

N. E. CROTHERS.
 INTERNAL COMBUSTION ENGINE.
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1,104,968.

Patented July 28, 1914.

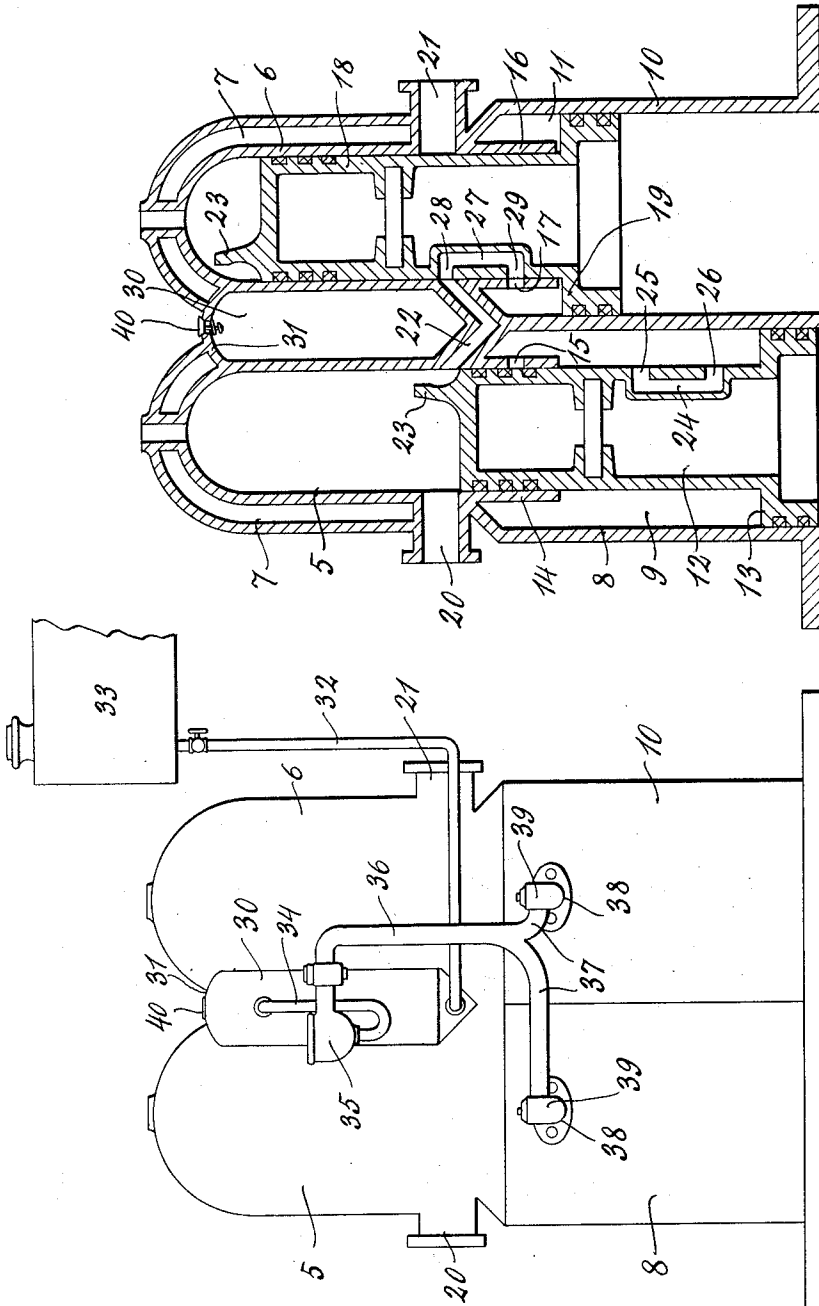


Fig. 2.

Fig. 1.

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INTERNAL-COMBUSTION ENGINE.

1,104,968.

Specification of Letters Patent.

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To all whom it may concern:

Be it known that I, NOBLE E. CROTHERS, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Internal-Combustion Engines, of which the following is a specification.

This invention relates to internal combustion-engines of the two-cycle type in which the working cylinder has an extension forming a pump chamber, in which latter works a plunger which is a part of the engine piston.

It is the object of the present invention to provide a two-cylinder engine of the type stated embodying certain novel features of construction to be hereinafter described and claimed.

The invention also has for its object to provide an engine of the kind stated which is simple in construction and highly efficient in operation.

A further object of the invention is to provide a fuel tank which is so located with respect to the engine cylinders that the fuel is heated by said walls, thus permitting the use of kerosene and other heavy hydrocarbons for fuel.

In order that the invention may be better understood, reference is had to the accompanying drawings, in which—

Figure 1 is an elevation of the engine, and Fig. 2 is a central vertical section thereof.

In the drawings, 5 and 6, respectively, denote the two working cylinders of the engine, the same being preferably cast *en bloc* and provided with a water jacket 7.

The cylinder 5 has an extension 8 of greater diameter, the same forming a pump chamber 9. The cylinder 6 has an extension 10 forming a pump chamber 11. The working cylinders and corresponding pump chambers are in axial alinement, the pump chambers being at the outer ends of the cylinders. In the working cylinder 5 operates a piston 12, the outer end of which has an extension terminating in a head 13 which serves as a pump-plunger, the same working in the pump chamber 9. The wall of the cylinder 5 extends for a short distance into the pump chamber 9 as indicated at 14, and in said extension is a port 15. A similar extension 16 with a port 17 is in the pump chamber 11. The piston 18 working in the

cylinder 6 has a plunger 19 working in the pump-chamber 11. The pistons travel in opposite directions. Thus, when one piston and its plunger is making an outward stroke, the other piston and its plunger is making an inward stroke. The cylinder extensions 14 and 16 containing the ports 15 and 17 provide guides for the pistons 12 and 18, and permit the application of packing rings to prevent leakage from the pump chambers into the working cylinders. The sudden pressure developed in the pump chambers is apt to cause a leakage past the pistons if no packing rings are provided. The cylinder extensions are made of such length as to allow the plungers 13 and 19 to nearly touch the same. Hence, if an engine of certain bore and stroke is to have a certain compression volume, the designer makes the cylinder extension of such length as to produce the desired volume the piston being given a corresponding length, and this may be done without changing the bore and stroke of the engine. Thus, if the extension is lengthened, the body of the piston must be correspondingly lengthened, which locates the plunger lower down in the pump chamber. If the extension is shortened, the body of the piston must also be shortened to locate the plunger higher up in the pump chamber. The cylinder 5 has an exhaust port 20 which is uncovered by the back of the piston 12 at the end of its outward stroke. A similar port 21 is provided for the cylinder 6.

The cylinders 5 and 6 are connected by a conduit 22, the respective ends of which are uncovered by the pistons 12 and 18 at the end of their outward stroke. This conduit serves as the inlet ports of the two cylinders and its two ends are inclined in the direction of the rear ends of the cylinders so that the fuel is discharged in that direction. The back of each piston has a deflector 23 which prevents the charge from passing out of the exhaust port when it first enters the cylinder. The incline of the conduit, together with the deflectors, cause the charge to pass rearward toward the corresponding ends of the cylinder, thereby preventing the fuel from mixing with the exhausting spent gases and thus being wasted. In the piston 12, adjacent to the head 13, is a longitudinal duct 24, the ends of which open through the side of the piston as indicated at 25 and 26, respectively. The piston 18 has a similar duct 27 with

ports 28 and 29, respectively, opening through the side of said piston.

Between the cylinders 5 and 6 is located a fuel tank 30 which is cast with said cylinders so that the latter form the side walls of the tank. The top of the tank is a transverse wall 31 which forms a part of the water jacket 7. The bottom of the tank is formed by one of the walls of the conduit 22. The tank structure may be likened to an enlarged water jacket space between the cylinders.

A supply pipe 32 leads from an elevated fuel reservoir 33 to the tank 30, said pipe entering the tank near the bottom thereof.

An outlet pipe 34 is connected to the tank near the top thereof and leads to a carbureter or other suitable charge-forming device 35. The outlet of the carbureter is connected to the intake pipe 36 having branches 37 which lead to the inlet ports 38 of the pump chambers 9 and 11, and are provided with check-valves 39. At the top of the tank is a safety valve 40 which relieves the tank of any excess pressure. The tank is designed to supply kerosene vapor to the engine, the vapor being generated by the heat from the cylinder walls. The valve 40 is necessary as vapor continues to form after the engine has stopped running and the cylinder walls are still hot. When the engine stops no more vapor is drawn off, but vapor continues to be generated in the tank until the engine is cooled off, and as this vapor will acquire a certain amount of pressure tending to spread and settle on the spark plugs and other places that should be kept clean, the valve is provided to allow the vapor to escape. By locating the tank 30 between the cylinders 5 and 6, the fuel, when the engine is running, will become heated from said walls so that it will vaporize more readily. It is therefore possible to use kerosene and other heavy hydrocarbons as fuel.

The operation of the engine is as follows:

On the outward or firing stroke of the piston 12 and its plunger 13 a fuel charge is drawn into the pump chamber 9 through the inlet port 38, which charge is compressed on the inward stroke. At the end of the inward stroke of the piston 12 and its plunger 13, the port 25 registers with that end of the conduit 22 which opens into the cylinder 5 and the port 26 registers with the port 15, and as the piston 18 is now at the end of its outward stroke, it has uncovered that end of the conduit 22 which opens into the cylinder 6. Thus, the charge which has been compressed in the chamber 9 by the plunger 13 passes into the cylinder 6 in which it is re-compressed when the piston 18 makes its upward stroke. The charge in the cylinder 6 is now fired and at the end of the outward stroke of the piston 18 the spent gases are exhausted through the port 21. The charge compressed in the chamber 11 by the plunger

19 passes into the cylinder 5 at the end of the inward stroke of the piston 18, at which time the port 29 is in communication with the port 17, and the port 28 is in communication with the conduit 22, and as that end of said conduit which opens into the cylinder 5 is now uncovered by the piston 12, the charge passes into said cylinder to be re-compressed on the inward stroke of the piston 12 and then fired. Thus the pump chambers discharge into the opposite working cylinders of the engine.

I claim:

1. In an internal-combustion engine, a pair of cylinders having water jackets, and connected by an inlet conduit, and a fuel tank between the cylinders, the side walls of which tank are formed by the corresponding walls of the cylinders, the bottom of the tank being formed by one of the walls of the inlet conduit, and the wall of the water jacket at the top of the cylinders forming the top of the tank.

2. An internal-combustion engine comprising a pair of working cylinders having exhaust ports, pump-chambers in axial alignment with the working cylinders said working cylinders having ported extensions into the pump chambers, a fuel inlet conduit opening at its ends into the respective working cylinders, and oppositely traveling pistons in the working cylinders and the ported extensions thereof, each piston having a plunger which works in the corresponding pump-chamber, and said pistons at the end of their outward travel uncovering the exhaust ports and the respective ends of the conduit, and having ducts which establish communication between the conduit and the ports of the aforesaid extensions into the respective pump-chambers.

3. An internal-combustion engine comprising a pair of working cylinders having exhaust ports, pump-chambers in axial alignment with the working cylinders, said working cylinders having ported extensions into the pump chambers, a fuel inlet conduit opening at its ends into the respective working cylinders, and oppositely traveling pistons in the working cylinders and the ported extensions thereof, each piston having a plunger which works in the corresponding pump-chamber, and said pistons at the end of their outward travel uncovering the exhaust ports and the respective ends of the conduit, and having ducts provided with ports which open through the side of the pistons and establish communication between the conduit and the ports of the aforesaid extensions into the respective pump-chambers.

4. An internal-combustion engine comprising a pair of working cylinders having exhaust ports, pump-chambers in axial alignment with the working cylinders, said work-

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ing cylinders having ported extensions into the pump chambers, a fuel inlet conduit opening at its ends into the respective working cylinders, and oppositely traveling pistons in the working cylinders and the ported extensions thereof, each piston having a plunger which works in the corresponding pump-chamber, and said pistons at the end of their outward travel uncovering the exhaust ports and the respective ends of the conduit, each piston having a duct provided with ports which open through the side thereof, one of said ports registering with the port of the aforesaid extension into the pump-chamber in which the plunger of the corresponding piston works, and the other port communicating with the corresponding end of the conduit at the end of the inward stroke of the piston.

5. In an internal combustion engine, a

working cylinder having a fuel supply conduit, a pump chamber in axial alinement with the working cylinder, said working cylinder having a ported extension into the pump chamber, and a piston in the working cylinder and the ported extension, said piston having a plunger which works in the pump chamber, and said piston also having an outlet duct for the pump chamber, said duct registering with the port of the cylinder extension and the aforesaid fuel supply conduit at the end of the compression stroke of the plunger.

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

NOBLE E. CROTHERS.

Witnesses:

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H. G. BATCHELOR.