A. BURNETT.

GAS ENGINE.

APPLICATION FILED FEB. 8, 1908.

960,498.

Patented June 7, 1910.

2 SHEETS—SHEET 1.

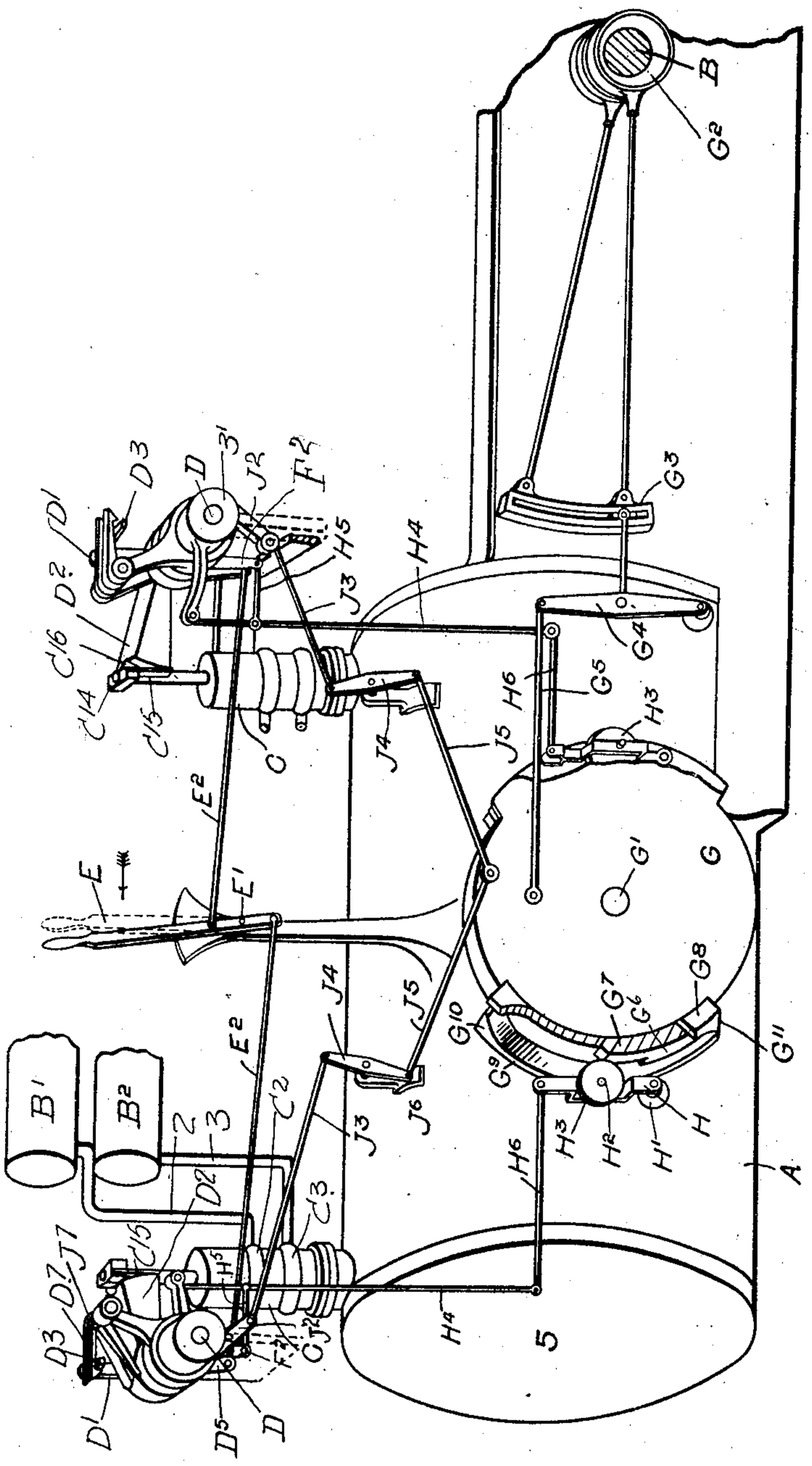

Fig. 1.

WITNESSES

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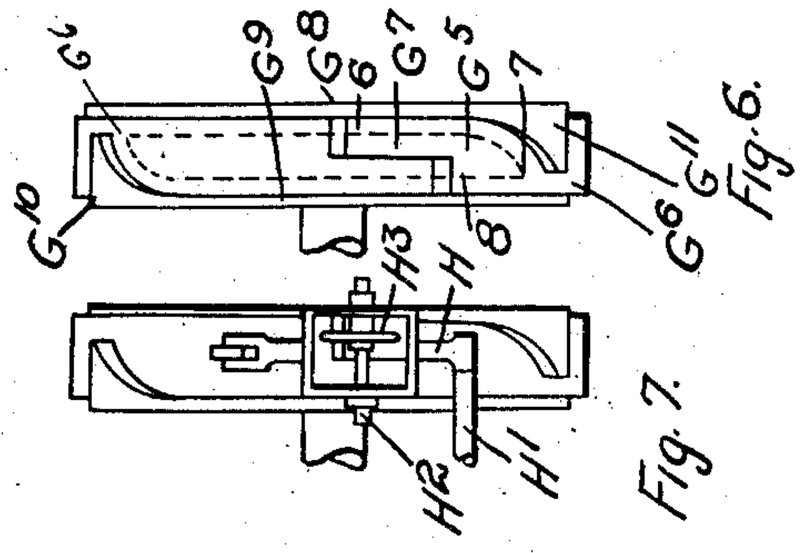

Fig. 6.

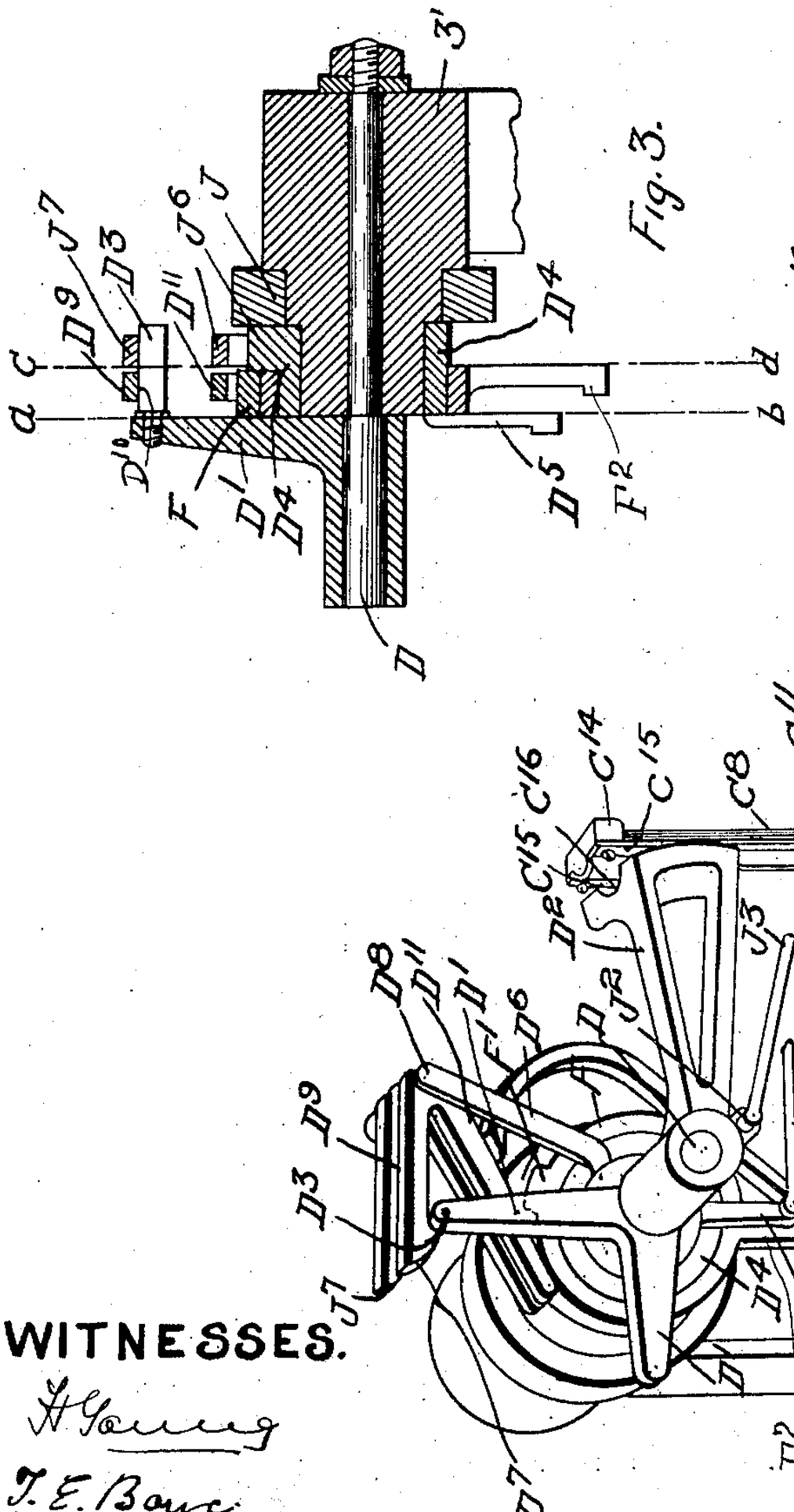

Fig. 3.

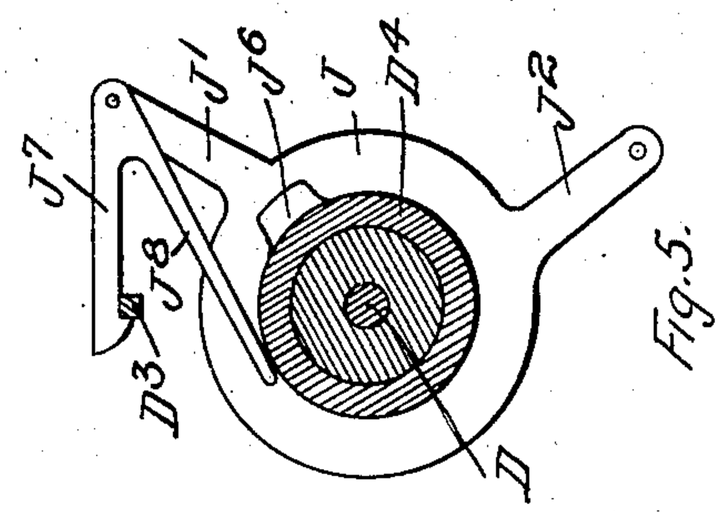

Fig. 5.

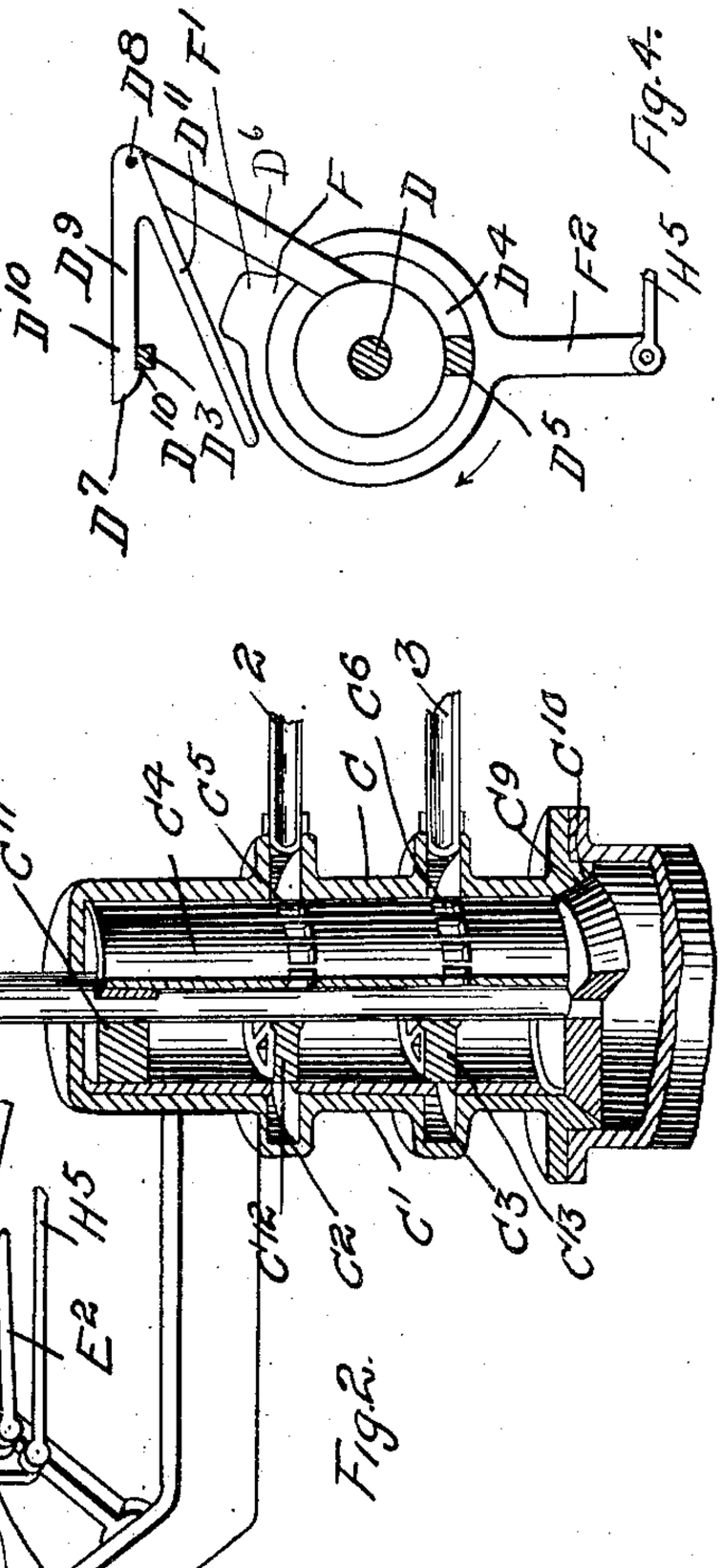

Fig. 4.

Fig. 2.

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UNITED STATES PATENT OFFICE.

ARCHIBALD BURNETT, OF PHOENIX, BRITISH COLUMBIA, CANADA.

GAS-ENGINE.

960,498. Specification of Letters Patent. Patented June 7, 1910.

Application filed February 8, 1908. Serial No. 414,992.

To all whom it may concern:

Be it known that I, ARCHIBALD BURNETT, of the town of Phoenix, in the Province of British Columbia, Canada, engineer, have invented certain new and useful Improvements in Gas-Engines, of which the following is the specification.

My invention relates to improvements in gas engines, and the object of the invention is to provide a gas engine of the double acting type which will be self starting under all conditions and it consists essentially of a double acting engine provided with the usual piston and piston rod and crank shaft; admission valves of peculiar construction and designed to admit gas and air under pressure into the cylinder of the engine and at the beginning of the working stroke of the piston; mechanism for opening one of the admission valves to supply the initial charge to the cylinder, mechanism whereby such mixture of gas and air is automatically supplied at the commencement of each power stroke during the running of the engine and mechanism whereby the feeding of the gas to one end of the cylinder at one time only is assured as hereinafter more particularly described by the following specification.

Figure 1 is a general perspective view of my engine. Fig. 2 is an enlarged perspective detail of my admission valve gear and the admission valve shown partially broken away and in section to exhibit the internal construction thereof. Fig. 3 is a longitudinal section through the valve gear. Fig. 4 is a cross section through the valve gear on line *a*—*b* (see Fig. 3). Fig. 5 is a similar view to Fig. 4 taken on line *c*—*d* (see Fig. 3). Fig. 6 is an edgewise elevation of the wrist plate. Fig. 7 is a similar view to Fig. 6 showing the coacting roller in position.

In the drawings like characters of reference indicate corresponding parts in each figure.

A is the cylinder of the engine provided with a double acting piston of any desired form and connected in the usual manner to the main shaft B.

B′ and B² are compressor tanks designed to hold respectively compressed gas and air.

C are the admission valves designed to admit a mixture of compressed air and gas to the cylinder. The admission valve consists of (see Fig. 2) a cylindrical casing C′ having a closed upper end and an open flanged lower end communicating with the admission port.

C² and C³ are annular enlargements forming annular channels and located intermediately of the length of the casing C′, and C⁴ is an inner cylinder provided with an annular row of openings C⁵ and C⁶ located opposite the enlargements C² and C³.

C⁸ is the valve stem provided with the lower tapered valve C⁹ resting upon the valve seat C¹⁰ formed at the lower end of the cylindrical casing C′.

C¹¹ is a balance valve designed to equalize the force of gas and air in opposite directions as it enters the valve, thereby preventing any liability of the valve C⁹ being forced off its seat.

C¹² and C¹³ are ring valves having radial arms and a central hub. These valves are secured to the valve stem intermediately of its length and are located normally opposite the ports C⁵ and C⁶ and are designed to close the same.

2 and 3 are gas and air pipes leading respectively from the gas and air compressor tanks to the annular channels C² and C³ of the admission valve.

I will now describe the mechanism by which the admission is operated.

D is a stud extending through the stepped bearing boss 3′ secured on a suitable portion of the engine. D′ is a bell crank suitably journaled thereon. D² is a segmental rock arm also journaled on the stud D and connected to the bell crank D′. The periphery of the segmental portion of the arm is provided with a circumferential groove C¹⁶. To each side of the valve stem are formed bosses C¹⁴ from which depend flexible metallic strips C¹⁵. The strips C¹⁵ are secured at their lower portion to the periphery of the segmental arm and to each side of the circumferential groove C¹⁶.

D³ is a pin preferably rectangular in form secured in the upper end of the upwardly extending arm of the bell crank.

D⁴ is a ring journaled on the lower step of the bearings and provided with the depending arm D⁵ and an upwardly inclined arm D⁶.

D⁷ is a crab claw pivotally supported on a pin D⁸ extending from the upper end of the arm D⁶. The crab claw consists of a substantially horizontal arm D⁹ terminating in a ratchet notch D¹⁰ and of an inclined trip arm D¹¹.

E is the operating lever fulcrumed at E′ on a suitable pin. To each side of the fulcrum E′ are connected links E². The links E² are connected at their opposite end to the depending arms D⁵ of the admission valve gears located at each end of the cylinder.

By throwing the lever E in the direction indicated by arrow, the end of the crab claw arm D⁹ is caused to mount over the pin D³ until the pin D³ engages with the notch D¹⁰ in the position shown in the drawing. The lever E is then thrown in the opposite direction to that indicated by arrow thereby rocking the ring D⁴ in the direction indicated by arrow (see Fig. 4) and thereby carrying the crab claw D⁷, the pin D³ engaging the crab claw and the segmental arm D², in the same direction and opening the admission valve. The gas and air under pressure flow from the tanks B′ and B² through the pipes 2 and 3, the ports C⁵, C⁶ and the open valve C⁹. By throwing the lever E farther in the same direction, the trip arm D¹¹ engages the cam projection F′ thereby tripping the arm D⁹ from engagement with the pin D³ and allowing the valve to close.

It will be observed that by the above operation the admission valve at both ends of the cylinder would be operated simultaneously and would therefore introduce a charge of gas into both ends of the cylinder simultaneously and allow one charge to neutralize the other. To obviate this I have provided the following mechanism. F is a float ring encircling the ring D⁴ but of narrower width. The ring F is provided with the before mentioned cam F′ and a depending arm F² (see Fig. 4). G is a wrist plate mounted on the stud G′. The wrist plate G has a rocking motion imparted to it by means of the eccentrics G² mounted on the main shaft of the engine and connected to the wrist plate by the reversing link mechanism G³, the lever G⁴ and connecting rod G⁵. G⁶ are cams located to each side of the wrist plate and on the periphery thereof. The cam G⁶ is provided with an extension G⁷. G⁸ and G⁹ are walls having inturned ends G¹⁰ and G¹¹ for a purpose which will hereinafter appear (see Fig. 6). H are arms pivoted on studs H′ at their lower ends and provided with a rectangular frame intermediately of their length. Secured in the sides of the frames are the arbors H². On the arbors H² are loosely journaled the rollers H³, designed to bear on the periphery of the wrist plate and capable of longitudinal movement on the arbors H². H⁴ are lever rods fulcrumed at their upper ends to a suitable portion of the frame of the engine and connected intermediately of their length to the depending arms F² of the float rings F by the link bars H⁵. The lower ends of the lever rods H⁴ are connected by the link bars H⁶ to the upper ends of the arms H.

As the wrist pin is rocked to and fro by means of its connection to the eccentrics G², the roller H³ travels on a path indicated by dotted lines in Fig. 6. It first travels in a direct line over the extension G⁷ of the cam G⁶ until it strikes the inturned portion of the wall G¹¹. The roller H³ then travels inwardly on its supporting arbor and on the return movement of the wrist plate the roller returns along the path marked by the inner dotted line until it strikes the inturned end G¹⁰ of the wall G⁹ which brings the roller again to its primary position. When the engine piston is at the end of its stroke assuming the end 5 is the end of the cylinder at which the piston is when starting, then the roller H³ will have mounted onto the portion G⁷ of the cam G⁶. The roller H³ being mounted on the cam G⁶ the arm H is thrown outwardly and the float ring turned on its bearing by means of the connecting link and lever rods H⁶, H⁵ and H⁴. By this movement of the float ring cam F′ is carried from beneath the trip arm D¹¹ of the crab claw D⁷ or into the position shown in the drawing in Fig. 4. The float ring remains in this position while the roller travels from the point 6 in its path to the point 7 and during its return movement to the point 8 (see Fig. 6), or while the crank travels 90° from dead center, the roller travels from point 6 to point 7 and while the crank travels from 90° to about 120°, the roller travels from point 7 to point 8 from dead center. Any time during this movement of the roller from point 6 to 8, the admission valve C may be opened by operating the lever E connected to the ring D⁴ by the rods E² which ring supports the crab claw D⁷. The notch D¹⁰ of the crab claw engages the pin D³ supported on the arms D; and thereby rocks the arm D² to depress the valve stem C⁸. By continuing the movement of the lever E, the trip arm D¹¹ engages the cam F′ thereby disengaging the pin D³ from the notch D¹⁰ of the crab claw. The valve is then closed by any suitable means such as a weight (not shown) which may be attached to the arm D², the weight being held in a suitable dash pot. Upon the crank of the engine cylinder passing the point of 120° from dead center, the roller travels off the cam G⁶ at the point 8, thereby through its connection to the float ring F the cam is carried beneath the trip arm D¹¹, thereby raising the arm D⁹ out of the path of the pin D³ and thereby disconnecting the lever E and the admission valve during the travel of the roller from point 8 back to point 6 and therefore during the revolution of the crank from 120° from dead center back to dead center through the remaining 240° of its revolution, or while the piston is at the

opposite end of the cylinder and till its return to its primary position. Upon the piston reaching the opposite end of the cylinder the roller H^3 engages with the cam G^6 to allow opening the admission at the corresponding end. It will therefore be seen that a charge of gas or air can be admitted only at one end of the cylinder at a time and at the beginning of the working stroke.

The starting charge having been admitted and exploded by any suitable mechanism I will now describe the means by which an admission valve is operated under the ordinary running conditions of the engine.

J is a ring supported upon the upper step of the bearing 3, and J′ is an upwardly inclined arm extending therefrom, and J^2 is a downwardly inclined arm. The arm J^2 is connected by a suitable link J^3, lever J^4 and link J^5 to the wrist plate G.

J^7 is a crab claw similar to the crab claw D^7 and designed to also engage with the pin D^3 in a similar manner.

J^6 is a cam formed on the sleeve D^4 to the inside of the float ring.

The rocking motion of the wrist plate is conveyed to the ring J by means of the link J^3, lever J^4 and link J^5.

The trip arm J^8 engages with the cam J^6 and, as the arm J^2 is operated by the wrist plate to rock the arm J^8 the crab claw J^7 engages the pin D^3 to open the valve as the piston reaches the opposite end of the cylinder to the end from which the piston was started. The valves at each end of the cylinder are operated in a similar manner before each working stroke of the piston.

By regulating the position of the cam J^6 in relation to the trip arm of the crab claw J^7 by means of the lever E to which it is connected, the point of cut off of the admission valve may be regulated so that a light charge may be admitted for a light load.

Although I only show one cylinder and the valve gears thereof it will be understood that I use a multiple cylinder engine so as to overcome the dead centers in starting and running the engine.

The exhaust valves may be of any suitable type operated from the wrist plate of the engine.

What I claim as my invention is:

1. A gas engine comprising a cylinder and piston, a supply of gas and air under pressure connected with said cylinder, valves on the engine, a hand lever for operating the valves to supply the air and gas to the cylinder to start the engine, means operated by the engine for automatically controlling the valves to secure a proper feed of the gas and air to the cylinder, and means controlled by the hand lever for regulating the operation of the valves by the engine.

2. An engine comprising a cylinder and piston, an inlet valve at each end of the cylinder, a hand lever for opening the valves to start the engine, means permitting the hand lever to open but one valve at a time, and means controlled by the engine for automatically controlling the valves after the engine has been started.

3. An engine comprising a cylinder, a piston therein, an inlet valve at each end of the cylinder, a stem for each valve, a bell crank lever, each lever being mounted on a stationary bearing, a segmental arm connected with said bell crank and engaging the valve stem, a pin carried by one arm of the bell crank lever, a ring journaled on the stationary bearing, a depending arm secured thereto, an upwardly inclined arm on said ring, a crab claw pivotally supported on said upwardly inclined arm and consisting of a horizontal arm having a notch therein adapted to engage with the pin, and a trip arm, a hand lever connected to the depending arm, a float ring having a cam thereon adapted to engage with the trip arm to throw the notch out of engagement with the pin, and means operated by the engine for oscillating said float ring to bring the cam into engagement with the trip arm whereby one valve is kept closed while the other is open.

4. An engine comprising a cylinder, a piston therein, an inlet valve at each end of the cylinder, a stem for each valve, a bell crank lever, each lever being mounted on a stationary bearing, a segmental arm connected with said bell crank and engaging the valve stem, a pin carried by one arm of the bell crank lever, a ring journaled on the stationary bearing, a depending arm secured thereto, an upwardly inclined arm on said ring, a crab claw pivotally supported on said upwardly inclined arm and consisting of a horizontal arm having a notch therein adapted to engage with the pin, and a trip arm, a hand lever connected to the depending arm, a float ring having a cam thereon adapted to engage with the trip arm to throw the notch out of engagement with the pin, and means operated by the engine for oscillating said float ring to bring the cam into engagement with the trip arm whereby one valve is kept closed while the other is open, said means consisting of a wrist plate mounted on the cylinder, means for rocking the wrist plate from the engine, cams on the wrist plate, an arm pivoted at one end to the cylinder, a roller carried by said arm engaging with the cam whereby the arm is given an oscillatory movement, and links connecting said arm with the floating ring.

5. An engine comprising a cylinder, a piston therein, an inlet valve at each end of the piston, a stem for each valve, a bell crank lever, a stationary bearing on which the bell crank lever oscillates, a segmental arm connected with the bell crank lever and with the valve stem, a pin carried by one arm of

the bell crank lever, a ring mounted to rotate on the stationary bearing, an upwardly extending arm on the ring, a crab claw pivoted on said arm, said claw consisting of an arm having a notch therein adapted to engage with the pin, and a depending arm, a wrist plate mounted on the cylinder, means for rocking the same from the engine, links connecting said wrist plate with the rotating ring to operate the valve, a cam adapted to engage with the trip arm to release the notch from the pin, and means for adjusting the position of said cam.

6. In a gas engine, a cylinder and piston, valves, means for controlling the valves, comprising a wrist plate having peripheral cams thereon, substantially L-shape in form, walls extending on each side of the plate from the bottom of the cam and having their diagonal opposite ends curved inwardly, arms pivoted at one end, connections from the other end to the valves, arbors in said arms, rollers journaled loosely on said arbors and capable of longitudinal movement for oscillating the arms.

7. An engine comprising a cylinder, a piston therein, inlet valves, a stationary bearing located near each valve, a bell crank on said bearing, an arm connecting the bell crank with the valve, a ring mounted on the bearing, a cam on said ring, an upwardly extending arm on said ring, a crab claw pivoted on said arm and comprising an arm having a notch therein, and a trip arm, a pin on the bell crank adapted to engage with the notch, a float ring on the bearing, a cam thereon adapted to engage with the trip arm to disengage the notch from the pinion, a wrist plate, means for rocking said wrist plate from the engine, means for connecting said plate with the floating ring to oscillate the ring, a hand lever for rocking the first mentioned ring with the cam thereon, a third ring, an upwardly extending arm thereon, a crab claw pivoted on said arm and consisting of an arm having a notch therein adapted to engage with the pin on the bell crank, and a trip arm with which the cam on the first mentioned ring is adapted to engage, and means for connecting said ring with the wrist plate.

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Witnesses:
J. L. MARTIN,
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