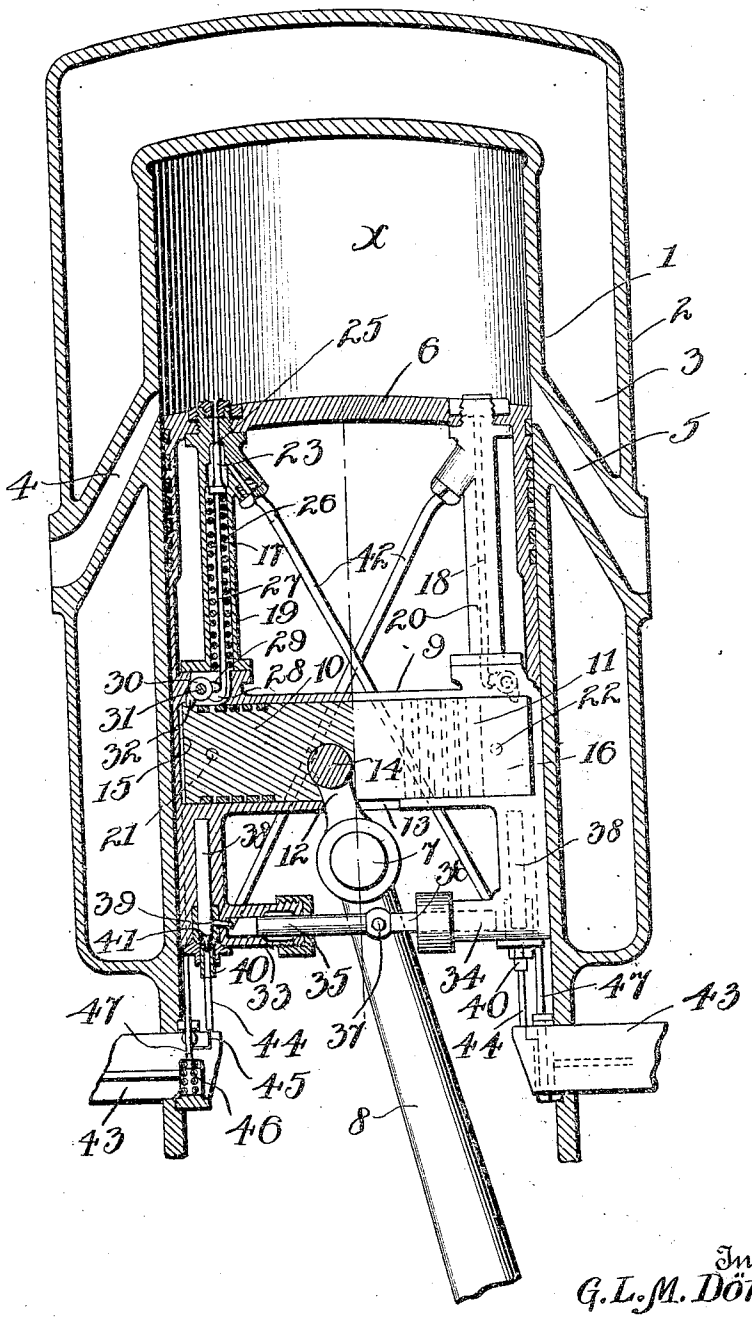
G. L. M. DÖRWALD.

INTERNAL COMBUSTION ENGINE.

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1,102,019.

Patented June 30, 1914.



Witnesses,

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GOTTFRIED LUDWIG MAX DÖRWALD, OF LONDON, ENGLAND.

INTERNAL-COMBUSTION ENGINE.

1,102,019. Specification of Letters Patent. Patented June 30, 1914.

Application filed June 7, 1912. Serial No. 702,354.

To all whom it may concern:

Be it known that I, GOTTFRIED LUDWIG MAX DÖRWALD, a subject of the German Emperor, residing at 226 Merton road, Wandsworth, London, England, have invented certain new and useful Improvements in Internal-Combustion Engines; and I do hereby 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.

The present invention relates to fuel feeding apparatus for internal combustion engines, and consists in the arrangements and combinations of parts hereinafter disclosed and particularly set forth in the accompanying claims.

The invention has for its purpose to provide a construction of internal combustion engine wherein the engine piston carries the charge forming and feeding mechanism, and which in the working of the piston operates to draw the fuel from the source of supply and compress and commingle the same with air, and then inject the mixture into the firing chamber.

With these and other objects in view the invention consists in the novel details of construction and combinations of parts more fully hereinafter disclosed and particularly pointed out in the claims.

The invention is shown by way of illustration in the accompanying drawing wherein the figure is a central vertical section, and part elevational view, of an engine cylinder and piston equipped with the mechanism.

Referring to the construction in further detail, 1 designates the engine cylinder having the usual casing 2 providing a water jacket 3; and 4 and 5 designate, respectively, the inlet and exhaust passages. A piston 6 is connected by the gudgeon 7 to the piston rod 8. A cylinder 9 is mounted within the piston 6 and is disposed transversely thereof, and a double piston 10 and 11 is mounted to operate within said cylinder 9, and derives its motion through the medium of the piston rod extension 12 which passes through the slot 13 of the cylinder 9 and engages with the double piston at the point 14. The cylinder and piston construction (9, 10 and 11) have for their purpose to compress air within the respective cylinder chambers 15 and 16, and force said air under compression into the firing chamber X through the passageways 17 and 18 through the tubes 19 and 20 connecting the cylinder 9 with the head of the piston 6. Air is admitted into the cylinder chambers 15 and 16 through the ports 21 and 22 formed in the cylinder 9.

A controlling valve 23 is provided for each of the tubes 19 and 20, and is adapted to normally close on the valve seat 25 through the agency of the spring 26 surrounding the valve stem or rod 27. The rod or valve stem 27 is constructed with a hooked end 28 that engages with a finger 29 on the member 30, which is pivotally mounted on the pin 31. A second finger 32 is carried by the member 30 and projects into the path of movement of the piston operating in the cylinder 9, and when engaged by said piston the mechanism aforesaid operates to withdraw or unseat the valve 23 and permit the air compressed in the chamber 15 to escape into the firing chamber X.

A pair of cylinders 33 and 34 are mounted on the piston 6 immediately beneath the cylinder 9, and pistons 35 and 36 are mounted to work in said cylinders 33 and 34 through the agency of the piston rod 8, to which they are connected by the pin 37. The cylinders and pistons 34, 35 and 36 have for their purpose to charge the engine cylinder with fuel under pressure. A chamber 38 is formed in the wall of the piston 6 adjacent each of the cylinders 33 and 34, and communicates with the chamber of each of said cylinders through the passageway 39, as clearly shown to the left in the accompanying drawing. A pair of tubes 40 is carried by the piston 6 and communicate, respectively, with the chambers 38, and a spring seated valve 41 normally closes the communicating passageway between each tube and chamber, as shown. A pipe or tube 42 extends from each of the fuel compressing chambers 33 and 34 to each of the air discharging tubes 19 and 20, and communicates therewith at the space or chamber provided for the working of the valve 23.

A pair of fuel supply tanks 43 is mounted

on the engine cylinder adjacent the crank shaft casing, and the fuel contained therein is adapted to be maintained under constant pressure from any suitable source. An outlet tube 44 is provided for each tank 43 and has its passageway normally closed by a needle valve 45 through the agency of a spring 46 acting against the rod 47 that carries the needle valve 45. The valve stem 47 is adapted to be engaged by the rim of the piston 6 on each stroke of the piston to unseat the valve 45, to permit the fuel under pressure to pass through the registering tubes 44 and 40 and enter the chamber 38. At points near the ends of the suction strokes of the pistons 35 and 36 in the cylinders 33 and 34, the valve rods 47 are moved to unseat their respective valves, and immediately following the tubes 44 are brought into register with the pipes 40. The fuel under pressure in the tanks 34 is then admitted into the chambers 38 to be forced through the tubes 42 on the return strokes of the pistons 35 and 36.

Assuming the parts to be in the positions shown, the operation is as follows: The piston 10, in moving to the right, will take in a charge of air through the port 21, and the chamber 38 and piston chamber 34 (on the right) will be charged with fuel from the tank 43, due to the suction created by the piston 36. On the reverse movement of the pistons 10 and 36 the charge of air will be compressed and forced through the tube 19, and the fuel charge through the tube 42, and said fuel and air charges will be commingled or mixed within the tube 19, and in this state enter the cylinder chamber X ready for ignition. The reversing of the engine is brought about by closing off the fuel supply of the tank 43, according to which one is at the time in use, and opening the other.

It is obvious that those skilled in the art may vary the details of construction and arrangement of parts without departing from the spirit of my invention, and therefore I do not wish to be limited to such features except as may be required by the claims.

I claim—

1. In an internal combustion engine the combination of a cylinder; a piston operable in said cylinder; a piston rod connected to the piston; an air compression cylinder carried by the piston; a piston operable in said air compression cylinder and connected to be actuated by said piston rod; means for conducting the compressed air from the air compression cylinder into the explosion cylinder; and means for admitting fuel to commingle with the compressed air delivered into the combustion cylinder.

2. In an internal combustion engine the combination of a cylinder; a piston operable in said cylinder; a piston rod connected to the piston; air compressing means carried by said piston and connected to be operated by said piston rod; means for conducting the compressed air from said compressing means into the explosion cylinder; a cylinder carried by the engine piston; means for feeding fuel into said cylinder; a piston operable in said cylinder for compressing said fuel and connected to be operated by the piston rod; and means for conducting the fuel to commingle with the compressed air delivered into the combustion cylinder.

3. In an internal combustion engine the combination of a cylinder; a piston operable in said cylinder; a piston rod connected to the piston; an air compression cylinder carried by the piston; a piston operable in said air compression cylinder and connected to be actuated by said piston rod; a pipe for conducting the compressed air from the air compression cylinder into the explosion cylinder; a second cylinder carried by the engine piston; a piston operable in said second cylinder and connected to the piston rod; means for feeding fuel into said second cylinder; and a pipe extending from said fuel cylinder to the air delivery pipe of the air compression cylinder.

4. In an internal combustion engine the combination of a cylinder; a piston operable in said cylinder; a piston rod connected to the piston; an air compression cylinder carried by the piston; a piston operable in said air compression cylinder and connected to be actuated by said piston rod; a pipe for conducting the compressed air from the air compression cylinder into the explosion cylinder; a spring seated valve normally closing the air conducting pipe; an actuating device connected to said controlling valve and adapted to be operated by the air compression piston to admit the air into the explosion cylinder; a second cylinder carried by the engine piston and adapted to be charged with fuel; a piston operable in said fuel cylinder and connected to be operated by the piston rod; and a pipe connecting the fuel cylinder with the discharge pipe of the air compression cylinder.

5. In an internal combustion engine the combination of a cylinder; a piston operable in said cylinder; a piston rod connected to the piston; a cylinder carried by the piston and providing opposed air compressing chambers; a double piston operable in said second cylinder to compress air in said chambers; pipes for conducting the compressed air from said chambers into the explosion cylinder; valve mechanism controlling passageways through said pipes and adapted to be actuated by the double piston;

a pair of cylinders carried by the engine piston; means for admitting fuel into said pair of cylinders; a double piston operable in said fuel cylinders and connected to be operated by the piston rod; and pipes connecting the respective fuel compression cylinders with the discharge pipes of the air compression cylinder.

In testimony whereof, I affix my signature, in presence of two witnesses.

GOTTFRIED LUDWIG MAX DÖRWALD.

Witnesses:
WILLIAM CROSSLEY,
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