No. 715,150. Patented Dec. 2, 1902.

W. J. ROBB.

VALVE GEAR FOR EXPLOSIVE ENGINES.

(Application filed Jan. 2, 1902.)

(No Model.) 4 Sheets—Sheet 1.

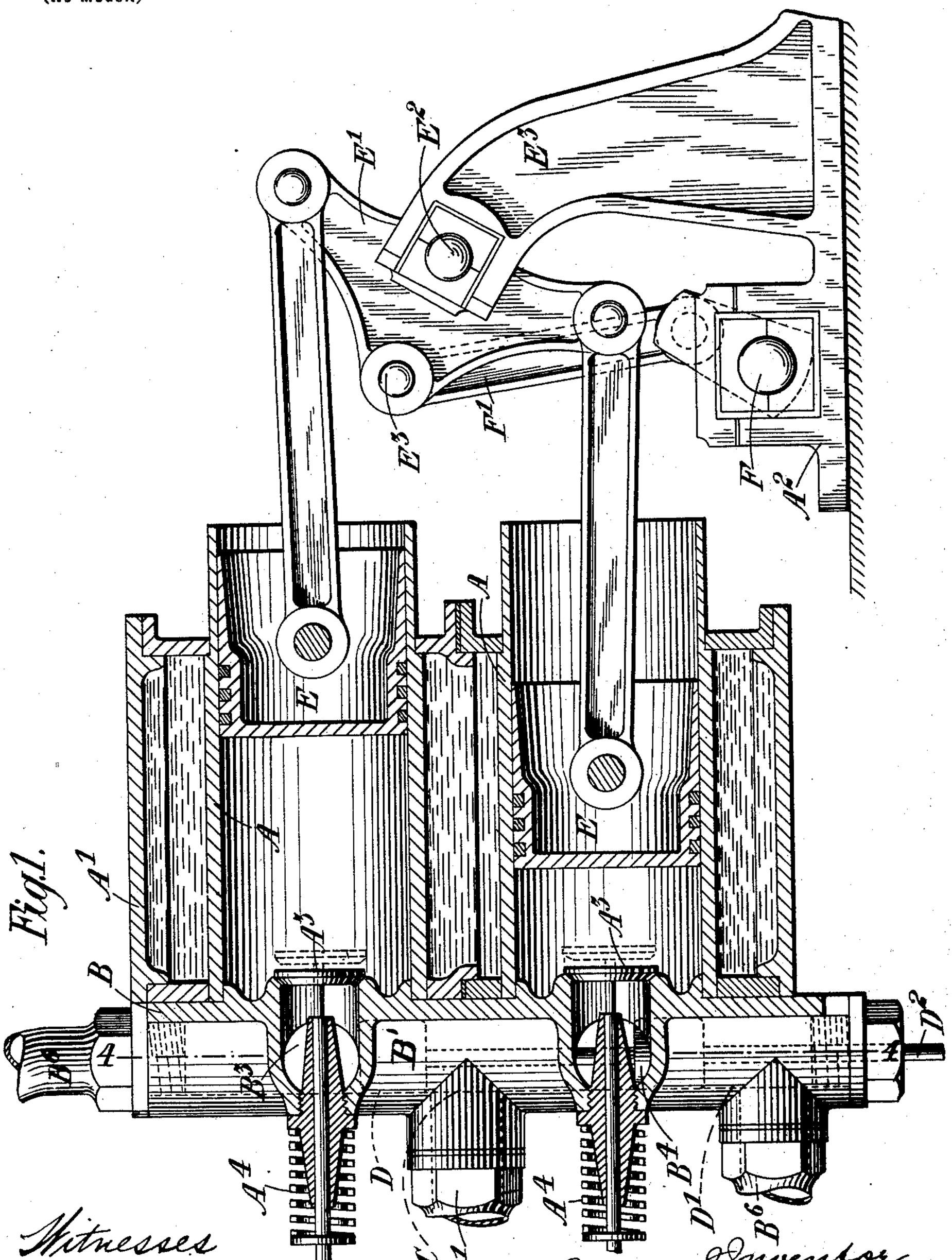


Fig. 1.

Witnesses
W. K. Boulter
C. Sedgwick

Inventor
William J. Robb
By Wm. K. Boulter
attorney

No. 715,150. Patented Dec. 2, 1902.

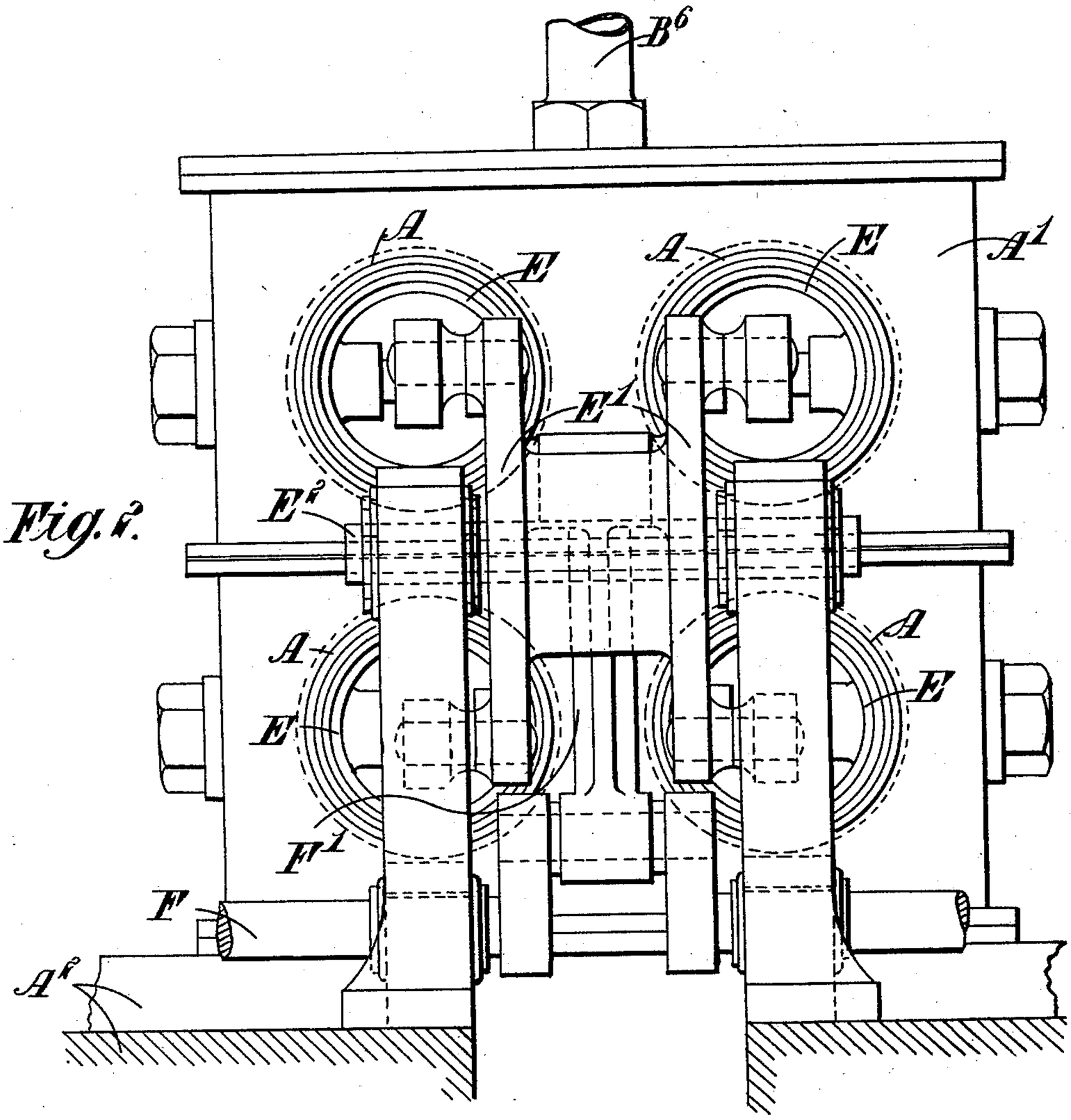
W. J. ROBB.

VALVE GEAR FOR EXPLOSIVE ENGINES.

(Application filed Jan. 2, 1902.)

(No Model.) 4 Sheets—Sheet 2.

Fig. 2.



Witnesses
W. K. Boulter
[illegible]

Inventor
William J. Robb
By Wm. E. Boulter.
attorney

No. 715,150. Patented Dec. 2, 1902.

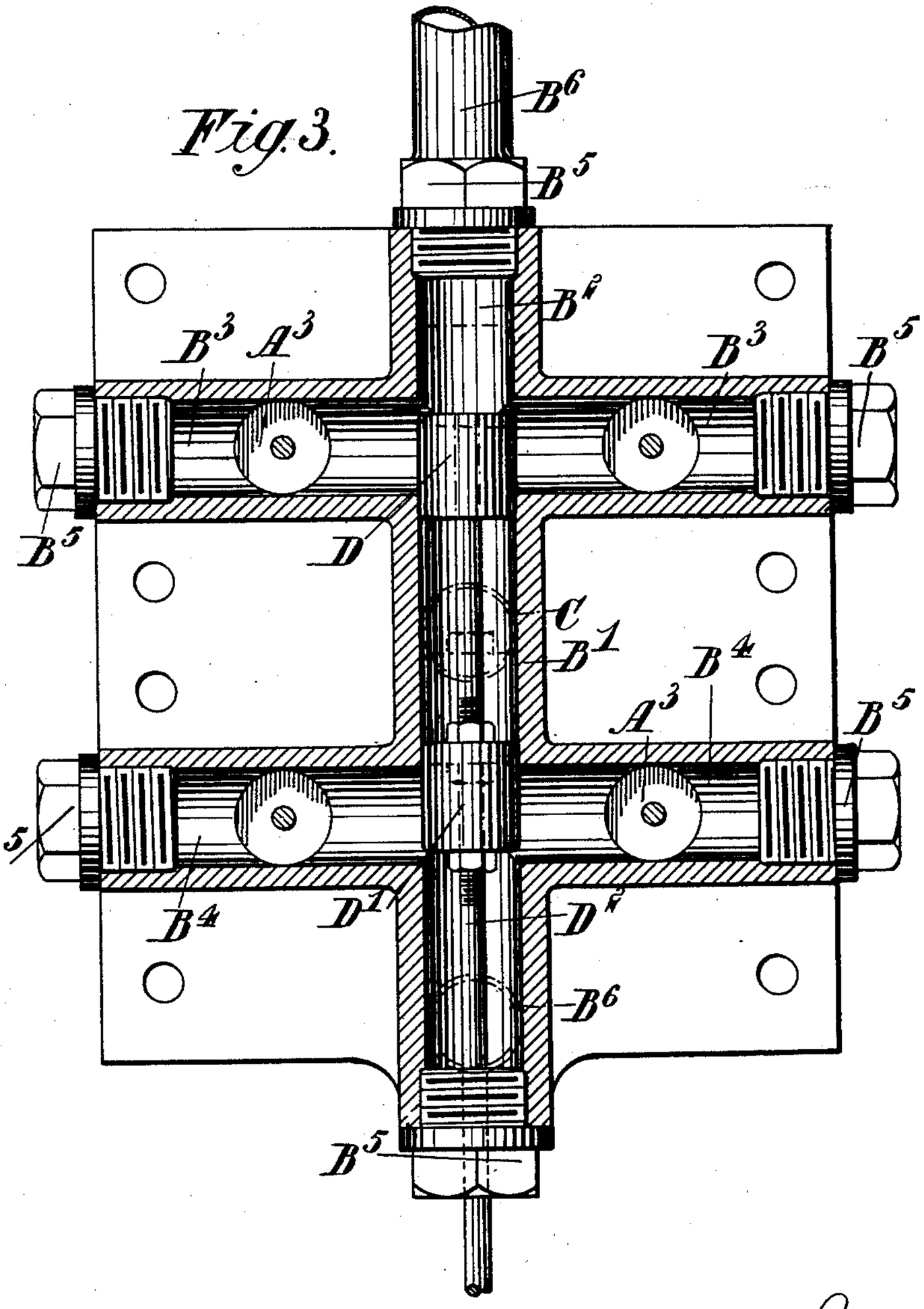
W. J. ROBB.

VALVE GEAR FOR EXPLOSIVE ENGINES.

(Application filed Jan. 2, 1902.)

(No Model.) 4 Sheets—Sheet 3.

Fig. 3.



Witnesses
W. K. Boulden
C. Hinckley

Inventor
William J. Robb.
By Wm. E. Boulden
attorney

No. 715,150. Patented Dec. 2, 1902.

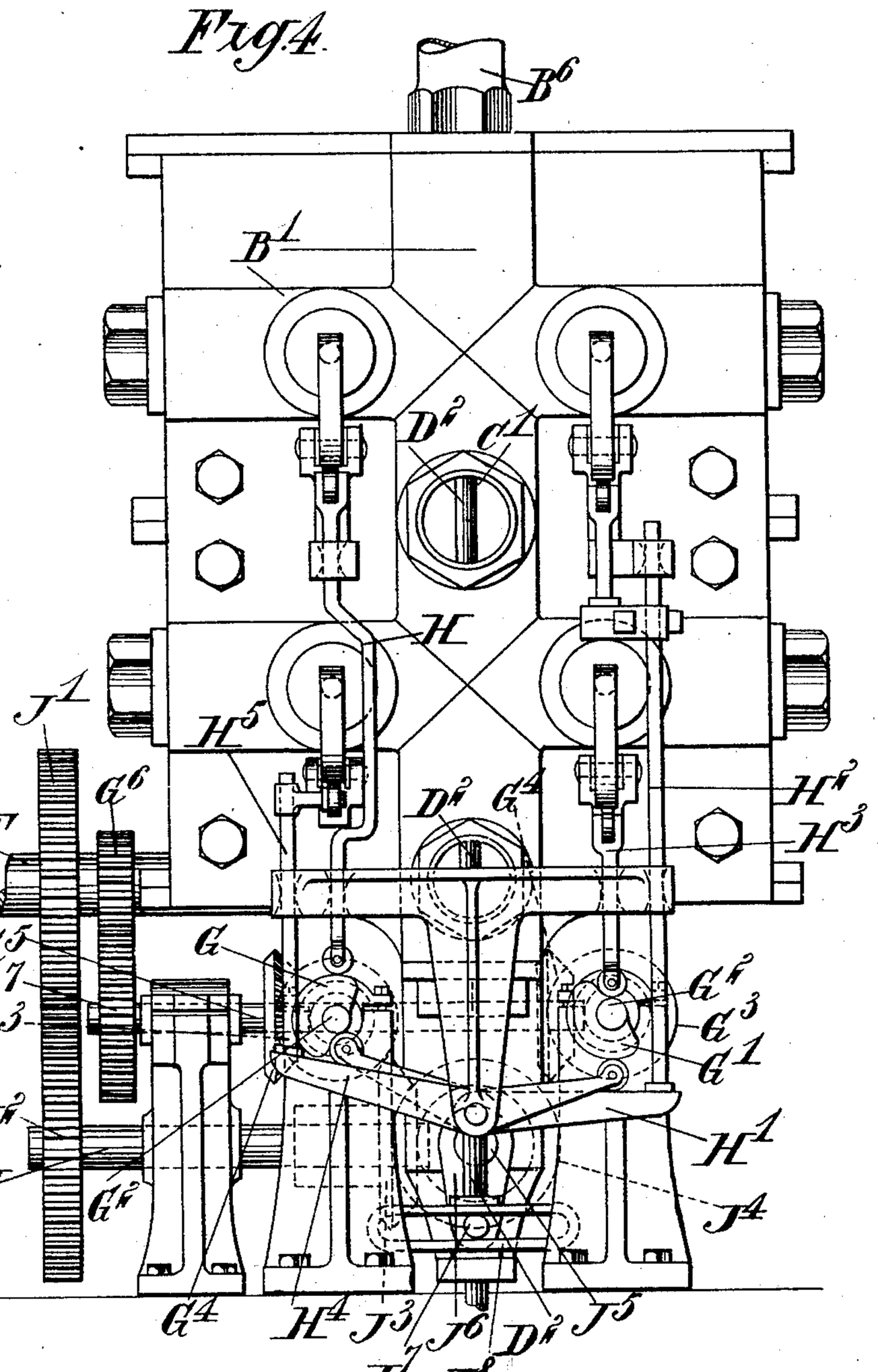
W. J. ROBB.

VALVE GEAR FOR EXPLOSIVE ENGINES.

(Application filed Jan. 2, 1902.)

(No Model.) 4 Sheets—Sheet 4.

Fig. 4.



Witnesses
W. K. Boulter
L. G. Huntington

Inventor
William J. Robb,
By Wm. E. Boulter,
Attorney

UNITED STATES PATENT OFFICE.

WILLIAM JOHN ROBB, OF PORTADOWN, IRELAND.

VALVE-GEAR FOR EXPLOSIVE-ENGINES.

SPECIFICATION forming part of Letters Patent No. 715,150, dated December 2, 1902.

Application filed January 2, 1902. Serial No. 88,160. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM JOHN ROBB, a subject of the King of England, residing at Portadown, Ireland, have invented certain new and useful Improvements in Valve-Gear for Explosive-Engines, (for which I have made application for Letters Patent in Great Britain under No. 13,309, dated July 1, 1901,) of which the following is a specification.

This invention relates to improvements in or relating to internal-combustion engines, and has particular reference to the valve-gear for these engines.

The invention is particularly adapted for application to two or four cylinder engines, although it may be applied to an engine having only one cylinder.

In the accompanying drawings, which illustrate this invention applied to a four-cylinder engine, Figure 1 is a longitudinal vertical section through the cylinders on one side of the engine. Fig. 2 is a front end elevation of the engine. Fig. 3 is a vertical section on the line 4 4 of Fig. 1; and Fig. 4 is an end elevation of the engine, showing the means for actuating the valves.

The cylinders A in the engine illustrated are provided with a water-jacket A′, which serves to support the cylinders and is rigidly secured by any convenient means to the bed-plate A^2 of the engine. The four cylinders are arranged in pairs vertically one upon the other and their rear ends closed by a plate B, common to all four cylinders.

The plate B is conveniently cast and provided on that face remote from the cylinders with a lug B′. The lug B′ is bored vertically approximately to the face of the plate, so that a vertical passage B^2 is formed in the lug open at each end if the boring is carried through the whole length of the lug. The lug is also similarly bored at right angles to the passage B^2, so that passages B^3 B^4 are formed, which lie approximately in the same plane as and communicate with the passage B^2. The lug B′ in the drawings is shown provided with side extensions for the borings B^3 B^4; but if the lug is made of sufficient width these extensions may obviously be dispensed with. The central vertical passage-way B^2 is conveniently placed equidistant from the cylinders on either side of it, and each cylinder is provided with a valve A^3, which communicates with one of the passage-ways B^3 B^4. The ends of all the passage-ways are closed by plugs B^5, conveniently screw-threaded, although the plugs of the passage-way B^2 are drilled through, as hereinafter described. Forming all of the passage-ways in one lug and arranging the cylinders in pairs vertically one above the other, as described, enables the passage-ways to be bored without any great expense, as the whole construction may be effected by three drillings. The plug at the bottom of each drilling or boring may be dispensed with, if desired, by omitting to carry the borings right through the lug, so that the "finishing ends" are left closed.

The valves A^3 are situated each practically at one end of a passage the other end of which communicates with the passage B^2, common to all the passages. Each valve is normally kept down upon its seating by a spring A^4, sufficiently strong to resist the suction produced by the piston as it performs the outstroke in the cylinder when the latter is not charged. Operating mechanism of any convenient kind may be provided for opening the valves at the required intervals against the action of their springs A^4. Each valve serves alternately as an inlet and exhaust valve, and the mechanism is so arranged that the valve is first opened for exhausting and then maintained open for charging. In the passage B^2 an inlet-port C is provided, situated between the passages B^3 B^4 and communicating with the carbureter or other device for supplying the fuel to the motor. At each end of the passage B^2 is an exhaust port or way B^6, that at the upper end being conveniently formed in the plug B^5, which latter in this case may take the form of a screw-threaded pipe secured in the end of the passage-way. The ports or outlets may communicate freely with the atmosphere or serve to convey the hot exhaust-gases to any part of the engine which may require heating. Within the passage B^2 is mounted a piston-valve having pistons D D′, carried by a piston or plunger rod D^2. The piston is of such a depth that it completely closes the passages B^3 B^4 as it passes. The pistons are situated at such a distance one from the other upon the plunger-rod D^2 that when in

the middle position, as shown in Fig. 4, each passage B^3 B^4 is in communication with its respective exhaust-port.

Any convenient mechanism may be provided for reciprocating the piston-valve D D', the mechanism being so adjusted that the pistons are at their middle position (shown in Fig. 4) when the crank-shaft of the engine is at its dead-center. By this arrangement a slight lead is given to the exhaust, which is found advantageous in working these engines.

The piston-valve D D' is of course reciprocated once every revolution of the crank-shaft, the engine being of the Otto cycle type.

One form of mechanism for operating the valves A^3 and plunger D is shown in Fig. 4. The valves are operated by cams G G', carried on longitudinal shafts G^2. Each of the shafts G^2 is provided with a miter-wheel G^3, which gears with miter-wheels G^4 on a transverse shaft G^5. The transverse shaft G^5 is driven from the crank-shaft F by spur-wheels G^6 G^7. The cam G operates the valve of the top left-hand cylinder by means of a rod H and the valve of the top right-hand cylinder by means of a tappet-lever H' and operating-rod H^2. In a similar manner the cam G' operates the valve of the bottom right-hand cylinder by means of a rod H^3 and the valve of the bottom left-hand cylinder by a tappet-lever H^4 and rod H^5. The rods H, H^2, H^3, and H^5 may all be spring-controlled, if desired, to keep them in operative contact with their respective cams.

To operate the plunger D, a transverse shaft J is provided, which receives its motive power from the crank-shaft F by spur-wheels J' J^4. On the transverse shaft J is a miter-wheel J^3, which gears with a miter-wheel J^4, fast on a longitudinal shaft J^5. At that end of the longitudinal shaft J^5 remote from the miter-wheel J^4 is secured a crank J^6, provided with a crank-pin J^7. The crank-pin J^7 engages a slotted member J^8, secured to the free end of the plunger-rod D^2.

It will be easily understood that by means of the cams G G' and their accompanying mechanism the valves A^3 are each operated in their proper order, and by means of the revolving crank J^6 the plunger F is reciprocated at the required intervals.

The back or end plate B may be secured to the cylinders A or the water-jacket A' by any convenient means, but is preferably made easily detachable, so that by removing the plate access may be readily had to the valves mounted in it.

The inlet-port C communicates with a pipe C', Fig. 1, the free end of which may communicate freely with the atmosphere or with a hot-air chamber in which the air is heated in the well-known manner by means of the exhaust-gases discharged from the cylinders.

The pistons E of the cylinders A are connected in pairs to opposite ends of a rocking beam E', carried by a rocking shaft or adapted to rock on a shaft E^2 on the bed-plate A^2. The rocking beam E' is provided with a projection E^3 approximately midway of its length, by which it is operatively connected with the crank-shaft F by means of a connecting-rod F'.

As the cycle of operations in each cylinder of the engine is the same, although the steps of the cycle do not take place synchronously in any two cylinders, as will be well understood, it is only necessary to describe the operation of the parts connected with one cylinder in describing the working of the engine. Presuming the bottom cylinder of Fig. 1 to be charged and the charge exploded, so that the piston is about to perform its outstroke, the valve A^3 remains closed until the return stroke of the piston, when it is opened by mechanism operated from the crank-shaft. At the same moment that the valve A^3 is opened mechanism, also operated from the crank-shaft, moves the piston-valve D D' upward, so that it takes up the position shown in dotted lines in Fig. 4. This movement of the piston-valve throws open the communication between the exhaust-port B^6 and the passage B^4, and thus permits the exhaust from the cylinder to pass out through the passages B^4 B^2 and the port B^6. As the piston now performs the next outstroke, the valve A^3 of the cylinder under consideration is still maintained open by its operating mechanism; but at the commencement of the outstroke of the piston the mechanism which operates the piston-valve D D' now again at the middle of its stroke, as shown in full lines in Fig. 4, continues to move the latter downwardly till it takes the position shown in dotted lines in Fig. 1. In this position the exhaust-port B^6 is cut off from the passage B^4 and the inlet-port C thrown into communication with this passage. The receding piston now draws in a charge through the inlet-port C, passage B^2, passage B^4, and valve A^3, which latter thus serves as an inlet and exhaust valve, as described above. The valve is now closed and the piston returns upon its instroke, compressing the charge to be exploded at the commencement of the second cycle of operations.

This engine is particularly adapted for use with heavy oils, and the employment of one valve for inlet and exhaust contributes considerably to the efficiency of the engine as the valves and the exhaust-ways become heated by the exhaust, so that condensation of the incoming charge is prevented.

The arrangement of the passages B^2 B^3 B^4 in the end plate B of the engine enables a single spray-nozzle to be mounted in close proximity to all the valves A^3, and the nozzle may be inserted in the pipe C' as close as is convenient to the plate B, preventing unnecessary condensation in the passage of the carbureted air to the valves.

To start the engine, a light oil may be used until the valves and passages are sufficiently

warmed to permit of the employment of the heavy oil.

Although the cylinders are shown in the drawings as horizontal cylinders, it will be understood that they may be vertically arranged, if desired, without in any way affecting the spirit of this invention.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. In an internal-combustion engine the combination of a working cylinder, a combustion-space within the cylinder, an end plate secured to the combustion end of the cylinder, a lug on the face of the end plate outside the cylinder, a passage-way through the lug approximately parallel with the face of the end plate, means for closing the outer ends of this passage, means of communication between one end of this passage-way and the combustion-space of the cylinder, a valve to control this means of communication, means for operating the valve, a second passage-way through the lug approximately at right angles to the first and in approximately the same plane and passing through the first passage-way remote from the cylinder-valve end, means for closing both ends of this passage, an exhaust-port communicating with this passage, an inlet-port communicating with this passage, a valve to control these ports and means for operating that valve as set forth.

2. In an internal-combustion engine the combination of a working cylinder, a combustion-space within the cylinder, an end plate secured to the combustion end of the cylinder, a lug on the face of the end plate outside the cylinder, a passage-way through the lug approximately parallel with the face of the end plate, means for closing the outer ends of this passage, means of communication between one end of this passage-way and the combustion-space of the cylinder, a valve to control this means of communication, means for operating the valve, a second passage-way through the lug approximately at right angles to the first and in the same plane and passing through the first passage-way remote from the cylinder-valve end, means for closing both ends of this passage, an exhaust-port communicating with this passage at a point to one side of the first passage, an inlet-port communicating with the second passage at a point on the other side of the first passage, a movable body within the passage for cutting off either the inlet or outlet port from communication with the first passage and means for reciprocating this body as set forth.

3. In an internal-combustion engine the combination of a working cylinder, a combustion-space within the cylinder, an end plate secured to the combustion end of the cylinder, a lug secured to the face of the end plate outside the cylinder, a passage-way through the lug approximately parallel with the face of the end plate, means for closing the outer ends of this passage, means of communication between one end of this passage-way and the combustion-space of the cylinder, a valve to control this means of communication, means for operating the valve, a second passage-way through the lug approximately at right angles to the first and in the same plane and passing through the first passage-way remote from the cylinder-valve end, means for closing both ends of this passage, an exhaust-port communicating with this passage at a point to one side of the first passage, an inlet-port communicating with the second passage at a point on the other side of the first passage, a piston in the second passage to control the communication of the ports with the first passage and means for reciprocating the piston substantially as set forth.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

WILLIAM JOHN ROBB.

Witnesses:
G. F. WARREN,
JOSEPH LAKE.