rod a^5 extends through the upper stuffing box or gland and is provided with a piston a^6 having piston rings thereon in the usual manner to afford a close fit in the cylinder. The lower end of said piston rod a^5 extends through the piston and is connected with an inner or compression piston a^7. An enlarged piston rod a^8 extends downwardly therefrom and through the lower gland, and at its lower end is an outwardly extending bracket arm a^9 corresponding with a similar bracket arm a^{10} carried on the piston rod a^5 and connected at its ends with said bracket arms is a valve actuating rod D.

Rigidly secured on the end a^8 of the piston rod below the bracket a^9 are oppositely and laterally extending arms a^{11} and upon the lower cylinder head B′ on opposite sides thereof are lugs a^{12} in which on suitable pintles a^{14} are pivotally engaged levers a^{13}. Powerful coiled springs a^{15} are secured on the pintles in position to hold said arms a^{13} normally elevated as shown in Fig. 2. Connecting the extremities of the arms a^{13} and the arms a^{11} are links or rods a^{16} so that when said arms a^{13} are moved upwardly under the action of their powerful springs the piston rod and pistons in the cylinder are carried upwardly thereby to the position indicated in Figs. 1, 2 and 3.

Opening through the upper head B into the pressure reservoir is an inlet valve casing b seated in the head B and having a valve b' at its lower end opening against

the pressure from the pressure reservoir. A stem b^2 extends upwardly through the casing and is provided on its upper end with an enlarged head b^3 beneath which and on the top of the casing engages a pushing spring b^4 acting normally to hold the valve seated. Said casing communicates through a suitable passage with a corresponding valve casing b^5 in which is a valve b^6 seating in the lower end of the same on which is secured a stem b^7 having an enlarged head b^8 at its upper end beneath which a strong pushing spring b^9 as shown in Fig. 5 holds the valve normally closed but permits the same to be opened by the pressure from the mixture in the pressure tank when the inlet valve is open.

Positioned on the opposite side of the cylinder head from the inlet valves is an exhaust valve which comprises a casing b^{10} similar to those before described seated in the cylinder head and opening from the upper end of the cylinder and in which is secured a valve b^{11} seating to close the exhaust passage b^{19} opening from the cylinder. Secured on said valve b^{11} is a stem b^{12} having a head b^{13} thereon beneath which engages a spring b^{14} acting to hold said valve positively closed except when positively actuated by the valve mechanism. A relief valve b^{15} is seated in said cylinder head B and communicates with the pressure chamber or tank A′ as shown in Fig. 5 and is provided with a stem which extends upwardly therefrom through a yoke b^{16} bolted above the head. A strong spiral spring b^{17} is engaged between the said yoke and valve and acts to hold the valve normally closed. The pressure of said spring is adjusted to readily withstand the maximum pressure at which it is desired to deliver the mixture into the cylinder so that at any time should a greater pressure be attained within the pressure tank the valve b^{15} opens causing a reduction of the pressure to the desired point.

Integral with the head B is an upwardly extending bracket E, positioned approximately equidistant between the inlet valve b and the exhaust valve b^{11}. Pivoted at the upper end of said bracket, closely adjacent the piston rod is a valve actuating lever E′ which extends at one end over and in position to engage the head b^3 of the inlet valve and extends beyond the same sufficiently to afford a handle for the operator, in starting, and at the other end extends over the head b^{13} on the exhaust valve stem. Said lever above the inlet valve is provided with a boss e adapted to engage the head b^3 and above the exhaust valve with a corresponding boss e' adapted to engage the head b^{13} on the exhaust stem. Said lever projects beyond the cylinder head and obliquely outwardly and downwardly on the exhaust side thereof affording an outwardly and downwardly directed tail E^2 which extends in close relation with the valve actuating rod D, and is adapted to be engaged thereby to shift said lever in actuating the inlet and the exhaust valves of the engine. Said valve actuating rod D comprises an inner plate d and a broader outer plate d' which overlaps the inner on each side thereof affording a rabbet on each side of the same as shown in Fig. 13 which fits in a suitable guide way formed by a hooked arm B^3 integral with the cylinder head B and which serves to hold said rod as it reciprocates up and down with the movement of the piston, in unvarying distance from the valve actuating lever. Secured on said valve actuating rod at a point approximately coinciding with the end of the lever E′ when the piston is at the end of its power stroke is an inwardly and upwardly directed arm d^2 which engages the tail E^2 of said lever as shown in Fig. 8 as the piston approaches the limit of its power movement and forces the same inwardly thus forcing the boss e' downwardly upon the head b^{13} of the exhaust stem, opening the exhaust valve, and permitting the escape of the products of combustion through the exhaust port b^{19}. As shown said lever E′ holds the exhaust valve open during the entire upward movement of the piston, and for this purpose a detent E^4 is pivotally engaged upon the cylinder head B and provided with a shoulder e^3 adapted to engage over an arm e^4 on said lever. A spring e^5 as shown in Fig. 11 is engaged on said detent and acts to hold the same normally with the upper or free end thereof directed toward the valve actuating rod and in position to engage said arm. Said detent E^4 is provided at its upper end with an outwardly directed hook e^6 adapted to limit the upward swing of the lever E′ and consequently the downward movement of the inlet valve. Below said hook e^6 is a shoulder e^7 adapted to engage beneath the arm e^4 and hold the inlet valve open during an interval sufficiently long to enable the cylinder to be charged.

As shown a laterally directed arm d^4 is engaged on the valve actuating rod D at a point insuring the same rising above the lower end of the tail E^2 when the piston is at its upper limit of movement as shown in Fig. 7 and against which the end of the tail engages, and as shown sufficiently above said arm d^4 is an inwardly directed tappet arm d^5 which as the valve actuating rod D approaches the upward limit of its movement engages a laterally directed arm e^8 on the tail E^2, swinging the inner end of the lever E′ downwardly and opening the inlet valve and carrying the arm e^4 above the shoulder e^7 of the spring detent E^4 as shown in Figs. 3 and 7. Suitably engaged on the same pivot with the detent E^4 is a metallic plate F the

upper end of which is provided with an outwardly directed arm f. On the outer side of said plate F is secured an insulating block or strip F′ of any suitable material and on the opposite side of said block is a contact plate F^2 provided at its upper end with a forwardly projecting blade or arm f^2 which lies below the arm f of the plate F and on the opposite side of the insulation therefrom and is slightly shorter so that when the arm f engages against the arm e^4 on the lever E′ the contact arm f^2 is held out of engagement therewith. The lower end of said plate F is provided with an outwardly and downwardly extending finger f^3 adapted to be engaged by the tappet arm d^5 on the valve actuating rod, whereby the contact member or sparker is swung rearwardly on its pivot out of engagement with the arm e^4 and is held out of contact therewith while the inlet valve is open.

As shown an arm f^4 integral with the plate F extends downwardly and rearwardly therefrom and is connected at its lower end with the bracket E by means of a pulling spring f^5 which acts to throw the contact member or sparker forwardly when the arm f^3 is released from the tappet arm d^5 bringing the blade f against the arm e^4 and preventing a contact of the blade f^2, therewith until the arm d^4 draws the lever down sufficiently to permit the inlet valve to close.

To facilitate starting the engine a pump G connected at its base with the passage c opening from the pressure chamber communicates with and delivers into the pressure tank A′, through any suitable passage or port g^2. The pump rod g thereof is connected with a hand lever g', which as shown is fulcrumed on the pressure tank.

The operation is as follows: In starting the engine a few strokes of the pump produces the necessary pressure within the pressure tank (which will be indicated upon the gage G′). The lever handle E′ is then quickly forced downwardly by hand opening the inlet valve b' through which and the valve b^6 the mixture under compression flows into the cylinder. This starts the piston downwardly closing the inlet valve, and the contact arm f^2 on the sparker is almost simultaneously brought into engagement with the arm e^4 of said lever completing the circuit through the jump spark plug F^5 igniting the charge driving the piston downwardly. The downward movement of piston compresses the mixture in the lower end of the cylinder forcing the same through the port c into the pressure tank. Near the downward limit of movement the arm d^2 on the valve actuating rod engages the tail of the lever E′ and forcing the same inwardly carries the adjacent end of the lever downwardly opening the exhaust valve. The shoulder e^3 of the spring detent E^4 then engages over the arm e^4 holding the lever down and the valve open during the upward movement of the pistons, impelled by the powerful springs a^{15} during which the explosive mixture is drawn into the cylinder from the carbureter C. The tappet arm d^5 first engages the arm e^3 releasing the detent E^4 permitting the exhaust valve to close and immediately by the downward movement of the other end of the lever E′ opens the inlet valve b'. The explosive mixture now flows into the upper end of the cylinder. Just prior to the opening of the inlet valve, the arm or finger f^3 on the contact is engaged by the tappet arm d^5 swinging the same rearwardly as shown in Fig. 7 so that when the inlet valve is open electrical contact is impossible. Under the pressure of the inflowing compressed mixture the piston is forced downwardly somewhat, carrying of course the valve actuating rod therewith, and as the same moves downwardly the tail E^2 of the lever E′ engages the arm d^4 on said rod forcing the adjacent end of the lever downwardly and permitting the inlet valve to close. While the inlet valve is open the blade f of the sparker rests on the arm e^4 and the circuit is broken but when the lever E′ assumes its neutral position as shown in Figs. 5 and 6, the slight downward movement of the arm e^4 causes the same to fall below the plate or arm f thus swinging the blade or contact arm f^2 against the arm e^4 completing the circuit or in other words igniting the charge in the cylinder. The operation is repeated as long as the supply of explosive mixture is maintained and the current is maintained. Owing to the fact that the movement of the piston in one direction is caused by the explosion of the compressed explosive mixture while the return movement is due to the action of the spring retarded somewhat by the outflow or exhausting of the products of combustion, it follows that the movement of the piston in one direction is at high velocity while in the other direction it is at much lower velocity thus affording a differential rate of piston travel useful for very many purposes.

While I have described but one construction embodying my invention I do not purpose limiting this invention otherwise than necessitated by the prior art, as obviously very many details of construction and operation may be varied without departing from the principles of my invention.

I claim as my invention.

1. In an internal combustion motor the combination with a cylinder and a piston therein, of a pressure receptacle or tank having valved connection with the power end of the cylinder, automatic means acting to admit the charge under pressure into the cylinder, whereby the piston is moved to-

ward the middle of the cylinder prior to the ignition of the charge, means igniting the charge, spring controlled levers on the cylinder, and means operatively connecting the same with the piston rod and adapted to return the piston after the explosion to charging position.

2. In an internal combustion engine the combination with a cylinder, a piston and the piston rod, of a pressure tank adapted to deliver an explosive charge into the cylinder under pressure, a sparking mechanism, valves controlling the inlet and the exhaust from the cylinder, a lever for actuating the valves and the sparking mechanism, and means carried on the piston rod for actuating said lever.

3. In a two cycle internal combustion engine the combination with a cylinder, the piston and the piston rod thereof, of spring controlled levers engaged on the piston rod and acting to return the piston to the power end of the cylinder after each discharge, an inlet and an exhaust valve at the power end of the cylinder, a valve operating lever acting to actuate both said valves and means carried on the piston rod for actuating said lever.

4. In a two cycle internal combustion engine the combination with a cylinder comprising a power and a compression end of a pressure tank, a valved port connecting the compression end of the cylinder with said pressure tank, a valved inlet connecting the power end of said cylinder with the pressure tank, an exhaust valve in the power end of the cylinder, a lever adapted to actuate said inlet and exhaust valves, a detent adapted to hold said lever at each limit of its movement, means carried on the piston rod adapted to operate said lever, and a release valve in the compression tank and adapted to regulate the pressure therein to a predetermined maximum.

5. In an internal combustion engine the combination with the cylinder having a compression and a power end of the piston therein, a piston rod connected therewith and extending beyond both ends of the cylinder, an inlet and an exhaust valve in the power end of the cylinder, a lever pivoted to actuate each of said valves, a valve actuating rod connected with the piston rod at each end of the cylinder and adapted to actuate said lever and a sparking mechanism controlled by said actuating rod adapted to ignite the charge when all the valves are closed.

6. In an internal combustion engine the combination with a cylinder having a power and a compression end of a pressure tank connected by a valved port with the compression end of said cylinder, a carbureter adapted to communicate with said compression end of the cylinder, a valved inlet port connecting the tank and the power end of said cylinder, an exhaust valve in the power end of the cylinder, a lever pivotally engaged on the cylinder head and positioned to actuate the inlet and the exhaust valves, reciprocating means operated from the piston for actuating said lever to operate said valves, a sparking mechanism also controlled by said lever and adapted to ignite the charge only when the valves are closed, and a detent acting to hold said lever in position to engage either of said valves for a timed interval.

7. In an internal combustion motor the combination with a cylinder having a compression and a power end of a piston rod extending through the end of the cylinder, a pressure tank having valved connection with the compression end of the cylinder, a port connecting the upper end thereof with the power end of the cylinder, inlet valves in said port, an exhaust valve opening through the head of the cylinder, a lever actuating one of the inlet valves and the exhaust valve rhythmically, a spring detent carried on the cylinder, a valve actuating rod connected with the piston rod and adapted to actuate said lever, to open and close said valves, said detent acting to engage said lever and regulate the opening of said valves and means carried by the rod acting to release said detent permitting the valves to close.

8. In an internal combustion engine, the combination with a cylinder of a piston therein, a piston rod extending through each end of the cylinder, an actuating rod carried on the piston rod, an inlet and an exhaust valve in the power end of the cylinder, a lever for actuating the same, contacts on said actuating rod adapted to operate said lever and means for holding the lever for a limited period at each limit of its movement.

9. In a device of the class described, the combination with a cylinder, of a piston therein, a piston rod extending through the ends of the cylinder, spring controlled levers on said cylinder, means connecting the same with the piston rod and acting to move the piston to the power end of the cylinder, arms on said piston rod, an actuating rod thereon, inlet and exhaust valves in the power end of the cylinder and means operated by said actuating rod for opening and closing said valves.

In testimony whereof I have hereunto subscribed my name in the presence of two subscribing witnesses.

WALTER J. O. JOHNSON.

Witnesses:
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W. W. WITHENBURY.