W. J. McVICKER.

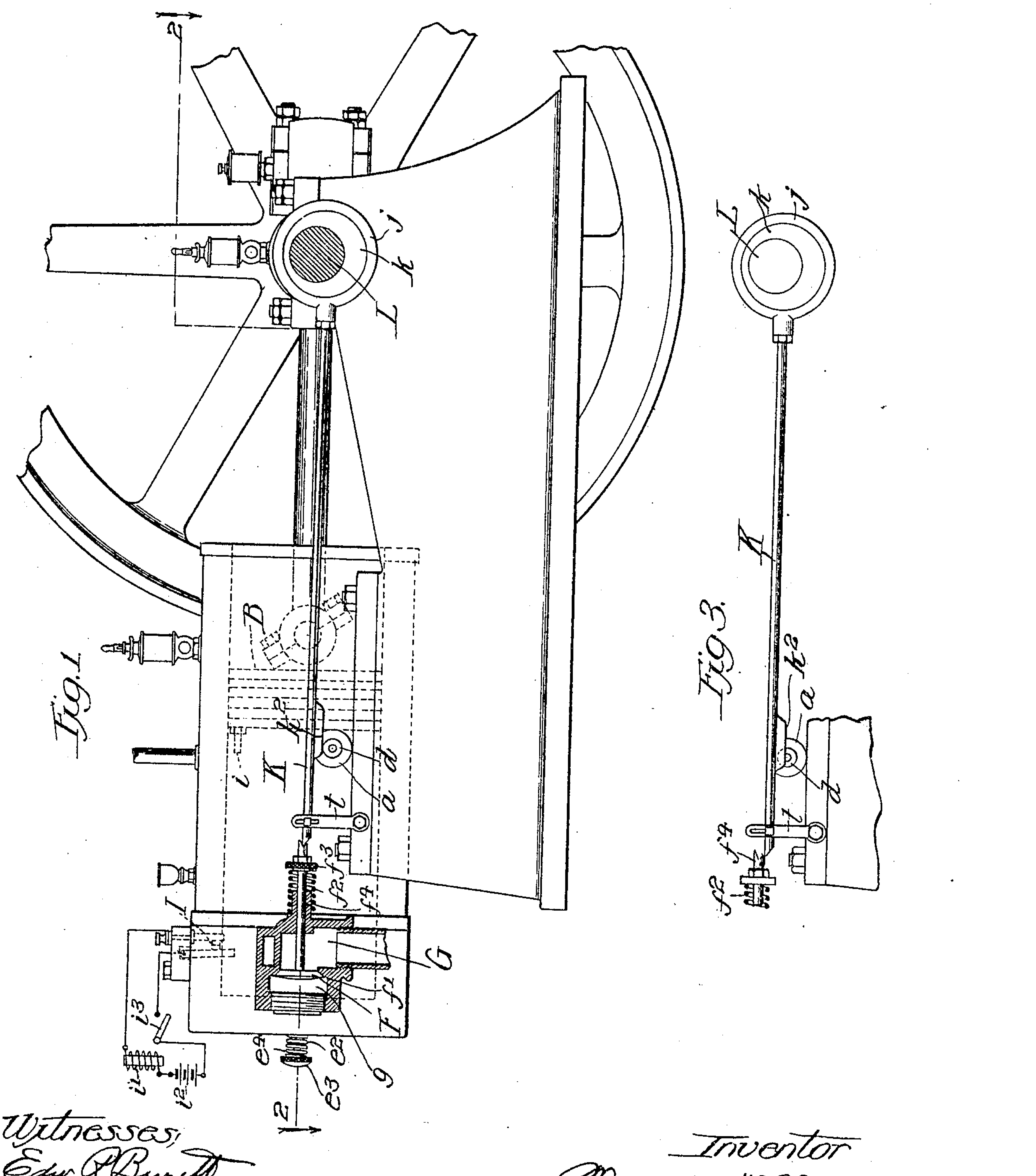
MECHANISM FOR CONTROLLING THE OPERATION OF INTERNAL COMBUSTION ENGINES.

APPLICATION FILED MAY 8, 1905.

927,582.

Patented July 13, 1909.

2 SHEETS—SHEET 1.



Witnesses;
Edw. P. Barrett
E. H. Smythe

Inventor
Walter J. McVicker
By Rector & Hibben
His Attys

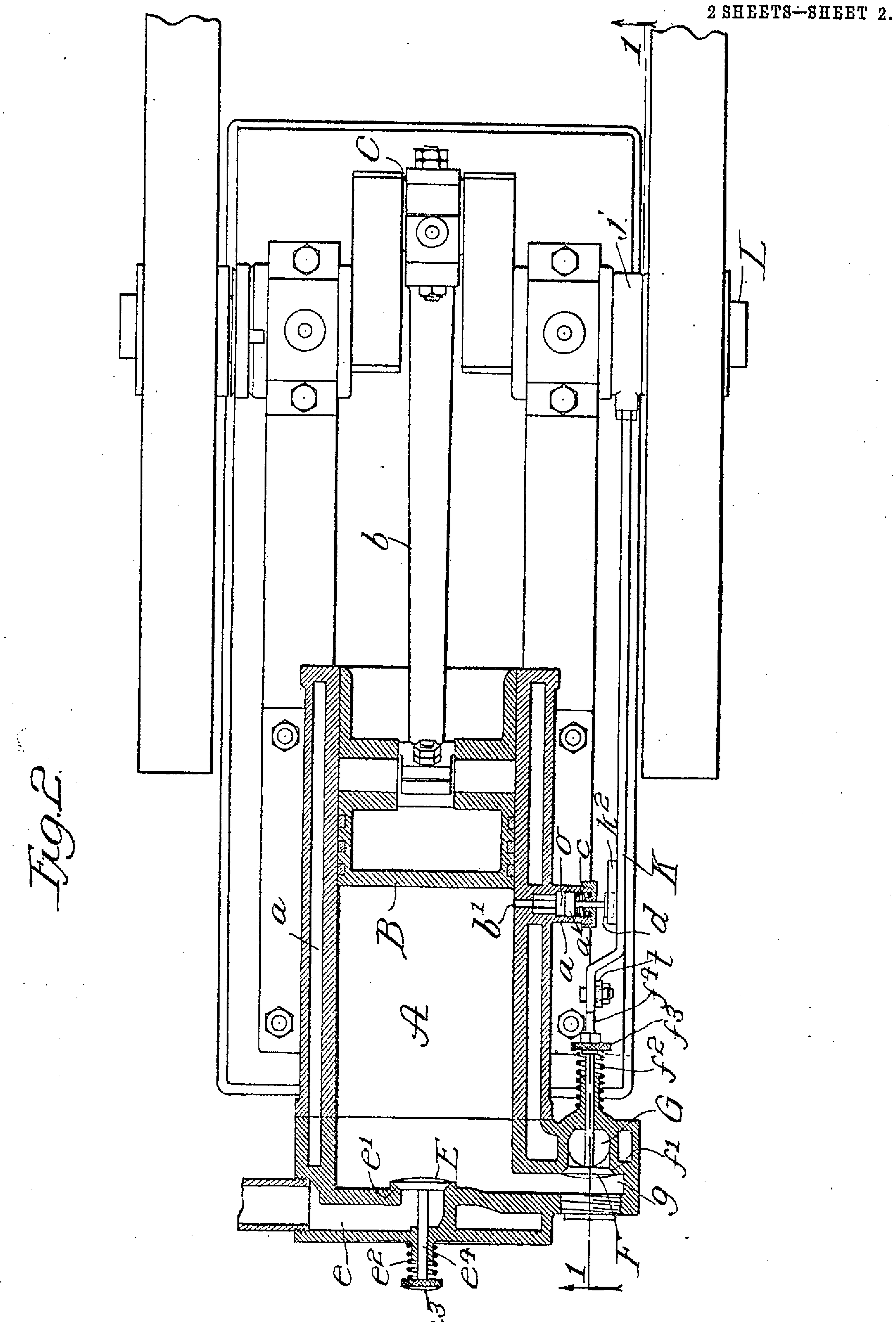
W. J. McVICKER.

MECHANISM FOR CONTROLLING THE OPERATION OF INTERNAL COMBUSTION ENGINES.

APPLICATION FILED MAY 8, 1906.

927,582. Patented July 13, 1909.

2 SHEETS—SHEET 2.



Witnesses
Edw. R. Barrett
A. Smythe

Inventor
Walter J. McVicker
By Rector & Hibben
his Attys

UNITED STATES PATENT OFFICE.

WALTER J. McVICKER, OF ALMA, MICHIGAN, ASSIGNOR TO ALMA MANUFACTURING COMPANY, OF DETROIT, MICHIGAN, A CORPORATION OF MICHIGAN.

MECHANISM FOR CONTROLLING THE OPERATION OF INTERNAL-COMBUSTION ENGINES.

No. 927,582. Specification of Letters Patent. Patented July 13, 1909.

Application filed May 8, 1905. Serial No. 259,265.

To all whom it may concern:

Be it known that I, WALTER J. McVICKER, a citizen of the United States, residing at Alma, in the county of Gratiot and State of Michigan, have invented certain new and useful Improvements in Controlling Mechanism for Internal-Combustion Engines, of which the following is a specification.

My invention relates to mechanism for controlling the operation of internal combustion engines, such as gas and gasolene engines and the like, and my object is to provide an improved organization for use in engines of the type in which the supply of fuel to the engine is automatically shut off when the means for causing its combustion in the engine is made inoperative, so that the engine may be controlled from the igniting device without loss of fuel. This result is effected in engines of this type by providing mechanism which operates automatically upon the explosion of a charge in the cylinder to open the exhaust valve to permit the escape of the explosion products, the valve remaining closed and retaining the charge in the cylinder in case it is not exploded. As the pressure due to the presence of the unexploded charge in the cylinder prevents a fresh charge from being drawn in, it follows that there is no consumption of fuel while the igniting device remains inoperative. Heretofore in engines of this type it has been customary to provide mechanism in which the force of the explosion in the main or an auxilliary cylinder was exerted directly upon the exhaust valve to open it. Instances of such arrangements are afforded in my prior patents 726731 and 743915, issued April 28, 1903, and November 10, 1903, respectively.

The object of my present invention is to provide an organization in which the force for opening the exhaust valve is derived through another channel, the controlling mechanism that responds to the explosion of a charge in the cylinder merely acting to direct the valve opening force, and to make it effective or leave it ineffective depending upon the occurrence or non-occurrence of the explosion.

The nature of my invention will appear from the following description, and the particular features which I regard as novel will be defined in the appended claims.

In the accompanying drawings, in which one embodiment of my invention is illustrated, Figure 1 is a side elevation, partly in section on line 1—1 of Fig. 2, of an internal combustion engine equipped with valve controlling mechanism in accordance with my invention; Fig. 2 is a plan view, partly in section, of the engine taken on line 2—2 of Fig. 1; and Fig. 3 is a diagrammatic representation of the valve-controlling mechanism in an alternative position to that shown in Fig. 1.

The engine to which I have shown my invention applied is of a familiar type, and needs no extended explanation. It comprises a support, between the two upright sides at one end of which a crank shaft is journaled, upon the ends of which are carried two fly wheels. Upon the other end of the frame or support the cylinder A with its associated valves and valve-operating mechanism is secured. A piston head B is arranged within the cylinder A, and fulcrumed to this head is a piston rod *b*, the other end of which is journaled to the crank shaft pin C. The cylinder A is surrounded by the customary water jacket *a*.

The fuel which is used in the operation of the engine is generated in any of the ways which are well understood in the art, and is led to the cylinder by way of the admission port *e*. The admission port communicates with the rear of the cylinder, the point of entrance of said port being governed by the valve E, which normally rests on the valve seat *e′*. The valve E is held in position on its seat by means of a compression spring e^2, which is interposed between the rear of the cylinder and a head e^3 on the end of the valve stem e^4, the head e^3 being made adjustable so as to enable the pressure necessary to open the admission valve to be easily regulated. Communicating with the rear of the cylinder is an exhaust port G, which communicates with the cylinder through a channel *g* extending from the rear end thereof. The exhaust port is controlled by a valve F resting in a valve seat f^1, the valve being normally held in position by means of a compression spring f^2 interposed between the wall of the exhaust port and the head f^3, secured to the valve stem f^4. It will be understood, of course, that the spring f^2, controlling the exhaust valve, is stronger than the spring e^2, controlling the admission valve.

I will now describe the particular mechanism which I have employed in the present instance for effecting the automatic control of the valves. Upon the shaft L of the engine is mounted an eccentric k, upon which is an eccentric strap or ring j connected with the valve rod or eccentric rod K. The end of the valve rod is supported adjacent to but normally out of engagement with the end of the valve stem f^4 by an arm t which is fulcrumed so that it is free to swing as the valve rod reciprocates. Mounted upon the outside of the cylinder is an auxiliary or secondary cylinder a, which communicates with the main cylinder by means of a port or passage b'. Within this auxiliary cylinder is a piston a' which is normally held in the front portion of the cylinder, that is the portion of the cylinder with which the entrance port or channel communicates, by means of a compression spring c. The piston is provided with a stem or rod which extends out of the auxiliary cylinder and carries a roller d. The valve rod K is provided with a shoe k^2, and with this shoe the roller of the end of the small piston stem is adapted to engage when the piston is thrust outward by means of pressure communicated from the main cylinder.

For exploding the charge in the cylinder the customary electric igniter is provided, in the present instance, the same consisting (as shown in dotted lines in Fig. 1) of a contact lever with its coöperating contact anvil, I, located in the rear part of the main cylinder, and arranged to be moved to break contact and produce the ignition spark by a pin i carried on the piston head B, the pin being brought into engagement with the contact lever of the igniter I at the end of the forward movement of the piston. The electrical circuit of the igniter may include a spark coil i', a battery i^2 and a switch i^3 for opening the circuit when the engine is not running, all as shown diagrammatically in Fig. 1.

The operation of the mechanism is as follows: Assume that the piston head B is at the end of the main cylinder A toward the admission port e; as it is caused to recede or move toward the other end of the cylinder by means of force applied in any manner the pressure within the cylinder is reduced and the valve E of the admission port is opened by the atmospheric pressure to permit the fuel or explosive mixture from a suitable source to pass into the cylinder. At the end of its backward stroke the piston head has moved far enough to uncover the port communicating with the auxiliary cylinder a, but the pressure existing in the main cylinder is but little if any more than the atmospheric pressure and consequently there is no tendency for the piston a' of the auxiliary cylinder to be moved. When the piston B reaches the end of its backward stroke the admission valve E closes, and the application of power continuing, the piston head returns to its position at the forward end of the cylinder, compressing the admitted charge as it advances. When it has accomplished the full extent of its forward stroke the charge is exploded by the igniter I, and, expanding, drives the piston B before it to the other end of the cylinder. The motion of the piston is communicated by way of the piston rod b to the crank shaft L and its consequent rotation acting through the eccentric k and eccentric ring j, causes a movement of the valve rod or eccentric rod K. As the piston B travels toward the rear of the cylinder it passes and uncovers the port leading to the auxiliary cylinder a, and the gaseous products of the explosion under a high degree of pressure flow into the auxiliary cylinder and act to thrust the piston a' backward against the compression spring c. This movement of the piston a' causes the roller d carried on the end of the piston stem to be thrust out into the path of movement of the shoe k^2 attached to the valve rod K. At this moment the valve rod, under the influence of the force communicated to it by the piston B through the medium of the piston rod, crank shaft, eccentric and eccentric ring, is moving toward the valve stem f^4, and as the shoe comes into contact with the roller d the valve rod is raised, its end brought into engagement with the end of the valve stem f^4 and, as the movement of the valve rod continues, the valve F is unseated and the exhaust port G opened to permit the gases in the cylinder to be driven out by the return stroke of the piston B. To prevent the premature closing of the exhaust valve by the withdrawal of the roller d from the shoe k^2, in case the piston a is prematurely retracted by the escape of the gases trapped in auxiliary cylinder a, I prefer to arrange the engaging ends of the valve stem f^4 and the valve rod K so that having once been brought into engagement they will remain together until the valve rod has been carried back far enough to permit its end to drop away from the forked end of the valve rod f^4. When the piston B has reached the limit of its stroke toward the admission port, and the products of the explosion of the charge have been forced out, the exhaust valve is closed and the power that has been stored in the fly wheels of the engine by the explosion acts to draw the piston B back again, thus drawing into the cylinder another charge of the explosive mixture. The cycle, as previously described, is gone through again, and is repeated as long as the igniter continues to operate.

Should the speed of the engine for any reason, increase beyond the rate desired, as by the load becoming lighter, or should it be desired to stop the engine, this may be done by merely causing the igniter to become inoperative, as, where the ignition is electrical, as in the present instance, by breaking its circuit, either manually or automatically, for a period of time corresponding with a few strokes of the piston, if it is merely desired to regulate the speed, or for a longer period where it is desired to stop the engine. The moment the igniter becomes inoperative the next preceding charge of fuel that was admitted to the cylinder will not be exploded, and the result will be that when the piston B has reached that point in its stroke where the port *b* communicating with the auxiliary cylinder *a* is uncovered the pressure in the main cylinder will be insufficient to thrust the roller *d* into the path of movement of the valve rod K and in consequence the end of the valve rod will not be thrown into position to operate the exhaust valve F. The exhaust valve therefore remains closed, the charge is retained in the cylinder, and being retained prevents the reduction of pressure in the cylinder on the back stroke of the piston sufficient to bring about the drawing in of another charge. If the operative relation between the valve rod and the exhaust valve were maintained at all times regardless of whether the charge in the cylinder had been exploded or not, as has been the arrangement heretofore, the piston would continue to operate to draw a fresh charge of fuel into the cylinder upon each alternate back stroke and to exhaust that charge upon each alternate forward stroke, thus wasting the fuel. By placing the operative relation between the valve rod and the exhaust valve under the control of the explosion pressure, this waste is prevented, and a charge once drawn into the cylinder is retained until it has been utilized. The moment the igniter is made inoperative the consumption of fuel ceases, to be resumed whenever the igniter is again made active, whether it be after an interval of a few strokes of the piston or at some more remote time. It will be appreciated from the foregoing that with my arrangement of valve control it is possible to exercise absolute control over the operation of the engine through the medium of the igniter alone, and without any loss of fuel.

I claim:

1. In an internal combustion engine, the combination with the main cylinder and the piston therein, of an exhaust valve, a constantly reciprocating rod normally out of coöperative relationship therewith and having formed thereon a cam surface, a member adapted to be moved transversely into the path of said cam surface to shift the rod into coöperative relationship with said valve, and mechanism controlling said member responsive to each explosion in the engine cylinder.

2. In an internal combustion engine, the combination, with the main cylinder and the piston therein, of an exhaust valve, a constantly operating rod normally out of coöperative relationship therewith, a piston-actuated roller adapted to be moved transversely into the path of movement of said rod and on which the latter is adapted to ride to establish said coöperative relationship, and an auxiliary cylinder in which said piston of the roller operates and which communicates with the main cylinder.

3. In an internal combustion engine, the combination, with the main cylinder and the piston therein, of an exhaust valve, a constantly operating rod normally out of coöperative relationship therewith, an eccentric for operating said rod, a member adapted to be projected across the path of said rod, a shoe on said rod which rides on said member when the latter is so projected, and shifts said rod into operative relation with said valve, and fluid pressure mechanism controlled by explosions in the main cylinder for operating said member.

4. In an internal combustion engine, the combination with the main cylinder and the piston therein connected with the usual crank shaft, of an exhaust port, a valve therefor mounted on a valve stem, a reciprocating valve rod extending from said shaft to said valve stem, but normally out of engagement therewith an auxiliary cylinder in communication with said main cylinder, a piston in said auxiliary cylinder adapted to be moved when the pressure in the main cylinder exceeds a predetermined amount, a shoe on said reciprocating valve rod, and a part adapted to be moved by said auxiliary piston into the path of movement of said shoe, whereby the reciprocating valve rod is thrown into engagement with said valve stem.

5. In an internal combustion engine, the combination with the main cylinder and the piston therein, of the admission port *e*, the admission valve E, the exhaust port G, the exhaust valve F, the reciprocating valve rod K normally out of engagement with said exhaust valve, the auxiliary cylinder *a* communicating with the main cylinder, the piston *o* in said auxiliary cylinder, the shoe k^2 on said valve rod, and the part *d* adapted to be moved by said auxiliary piston into engagement with said shoe to throw said valve rod into engagement with said exhaust valve.

6. In an internal combustion engine, the combination with the main cylinder and the piston therein, of an exhaust port, a valve governing the same, a reciprocating valve rod adjacent to but normally out of engage-

ment with said exhaust valve, and adapted to reciprocate constantly while the engine is running a support for said valve rod having slotted connection therewith and adapted to swing with the reciprocation of the rod, and mechanism responsive to explosion pressure in said cylinder adapted to throw said valve rod away from its normal support and into engagement with said valve.

7. In an internal combustion engine, the combination with the usual cylinder, piston and crank shaft, of an exhaust port, a valve therefor having a stem, a constantly reciprocating valve rod having one end attached to an eccentric mounted on the crank shaft and having the other end disposed adjacent the end of said valve stem but out of line therewith, a support for said valve rod at such end having slotted connection therewith and adapted to swing with the reciprocation of the rod, and mechanism responsive to explosion pressure in said cylinder adapted to throw said valve rod away from its normal support and shift said rod into line with said stem so as to engage the same.

8. In an internal combustion engine, the combination with the usual cylinder, piston and crank shaft, of an exhaust port, a valve therefor, a stem on which said valve is mounted, a valve rod eccentrically mounted upon the crank shaft and extending substantially parallel with the piston rod to a point adjacent said valve stem, a support for said valve rod near said point having slotted connection therewith and adapted to swing with the reciprocation of the rod, and mechanism responsive to explosion pressure in said cylinder adapted to throw said valve rod away from its normal support and into line with said stem so as to engage the same, said parts being so formed as to remain in engagement during a predetermined time.

WALTER J. McVICKER.

Witnesses:

L. S. Kirby,

L. E. Willson.