J. E. BROWN.

DOUBLE ACTING TWO CYCLE INTERNAL COMBUSTION ENGINE.

APPLICATION FILED JUNE 3, 1907.

1,007,331. Patented Oct. 31, 1911.

3 SHEETS—SHEET 1.

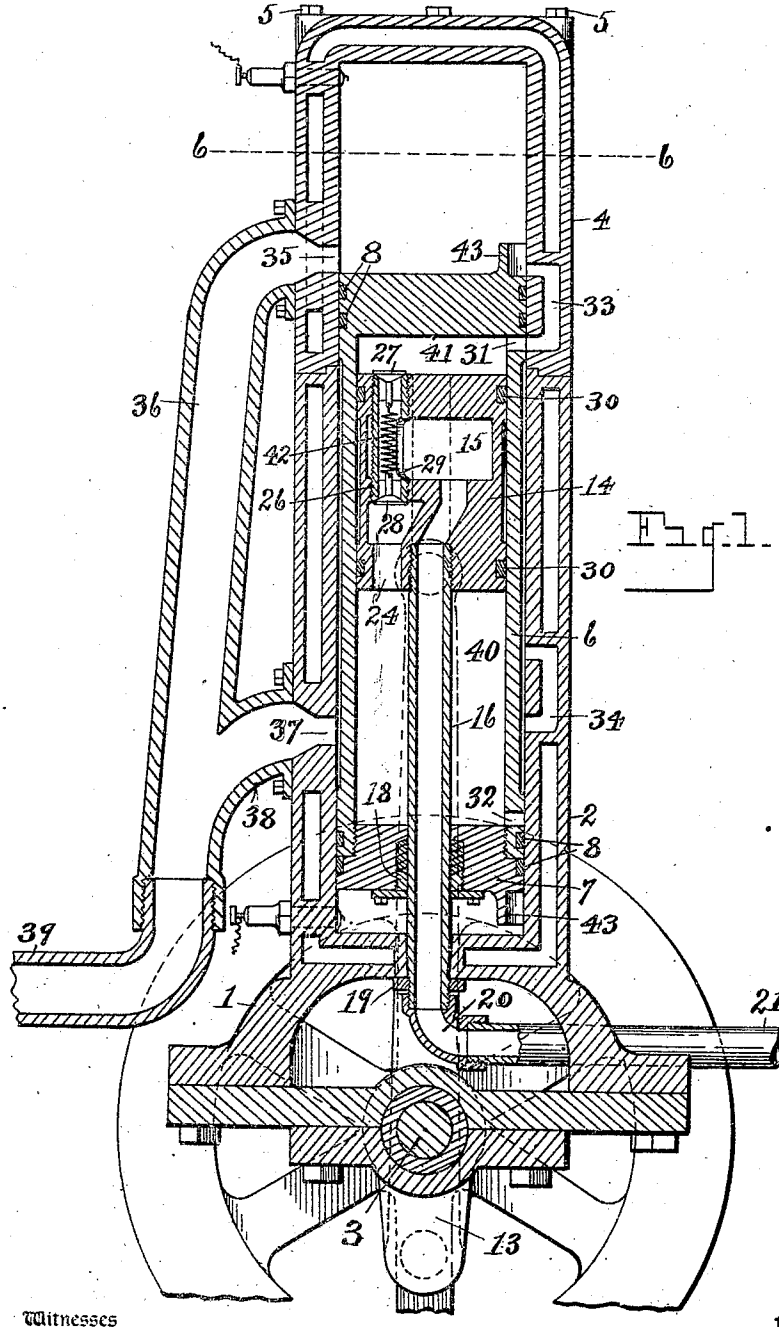

Fig. 1.

Witnesses

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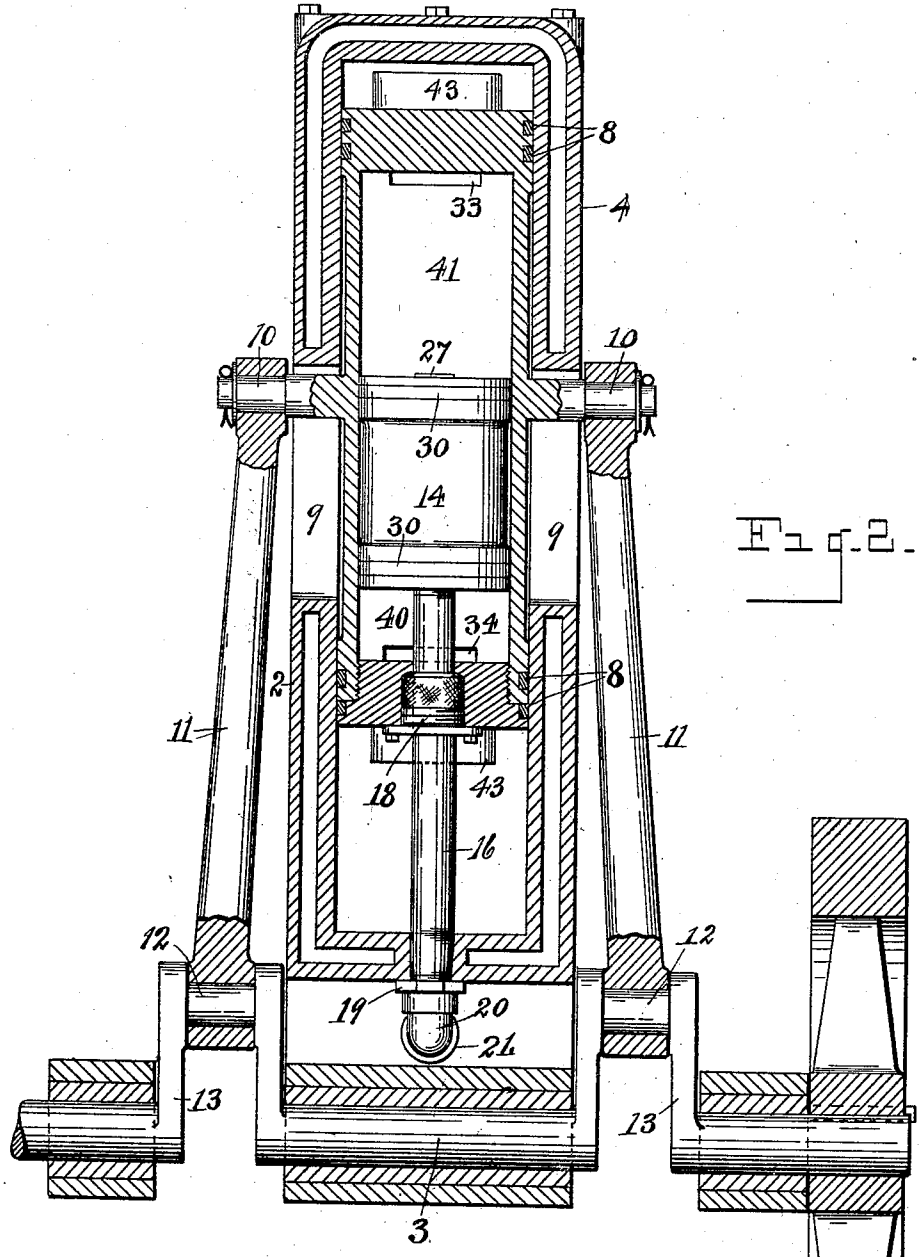

Fig. 2.

Witnesses

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3 SHEETS—SHEET 3

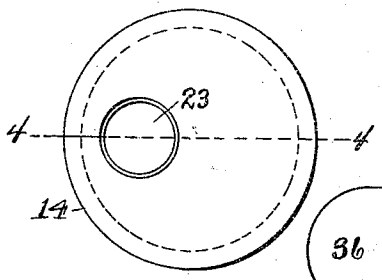

Fig. 3.

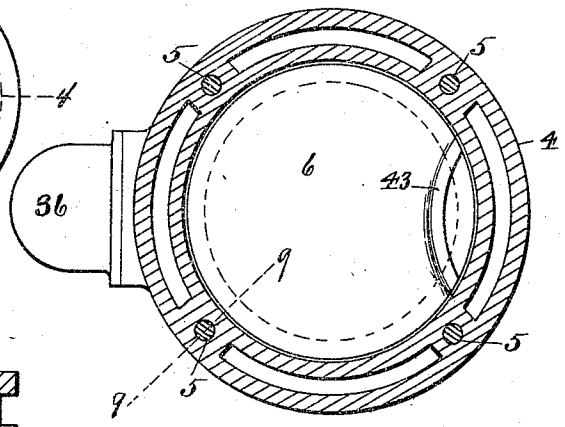

Fig. 6.

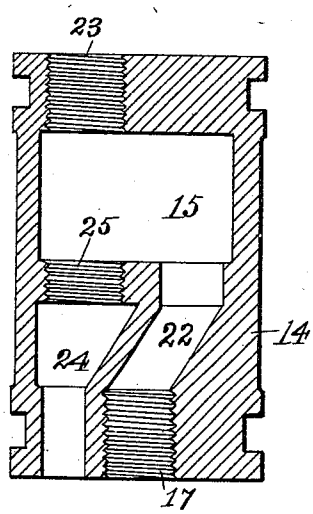

Fig. 4.

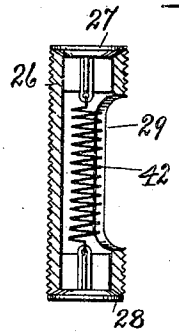

Fig. 7.

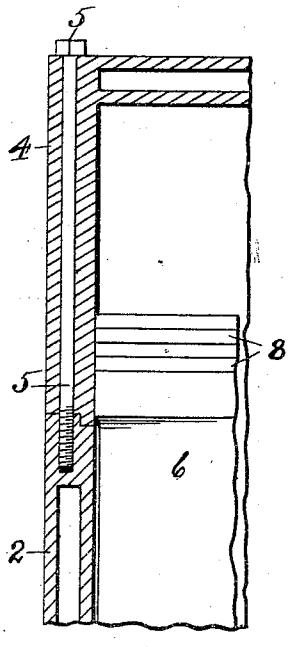

Fig. 7.

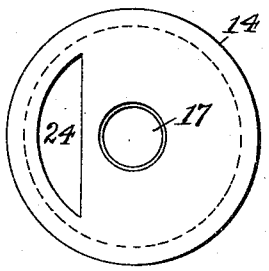

Fig. 5.

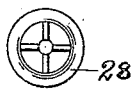

Fig. 8.

Witnesses

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UNITED STATES PATENT OFFICE.

JOHN E. BROWN, OF SARNIA, ONTARIO, CANADA, ASSIGNOR OF ONE-HALF TO LUKE W. TURNBULL, OF PORT HURON, MICHIGAN.

DOUBLE-ACTING TWO-CYCLE INTERNAL-COMBUSTION ENGINE.

1,007,331. Specification of Letters Patent. Patented Oct. 31, 1911.

Application filed June 3, 1907. Serial No. 376,907.

To all whom it may concern:

Be it known that I, JOHN E. BROWN, a citizen of the Kingdom of Great Britain, residing at Sarnia, in the county of Lambton, Province of Ontario, Canada, have invented certain new and useful Improvements in Double-Acting Two-Cycle Internal-Combustion Engines; and I do declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to the figures of reference marked thereon, which form a part of this specification.

This invention relates to a double acting two cycle internal combustion engine, and consists in the construction and arrangement of parts hereinafter fully set forth and pointed out particularly in the claim.

The object of the invention is to produce an engine of the character described, of compact and simple construction wherein the arrangement is such as to provide for exploding a charge alternately in the opposite ends of the working cylinder and for compressing the explosive charges within the piston and forcing said charges alternately from the opposite ends of the piston into the ends of the cylinder prior to compression by the moving piston and ignition, as will be well understood in the art.

The above object is attained by the structure illustrated in the accompanying drawing, in which:—

Figure 1 is a central, vertical section through an engine involving my invention, said section being at right angles to the crank shaft. Fig. 2 is a similar section parallel with the crank shaft. Fig. 3 is a plan view of the fixed piston within the movable piston of the engine. Fig. 4 is a longitudinal section therethrough as on line 4—4 of Fig. 3. Fig. 5 is an inverted plan view of said fixed piston. Fig. 6 is a horizontal section through the main cylinder as on line 6—6 of Fig. 1. Fig. 7 is a longitudinal sectional view through the double check valve case which is screwed into the fixed piston for purposes hereinafter explained. Fig. 8 is an end view of Fig. 7. Fig. 9 is a fragmentary view in section through the upper end of the main cylinder showing the manner of connecting the parts thereof.

Referring to the characters of reference, 1 designates the base formed integral with the lower end of the main cylinder 2 which is supported thereon. The crank shaft 3 is suitably journaled below the base of the cylinder. For the purpose of affording ready access to the interior of the cylinder, the upper or cap portion 4 thereof is made detachable and is secured to the body of the cylinder by suitable tie-bolts 5 passing vertically therethrough, as clearly shown in Fig. 9. Within the cylinder is the movable motor piston 6 which is formed hollow and is provided at one end with a removable head 7. Said piston is of the double-acting type and is provided at its opposite ends with suitable packing rings 8. Intermediate the ends of the cylinder, the wall thereof on opposite sides is provided with a slot 9, and formed integral with the piston and projecting laterally therefrom through said slots are the journal pins 10 on which are journaled the upper ends of the connecting rods 11. The lower ends of said connecting rods are journaled on the pins 12 of the cranks 13 of the shaft 3.

Within the movable or motor piston is a stationary piston 14 having a central chamber 15 therein. The stationary piston is supported within the movable piston by means of the hollow standard 16 which at its upper end is threaded and screwed into the tapped opening 17 in the lower end of said stationary piston, said standard passing through the head 7 of the movable piston 6 in which is formed a suitable stuffing box 18 which embraces said standard, the lower end of said standard passing through a tapered aperture in the lower cylinder head and receiving the nut 19 by means of which it may be drawn tightly into place. Connected with the lower end of said standard is an elbow 20 with which is connected a suitable pipe 21 leading from the carbureter or charge-forming device, not shown. From the upper end of the hollow standard 16 a passage way 22 is formed in the stationary piston leading from the chamber 15. Formed through the upper end of the stationary piston is a tapped opening 23 which communicates with said chamber, and formed through the lower end of said piston is a

port 24 having a tapped portion 25 communicating with said central chamber. Screwed into the openings 23 and 25 so as to render it removable therefrom is a valve cage 26 having at its upper end a check valve 27, and at its lower end a check valve 28, said valves being adapted to seat upon the opposite ends of said cage to close the passage therethrough. In the wall of the cage is an opening 29 which establishes communication between the valve cage and the chamber 15. By this arrangement said chamber is placed in communication with the opposite ends of the piston 6 through the valve-controlled openings in the opposite ends of said cage. Suitable packing rings 30 are employed between the ends of the stationary piston and the inner wall of the movable piston.

Formed through the wall of the movable piston at its upper end is a port 31, and in the wall of said piston at its lower end is a similar port 32. In the wall of the cylinder is a by-pass 33 with which the upper port in the piston 6 is adapted to register. A second by-pass 34 is also formed in the wall of the cylinder near its lower end with which the lower port in said piston is adapted to register. An exhaust port 35 is formed through the wall of the cylinder at the upper end thereof with which the exhaust pipe 36 communicates, and at the lower end of said cylinder is an exhaust port 37 communicating with the exhaust pipe 38, said exhaust pipes 36 and 38 connecting with a single exhaust pipe 39.

In explaining the operation of the engine, reference will first be made to Fig. 1, wherein the parts are in the position immediately following the explosion of a charge in the upper end of the cylinder, the piston 6 being at the limit of its down stroke and the exhaust port 35 being uncovered by the piston to permit the burned gases to escape. As the piston 6 moves downwardly, the area of the chamber 40 therein below the stationary piston is greatly increased, causing a partial vacuum therein and a consequent inflow of explosive mixture which is drawn through the hollow standard 16 into the chamber 15 of the stationary piston and past the valve 28 into the chamber 40; in the meantime the explosion of a second charge at the lower end of the cylinder will have driven the piston 6 upwardly, thereby compressing the charge in the chamber 40 until the movement of the piston 6 shall have caused the port 32 therein to register with the upper end of the by-pass 34, when the compressed charge in chamber 40 will pass around the lower head of said piston into the lower end of the cylinder in position for compression by a return stroke of the piston. As the piston 6 moves upwardly in compressing the charge in the chamber 40, the area of the chamber 41 at the upper end of the movable piston is greatly increased causing a partial vacuum therein and an inflow of the explosive mixture which is again drawn through the hollow standard 16 into the chamber 15 of the stationary piston and past the valve 27 into said chamber 41 so that upon the return stroke of the piston 6 the explosive charge in chamber 41 is compressed until the movement of the piston causes the port 31 to register with the lower end of the by-pass 33, when said charge will escape under pressure into the upper end of the cylinder. It will be noted that the valves 27 and 28 are connected by a coiled spring 42, the tension of which will normally hold said valves to their seat, but which will yield sufficiently to allow said valves to rise to permit an explosive charge to pass into the opposite ends of the movable piston, as before described.

When the piston 6 is forced upwardly by the explosion of a charge in the lower end of the cylinder, the exhaust port 37 is uncovered at the time said piston reaches the limit of its upward movement, thereby allowing the burned gases to escape. It will be noted that each end of the piston is provided with a curved deflector 43 which extends around the inlet port of the by-pass so that the inrushing charge is deflected upwardly into the cylinder to prevent its escape with the exhaust. It will now be apparent that a reciprocation of the main piston 6 will cause an explosive charge to be alternately introduced into the opposite ends of the cylinder, which charges are successively compressed by the return stroke of the piston and exploded by the ordinary ignition device in common use, affording two impulses for each revolution of the engine shaft. It will be noted that this result is accomplished without a material elongation of the cylinder and without increasing its diameter at any point, the hollow motor piston in connection with the stationary piston therein serving as a pump to force the explosive charges successively into the ends of the cylinder, the stationary piston, the movable piston and the main cylinder being co-axial.

Having thus fully set forth my invention, what I claim as new and desire to secure by Letters Patent, is:—

The combination of a cylinder adapted to explode a charge at each end, a hollow reciprocatory piston therein, said piston having ports near the ends thereof, the wall of the cylinder having by-passes therein which open into the cylinder at each end, said by-passes adapted in conjunction with said ports to establish communication between the interior of the hollow piston at its ends and the ends of the cylinder, the movable

piston in its travel alternately opening and closing both ends of said by-passes, a stationary piston within the movable piston, said stationary piston having a chamber located centrally therein and having valve-controlled ports opening through the opposite ends thereof which connect the chamber of the stationary piston with the interior of the movable piston on each side of said stationary piston, and a hollow rod passing through one end of the cylinder and through one end of the movable piston, said hollow rod supporting the stationary piston and communicating at one end with the chamber therein independently of said valve-controlled ports.

In testimony whereof, I sign this specification in the presence of two witnesses.

JOHN E. BROWN.

Witnesses:
P. H. PHILLIPS,
W. L. JENKS.