P. D. JOHNSTON.

INTERNAL COMBUSTION ENGINE.

APPLICATION FILED MAY 17, 1907.

946,780.

Patented Jan. 18, 1910.

Fig. 1

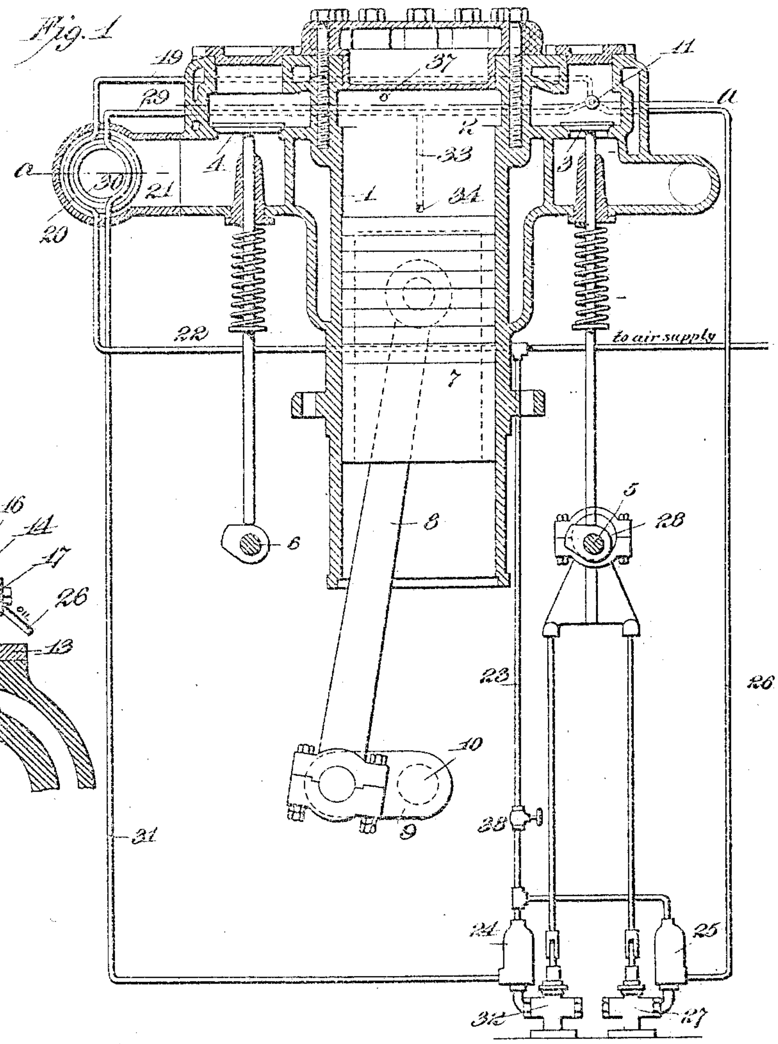


Fig. 3

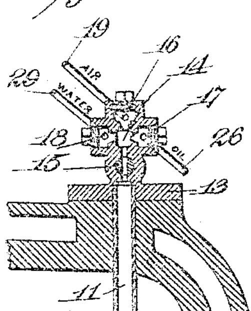
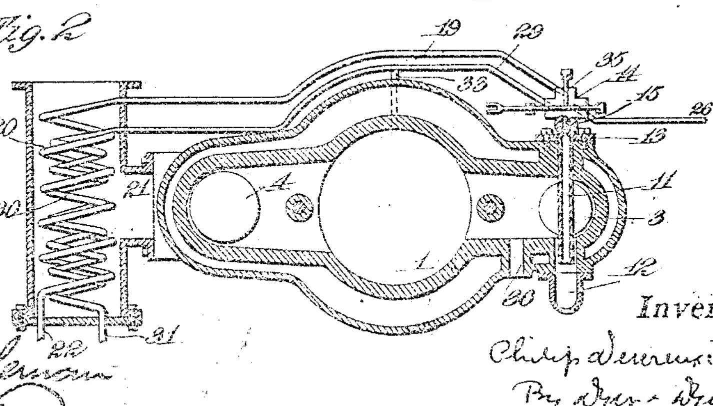


Fig. 2



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UNITED STATES PATENT OFFICE.

PHILIP DEVEREUX JOHNSTON, OF COLD SPRING, NEW YORK, ASSIGNOR TO AMERICAN OIL ENGINE COMPANY, A CORPORATION OF NEW YORK.

INTERNAL-COMBUSTION ENGINE.

946,780. Specification of Letters Patent. Patented Jan. 18, 1910.

Original application filed August 17, 1906, Serial No. 330,971. Divided and this application filed May 17, 1907. Serial No. 374,266.

To all whom it may concern:

Be it known that I, PHILIP DEVEREUX JOHNSTON, a citizen of the United States, residing at Cold Spring, Putnam county, State of New York, have invented an Improvement in Internal-Combustion Engines, of which the following is a specification.

The object I have in view is the production of an internal combustion engine by means of which the efficiency can be increased and greater economy secured than heretofore by the use of a heavier and less volatile hydro-carbon.

This application for patent is a division of an application filed by me August 17, 1906, Serial No. 330,971.

Further objects will appear in the following specification and accompanying drawings. These drawings illustrate mechanism embodying my invention.

Figure 1 is a sectional view of the operative parts of such an engine. Fig. 2 is a horizontal sectional view taken on the line *a*—*a* of Fig. 1, across the combustion chamber; and Fig. 3 is an enlarged detail of a portion of the mechanism shown in Fig. 2.

In all the views like parts are designated by the same reference characters.

The engine illustrated is an oil engine of the 4-cycle or 4-stroke type, although the engine is not limited by such a construction, but may be equally well applied to engines using other forms of hydro-carbon or of the 2-cycle or 2-stroke type.

In the drawings, 1 is the cylinder, which is shown as water-jacketed, and has at the top a combustion chamber 2.

3 is the inlet valve, and 4 the outlet valve, each valve being shown as operated by a cam, carried by the valve shafts 5 and 6 respectively.

7 is the piston of the ordinary type, to which is attached the connecting rod 8. This connecting rod is connected to the crank 9, which is carried by the shaft 10.

Above the inlet valve 3 is a tube 11. This tube is shown extending through one of the walls of the combustion chamber and passes part-way through an opening in the opposite wall. The tube is open at each end; the free end of the tube is covered by a hood 12, which is not water-jacketed, but has sufficiently thin walls to be readily heated by the combustion of the contents of the combustion chamber. The other end of the tube is connected to a mixing valve 13. This mixing valve is provided with an internal mixing chamber 14. Between the mixing chamber and the tube 11 is a cut off valve 15. This cut off valve is operated by a suitable mechanism at the proper time so as to close communication between the mixing chamber and the tube.

Three nozzles discharge into the mixing chamber 14. The nozzle 16 is arranged to deliver air into the mixing chamber, the nozzle 17, oil or other form of liquid fuel, and the nozzle 18, water. The nozzles 17 and 18 are shown with their orifices opposed to each other, while the nozzle 16, for the introduction of air into the mixing chamber has its orifice at right angles to the other two nozzles.

The air nozzle 16 communicates, by means of a pipe 19, with a coil 20, arranged within a chamber 21, which communicates with the exhaust port 4. The coil is in such a position that it will be constantly swept by the hot products of combustion. Connecting the coil 20 and a source of air supply under pressure (not shown) is a pipe 22. A suitable means of supplying air under pressure may be an air pump or a tank containing compressed air. A pipe 23 communicates with the pipe 22, so as to be subjected to the same pressure as contained in the pipe 22, and this pipe 23 communicates in turn with the equilibrium chambers 24 and 25. The oil is admitted to the nozzle 17 by means of a pipe 26, which is connected to a pump 27 from a source of oil supply. This pump 27 is actuated from a cross-head carried by an eccentric 28 on the shaft 5. The pump 27 and pipe 26 communicate with the equilibrium chamber 25. The air supply pipe 23 may be provided with a valve 38 for the purpose of cutting off or limiting the flow of air to the two equilibrium chambers.

The water nozzle 18 communicates through a pipe 29 with a coil 30, which passes through the chamber 21 so as to be acted upon by the heat of the discharging products of combustion. This coil 30 is connected through the agency of a pipe 31, to a pump 32, which is operated from the same cross-head as is the pump 27. The equilibrium chamber 22 communicates with the

pump 32 and pipe 31. A branch pipe 33 connects the pipe 29 with the interior of the cylinder by means of a port 34. This port is shown in such a position as to be closed by the piston when the latter reaches about one-half of its inward stroke. The amount of opening of the nozzles 16, 17 and 18 may be controlled by suitable valves (not shown), whereby the richness of the mixture and the speed of the engine will be regulated. These valves may be simultaneously actuated by a system of linkage, which is shown by the character 35. This linkage connects with the governor, by means of which the extent of opening of the nozzles within the mixing chamber is controlled. A port 36 communicates with the combustion chamber and is for the purpose of permitting the entrance of a starting valve, by means of which a supply of air under pressure, and a volatile hydro-carbon, will be admitted to start the engine.

In operation, after the engine has been started, and the tube 11 has become heated by the combustion of the volatile hydro-carbon within the combustion chamber, a supply of liquid hydro-carbon is injected into the mixing chamber through the nozzle 17; at the same time a supply of water is injected into the same chamber through the nozzle 18. The discharge from the orifices of the two nozzles meets within the combustion chamber and the hydro-carbon is very finely divided therein and becomes thoroughly mixed with the water. At the same time a supply of air, under pressure, is admitted into the mixing chamber through the nozzle 16, and this air mixes with the previously atomized hydro-carbon and water, and thoroughly volatilizes the two. The valve 15, being at this time open, the mixture of oil, air and water passes into the tube 11, where, coming in contact with the hot walls thereof, it will be converted completely into vapor. This vapor will issue from the open end of the tube, and coming in contact with the heated hood 12, the mixture will become further heated, and will be in condition to be consumed without any objectionable deposits of soot or graphite within the combustion chamber, the cylinder or upon the piston. After leaving the retort, the mixture of oil or other liquid fuel, water and compressed air will come in contact with air which is being drawn in through the inlet valve 3. The complete mixture will then be drawn into the cylinder and will be there compressed by the ascending piston. The amount of compression can be great so that the gas will be in condition to be completely consumed. The efficiency of the engine is increased by heating the air and water by means of the coils 20 and 30, which are subjected to the hot discharged products of combustion. A certain amount of water will enter the cylinder through the port 34, the amount being determined by the size of the port and its location within the cylinder. The equilibrium chambers 24 and 25, communicating as they do with the source of air supply, and subjected to the pressure of such air, will keep the contents of the mixing chamber in equilibrium. During the suction stroke, or while the piston 7 is descending, the complete mixture of air, oil and water will be discharged through the retort into the combustion chamber. This will continue during a portion of the compression stroke, or until the pressure within the combustion chamber equalizes that within the mixing chamber, or until the mixing valve 15 is closed, should that occur before the pressures are equalized. As soon as this happens no more air will be admitted into the equilibrium chamber, and as the pressure through the nozzles of oil and water is the same as that of the air, no more liquid will be admitted into the mixing chamber. Should the port 34 not at this time be covered by the piston no more water will enter the cylinder during this stroke. After the mixture has been compressed it is ignited in the usual manner, and the combustion of the mixture produces the working impulse upon the piston, as is well understood.

The invention may be carried out by other mechanism than that shown. If desired, the compressed mixture may be drawn off through the port 37, and utilized in producing heat or power in other mechanism.

By the structure described it is possible to employ the heavier and cheaper hydro-carbons which have been found extremely difficult to be used in an internal combustion engine, for the reason that they tend to cause deposits of carbon or graphite within the cylinder and upon the piston, and to choke the valves, such deposits probably being caused by the fractional distillation of the more volatile constituents of the hydro-carbon due necessarily to the great pressure and high temperature required to effect the combustion of the less volatile constituents of the fuel. By mixing the oil with water, in the presence of air, in a mixing chamber, the subdivision of the hydro-carbon is made more minute than has heretofore been possible, and the combustion more perfect.

In accordance with the provisions of the patent statutes, I have described the principle of my invention, together with the apparatus which I now consider to represent the best embodiment thereof, but I desire to have it understood that the apparatus shown is merely illustrative and that the invention can be carried out in other ways.

Having now described my invention, what I claim and desire to secure by Letters Patent, is:

An internal combustion engine having a

mixing chamber, means for introducing a stream of liquid fuel into the chamber, and means for introducing a stream of air into the chamber and against the stream of fuel, means for introducing a stream of water into the chamber and against the stream of fuel, the air inlet pipe and the water inlet pipe passing through a portion of the exhaust passage of the engine so as to be heated by the products of combustion.

This specification signed and witnessed this 14th day of May, 1907.

PHILIP DEVEREUX JOHNSTON.

Witnesses:

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