C. JACOBSON.

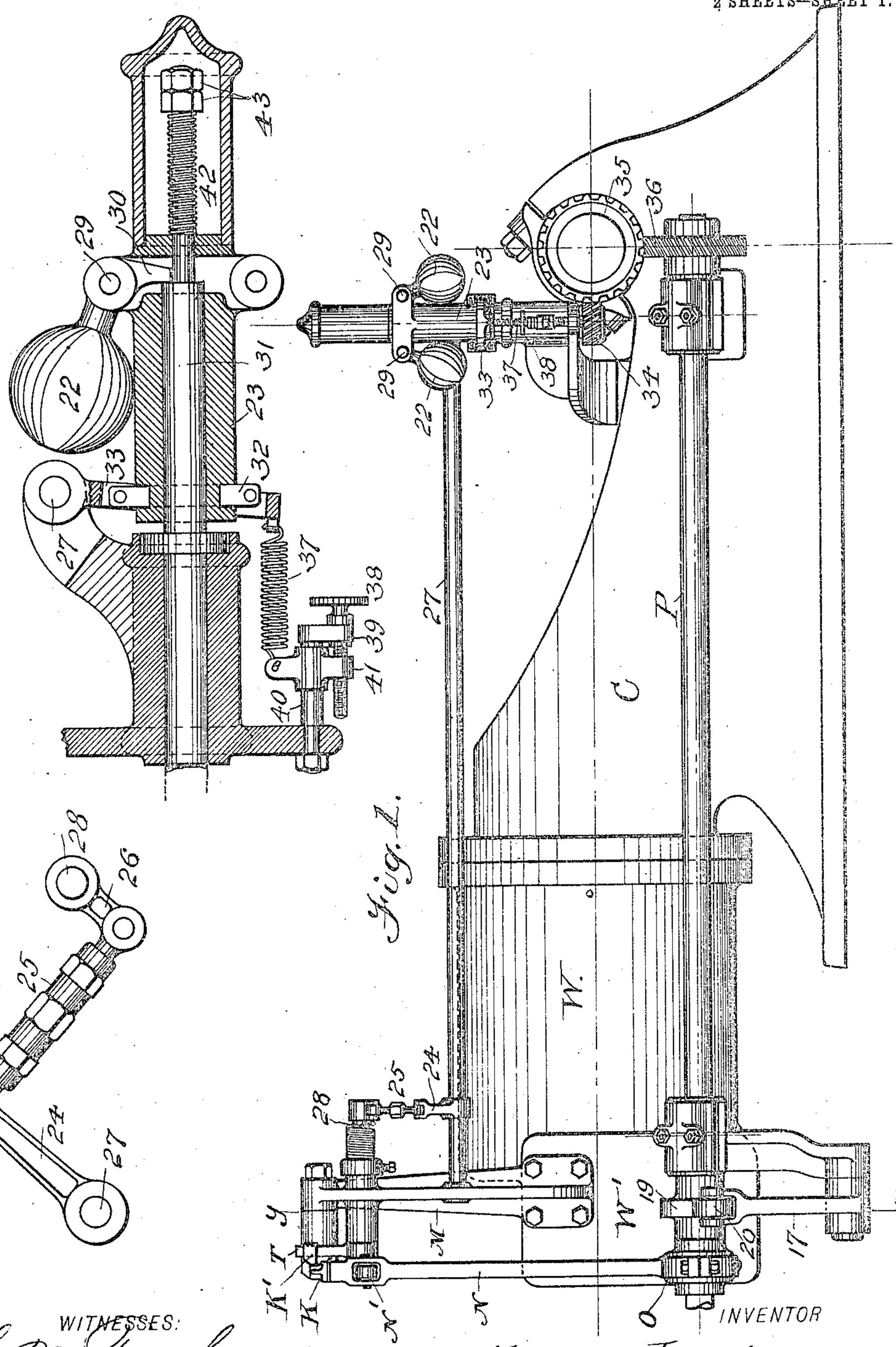
GOVERNOR CONTROLLED VALVE MECHANISM FOR GAS ENGINES.

APPLICATION FILED JULY 18, 1904. RENEWED JAN. 16, 1909.

934,813. Patented Sept. 21, 1909.

2 SHEETS—SHEET 1.

Fig. 2.



WITNESSES:

C. W. Fowler

M. A. Miley

INVENTOR

Charles Jacobson

BY

T. Walter Fowler

ATTORNEY

C. JACOBSON.

GOVERNOR CONTROLLED VALVE MECHANISM FOR GAS ENGINES.

APPLICATION FILED JULY 18, 1904. RENEWED JAN. 16, 1909.

934,813. Patented Sept. 21, 1909.

2 SHEETS—SHEET 2.

Fig. 4.

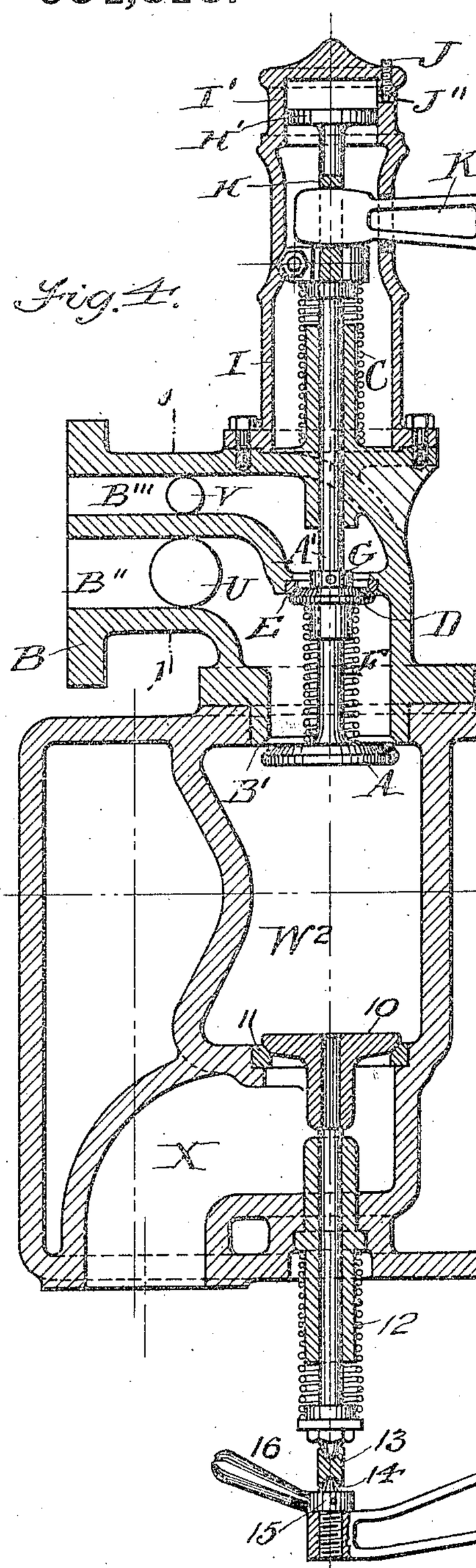


Fig 5

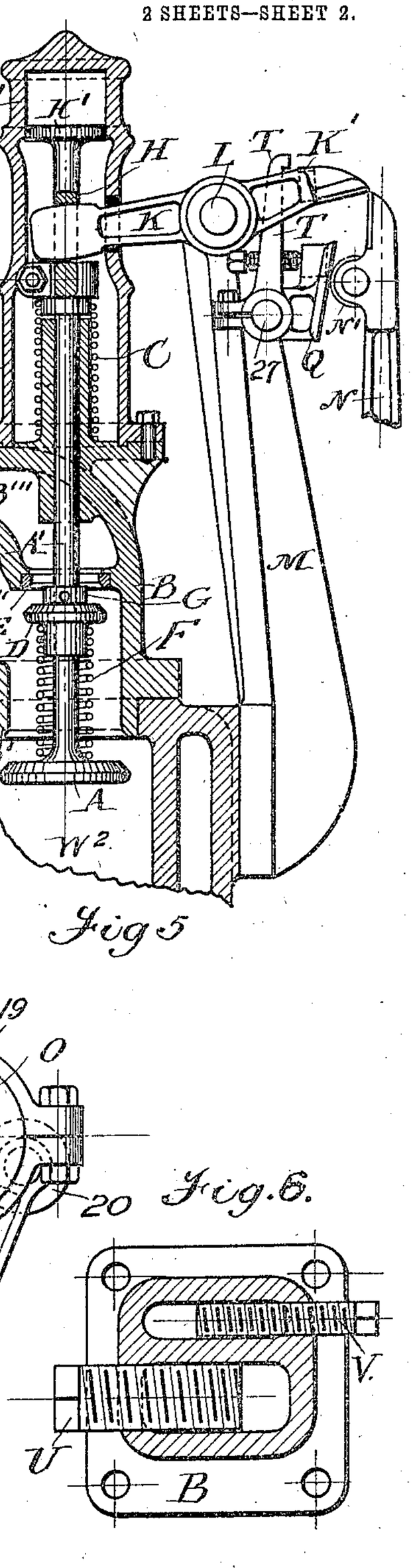


Fig. 6.

WITNESSES:

C. D. Fowler.

M. H. Miley

INVENTOR

Charles Jacobson

BY

T. Walter Fowler

ATTORNEY

UNITED STATES PATENT OFFICE.

CHARLES JACOBSON, OF WARREN, PENNSYLVANIA.

GOVERNOR-CONTROLLED VALVE MECHANISM FOR GAS-ENGINES.

934,813. Specification of Letters Patent. Patented Sept. 21, 1909.

Application filed July 18, 1904, Serial No. 217,067. Renewed January 16, 1909. Serial No. 472,741.

To all whom it may concern:

Be it known that I, CHARLES JACOBSON, a citizen of the United States, residing at Warren, in the county of Warren and State of Pennsylvania, have invented new and useful Improvements in Governor-Controlled Valve Mechanism for Gas-Engines, of which the following is a specification.

My invention relates to certain new and useful improvements in gas engines and it consists of the parts and the constructions arrangements and combinations of parts which I will hereinafter describe and claim.

In the accompanying drawing forming part of this specification and in which similar characters of reference indicate like parts in the several views,—Figure 1, is a side elevation of a gas engine embodying my invention and showing a bed plate, a cylinder, the inlet and exhaust valve mechanism, and the governing mechanism. Fig. 2, is a vertical sectional view of the governor. Fig. 3, is a detail of the link connection between the inlet valve mechanism and the governor rod. Fig. 4, is a transverse sectional view on the line *x*—*y* of Fig. 1. Fig. 5, is a similar section partially broken away, showing the regulating block and the inlet mechanism in the position that they assume when the engine is working at full load. Fig. 6, is a horizontal cross section on the line 1—1 of Fig. 4.

In carrying out my invention, I may employ the salient features in connection with any of the usual types of explosive engines without any departure from the spirit of my invention.

In Fig. 1, I illustrate an engine of the horizontal cylinder type whose cylinder W is appropriately secured to a bed plate C and which cylinder may be water jacketed and provided with an internal bushing, the construction and assembling of which parts may follow closely the lines described and claimed in my former application, Serial Number 216,674 filed July 15, 1904. I also prefer to form the cylinder with an offset casing W′ at one end having a compression space W^2 into which a charge of pure air, and the fuel charge, will be admitted as hereinafter explained.

In Figs. 4 and 5, I illustrate in detail the valve mechanism and wherein A is the upwardly closing inlet valve for the explosive mixture said valve designed to be held closed against a suitable seat B′ by means of a spring C except when it is mechanically moved to uncover the inlet passage through the seat, as I will hereinafter indicate. On the inlet valve stem A′ is also mounted, in line above the valve A, a valve D which admits the gas or other fuel vapor into that portion of the inlet elbow B where the fuel and the air mix before entering the compression space of the valve chamber through the aforesaid valve A. The valve D is held on its seat E by means of a spring F except when it is mechanically opened, as I will hereinafter indicate. On the valve stem A′ is fixedly secured a collar G, and the valve D is below this collar and is freely slidable on the stem, it being pressed toward its seat by the spring F as before mentioned.

On the upper end of the valve stem A′ is clamped or otherwise fixed a yoke H said yoke carrying a piston H′ which operates as a dash-pot in a chamber I′ formed in the cap portion of a cylinder I which incloses the valve stem and is bolted to the elbow B of the valve chest. This dash-pot arrangement serves as a cushion to relieve the hammering of the valves and the noise incident thereto, and said cushion is regulated by means of a screw J which controls an exit opening J″ in the cap portion of the cylinder.

A lever K is pivotally mounted between its ends upon a pin L mounted in the upper end of a bracket M fixed to the valve casing, said lever having one end extending through an opening in the wall of the cylinder I and through the yoke H and bearing upon the upper end of the valve stem A′. The opposite end of the lever K is designed to engage the free end of an upright trip rod N whose opposite end is actuated by an eccentric O fixed to the shaft P mounted at the side of the engine frame and cylinder as shown in Fig. 1.

That I may properly regulate the point at which the trip rod N shall disengage with the trip lever K, to operate the valve mechanism, I employ a regulating block Q which is carried on and operated by the governor rod 27, and against which block the trip rod N is held by a spring S as shown in Fig. 4. On the governor rod 27 is also an arm or safety catch T the object of which is to hold the inlet valve on its seat by the hook end of the arm catching hold of the trip lever K

when the speed of the engine exceeds a predetermined point.

In Fig. 4 is clearly shown the air inlet passage B″ and the passage B‴ for the gas or other fuel; and in these passages are placed the threaded or adjustable stops U and V Fig. 8, which determine the relative quantity of air and gas which is permitted to enter the compression space W² as the explosive charge. Fig. 4 also shows the exhaust valve 10 which is designed to close upon a suitable seat 11 in the offset valve chest, said valve having a stem which extends to the outside of the chest casing and is threaded to receive a suitable nut. Surrounding the stem of the exhaust valve is a spring 12 for effecting its closing movement; and the end of the valve stem is shown rounded and adapted to fit in a corresponding socket in the end of a rocking block 13, the purpose of which is to preserve the proper alinement of the stem, said block having, also a socket in its lower end adapted to receive the rounded end of a stud 14 to which is pinned a disk 15 having a handle 16, said stud 14 being provided with comparatively coarse threads working in a tapped hole in the end of one arm of a substantially bell-crank lever 17 whereby upon turning the disk 15 by means of its handle, the stud 14 may be raised or lowered relative to the bell crank lever 17, to adjust the throw of the lever and the consequent opening and closing movements of the exhaust valve.

The bell crank lever 17 is fulcrumed between its ends to a bracket 18 bolted to the side of the valve chest, said bracket having an appropriate bearing for the side shaft P, upon which shaft is fixed a cam 19; and upon the upper end of the lever 17 is a roller 20 which contacts with the cam whereby the lever is rocked about its fulcrum to lift the exhaust valve against the pressure of its closing spring. The back of the cam 19 is provided with a slightly raised portion or surface 21 which stands opposite to the cam proper and which surface normally does not come in contact with the friction roller 20. When, however, the engine is being first started, the operator grasps the handle 16 and rotates the same to adjust the lever 17 to bring the roller 20 into the range of action of the surface 21 so that this surface will operate upon the roller during part of the backward traverse of the piston and open the exhaust valve, and reduce the compression caused thereby in the space W² and allow the engine to be turned over more freely until started when the handle 16 is turned back to its normal position and the lever 17 is moved about its pivotal center to remove the roller slightly out of the range of action of the cam surface 21 whereby the latter ceases to operate against the roller and the lever 17 remains stationary as fully shown, described and claimed in my aforesaid prior application.

In order that the operation of the parts previously described may be fully understood, I will state that the cam 19 is so set on the side shaft P that it commences to contact with the roller 20 at the proper point in the expansion stroke of the engine cycle, and thereby opens the exhaust valve by means of the bell crank lever 17. The cam is arranged to hold the exhaust valve open until the end of the return or clearance stroke, or a little beyond the same. The valve is then held upon its seat by the spring 12 during the admission, compression and most of the expansion stroke. The valve is, therefore, opened once for every two revolutions of the engine.

The operation of the inlet mechanism may be generally described as follows: The eccentric O which actuates the trip rod N, is so set on the side shaft P that it gives an upward impulse to the trip rod at the proper point in the cycle. The trip rod thus actuated engages the outer end of the pivoted trip lever K, rocking said lever about the pin and moving the inner end of the lever downward thereby depressing the valve stem A′ against the resisting pressure of the spring C and moving the valve A away from its seat B′. During the first part of the said movement of the valve stem and valve A, the valve D, which is loose on the stem, remains on its seat E with the valve stem sliding through the hub or sleeve of the valve. Thus when the valve A first opens the first effect is to admit a scavenging charge of pure air to the compression space W² of the valve chest before any charge of gas, or mixed air and gas, is allowed to enter said space. This charge of pure air should be allowed to enter the space W² before the exhaust valve closes and thus have the opportunity to clear the space of foul gases or waste products of combustion and pass into the exhaust pipe X before the charge of explosive gas enters the cylinder.

The collar G, which is fixed to the valve stem, normally lies above the valve D, and when the stem is operated as just described, said collar is carried into contact with the valve and finally forces the same open against the closing power of its spring F thereby allowing the charge of fuel to mix with the pure air entering through the passage B″ and the combined charge to enter the compression space W² of the valve casing as an explosive mixture.

As the free end of the regulating block is set at an angle with the upward line of movement of the trip rod N, the roller N′ of this rod by working against the inclined face of the block pushes the upper end of the trip rod away from the trip lever K and

finally disengages it. The point at which this trip-off occurs is regulated by the angle at which the face of the regulating block is set. In Fig. 4, the block is set in such position that the trip rod trips off just as the gas valve is reached thus admitting no fuel and consequently producing no explosion, but merely a scavenging charge of air. In Fig. 5 the parts are shown in such position that the trip rod opens the valve to its full extent, thus admitting a full charge of mixed air and gas.

It will be understood, of course, that the trip rod may release the lever at any point between the two positions shown in Figs. 4 and 5, thus varying the amount of mixture admitted from nothing to full load according to the work required.

The angle of the face of the regulating block is determined by a centrifugal governor one form of which is shown in enlarged detail in Fig. 2, and which will now be described. This governor has the fly-balls 22 which, when the governor is running slowly, rest against the governor body 23. The links 24, 25 and 26 and the regulating block Q are so set that the face of the block is then in the position shown in Fig. 5. When the speed of the governor increases sufficiently so that centrifugal force throws the balls outward from the body 23, this action swings the lever arms of the balls about the pivotal points 29 and causes the toe pieces 30 of the lever arms to bear on an offset in the governor shaft, as shown in Fig. 2, thereby lifting the body 23 of the governor. On this body portion 23 is a collar 32 which moves with said body and fits in a groove in the lower portion thereof, while a yoke 33 encompasses the collar, and is pivotally attached thereto, so as to move up and down freely with the governor body and collar.

The yoke 33 is rigidly fixed to the governor shaft 27 so that when the yoke moves up and down at its pivotal center with the governor body the shaft 27 is rotated; and as the regulating block Q is attached rigidly to this same governor shaft 27, the angle of its face is necessarily changed with every movement up or down of the governor body whereby the amount of the explosive charge admitted is changed with any variation of speed of the engine.

The governor shaft 31 is shown as driven by a spiral gear 34 which meshes with a corresponding gear 35 which is operated by the crank shaft of the engine to drive the side shaft P through the medium of a gear 36 on the latter, as shown in Fig. 1.

Referring again to the safety catch T of Figs. 4 and 5 I would say that this catch is also rigidly attached to the governor shaft 27 so that when said shaft is rotated, as previously explained, the outer end of the catch moves away from or toward a boss K′ on the trip lever according to the direction the shaft oscillates. When the speed of the engine passes a certain point, the offset or hook on the outer end of the catch engages with the boss K′ and holds the trip lever rigidly in place until a rotation occurs in a reverse direction to disengage it. This prevents the inlet valve from being sucked open by the unusual suction caused by an excessive speed of the engine, and excludes any chance for runaway of the machine.

The speed of the engine may be varied by a change in the tension of the spring 37 which is attached to the outer end of the yoke 33, and when the tension of this spring is increased, greater speed is required before the centrifugal force of the governor balls can overcome it. When the tension of the spring is diminished a less speed is required to overcome it.

In order that the tension of the spring may be readily adjusted and while the engine is running, a thumb screw 38 is provided, which screw is held by a head and a washer on either side of an arm 39 on a post 40 so arranged that it is free to turn, but not to move up and down. The lower end of the thumb screw 38 passes through a tapped hole in an extension of a sliding sleeve 41 while one end of the spring 37 is attached to another extension of this same sleeve and which sleeve is fitted to move up and down on the post 40. From the description of these parts it will be understood that when the thumb screw is turned in one direction the tension of the spring 37 is increased and the speed of the engine increased, while any turning of the screw in the opposite direction decreases the tension and thus the speed. A still greater range of speed may be covered by a change in the spring 42 either by screwing down the nuts 43 or by putting on a heavier spring.

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

1. In a gas engine, the combination of the engine cylinder having a compression space, and separate air and gas conducting means, independent valves controlling said conducting means, and means for operating the valves including the stem of one of the valves and a collar on the stem normally out of contact with the other valve and adapted during the movement of said stem to contact with said other valve for operating the same, said other valve being loose on said stem, a lever for actuating the valve stem, a trip-rod for actuating the lever, and a governor actuated by the speed of the engine and having a member which is projected into the range of action of the trip-rod to vary the length of contact of the trip-rod with the lever and thereby vary the opening movements of the valves.

2. In a gas engine, the combination of the engine cylinder, air and gas conducting means, a valve mechanism controlling said conducting means, and means automatically controlling the valve mechanism said means including a rocking governor rod, a member fixed thereto and partaking of the rocking movements thereof, and having a contact face normally inclined, a rocking-lever, and a trip-rod and means for imparting an impulse thereto, said trip-rod having a part to contact with the trip-lever and a second part to contact with the inclined face of the said member, whereby the rod is tripped off the lever during the travel of the second-named part of the rod along the inclined face of the said member, and a safety catch fixed to the governor rod and adapted to engage and lock the trip-lever.

3. In a gas engine, the combination of the engine cylinder, the separate air and gas conducting means, separate air and gas controlling valves, one of said valves having an extending stem, and means for actuating the valves including a rocking-lever having one end to engage said stem, the other valve mounted on the stem and actuated thereby, a trip-rod adapted to reciprocate in the plane of the other end of said lever, a speed governor and a rocking rod actuated thereby, and a block on the rod and partaking of the rocking movements thereof, said block having a contact face normally inclined and rendered more or less inclined as the speed of the governor varies whereby the duration of contact between the trip-rod and trip-lever is varied and the throw of the lever and extent of opening movement of the valves are made responsive to the speed requirements of the engine.

4. In a gas engine, the combination of the engine cylinder, the separate valves for controlling the admission of air and gas one of said valves having a valve stem and the other valve slidably mounted on said stem, a rocking lever having one end to engage said stem and the opposite portion provided with a lug, a trip-rod to engage said lever and lift it to depress the valve stem, a rocking governor rod, a block fixed thereto and having a face normally inclined relative to the travel of the trip-rod, and made more or less inclined as the governor rod is rocked one way or the other as the speed of the engine varies, said trip-rod having a roller to travel in contact with said inclined face of the block, and a safety catch fixed to the governor rod and adapted to engage the lug on the trip-lever.

In testimony whereof I have hereunto set my hand in presence of two subscribing witnesses.

CHARLES JACOBSON.

Witnesses:
C. W. Fowler,
T. Walter Fowler.