G. H. HINCHLIFFE.

INTERNAL COMBUSTION ENGINE.

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1,171,435.

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Fig. 1.

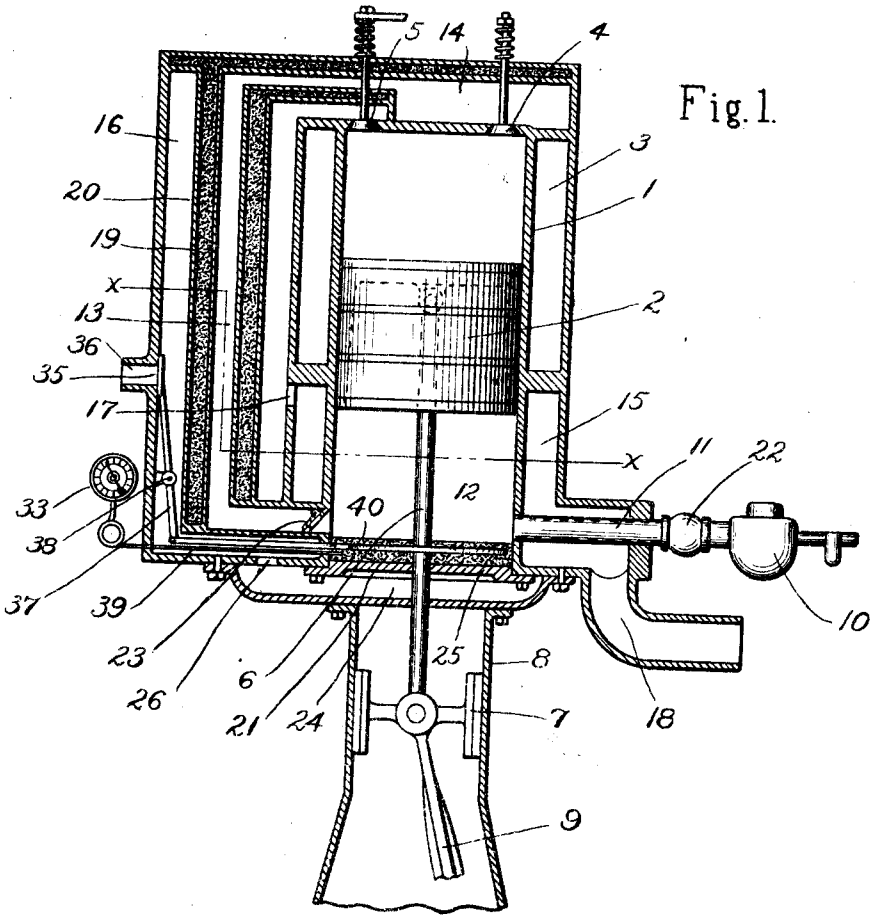
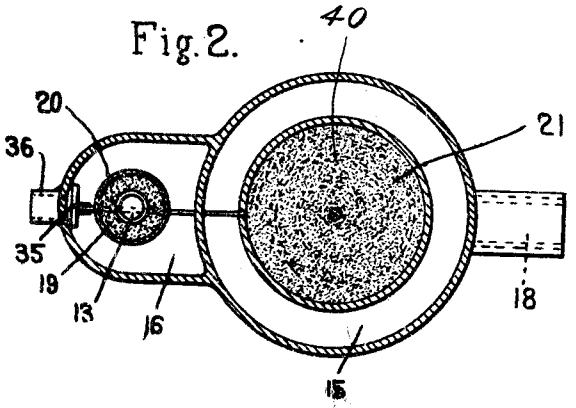


Fig. 2.



Witnesses.

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INTERNAL-COMBUSTION ENGINE.

1,171,435. Specification of Letters Patent. Patented Feb. 15, 1916.

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To all whom it may concern:

Be it known that I, GEORGE H. HINCHLIFFE, a citizen of the United States, residing at Boston, county of Suffolk, State of Massachusetts, have invented an Improvement in Internal-Combustion Engines, of which the following description, in connection with the accompanying drawing, is a specification, like characters on the drawing representing like parts.

This invention relates to internal combustion engines and has for its object to provide an engine of this type which is capable of advantageously using the heavier oils, such as kerosene, or even crude oil, for fuel.

In accordance with my invention I provide an arrangement whereby the exhaust gases from the engine are utilized to heat the incoming charge, so that the oil constituting said charge will be thoroughly vaporized before it is introduced into the working end of the cylinder.

The invention also aims to provide a novel construction whereby the temperature of the heating chamber in which the incoming charge is heated can be regulated so as to maintain an approximately uniform temperature therein, with the result that the engine will operate uniformly under all conditions.

My invention can be embodied in either a two-cycle engine or a four-cycle engine, but in order to illustrate the principle thereof, I have shown it as it would be embodied in a four-cycle engine. I wish it understood, however, that by suitable modifications it can be readily embodied in a two-cycle engine.

In the drawings, Figure 1 is a vertical sectional view of a selected embodiment of my invention. Fig. 2 is a sectional view on the line x—x, Fig. 1.

I have shown at 1 the cylinder of an engine in which a piston 2 operates. This cylinder is shown as provided with the usual water jacket 3 and with the automatically-acting inlet valve 4 and the exhaust valve 5 of usual construction which will be operated by any suitable mechanism not shown. In the construction herein shown the piston is provided with a piston rod 6 connected to a cross-head 7 operating in guides 8 and to which is connected a connecting rod 9 that leads to the usual crank shaft.

The parts thus far described may be of any suitable or usual construction.

In accordance with my invention each incoming charge of fuel is subjected to the warming influence of the exhaust gases so that if the oil of the charge is not completely vaporized by the carbureter the heating of the charge by the exhaust gases will result in completing the vaporization and thus producing a warm completely-vaporized charge which will be most effective in the working end of the cylinder. In the embodiment herein shown the fuel charge is delivered from a carbureter 10 of any suitable construction through a pipe 11 into a chamber 12 which is herein constituted by the lower end of the cylinder 1 beneath the piston 2. This chamber 12 communicates by means of a duct or passage 13 with the space 14 at the top of the cylinder, which space in turn has communication with the working end of the cylinder through the inlet valve 4. The chamber 12 is surrounded by a jacket 15 into which the exhaust gases are discharged, and the duct 13 is also provided with means for heating it, so that each incoming fuel charge is heated not only in the chamber 12, but also in its passage through the duct 13.

The exhaust valve 5 opens into a passage or chamber 16 which surrounds the inlet passage 13 and which communicates through a port 17 with the jacket chamber 15, said jacket chamber being provided with the exhaust port 18 through which the gases are finally exhausted. In order to maintain as even a temperature as possible in the inlet duct 13, I propose to incase said duct or passage in a jacket 19 of some heat-retaining material, such, for instance, as soapstone. This can be conveniently done by employing a casing 20 which is situated concentrically of the duct 13 but spaced therefrom thereby to provide an annular space between the casing and duct which can be filled with the heat-retaining material. As stated above, soapstone is a good material for this purpose and the space between the casing 20 and the duct 13 can be readily filled with powdered soapstone which may be made up into cement form if desired, or with any suitable heat-conducting or heat-retaining material. In order to further conserve the heat of the exhaust gases I propose to employ a heat-retaining member 21 in the bottom of the chamber 12.

This heat-retaining member may conveniently be in the form of a piece of soapstone or may be made of any material which will retain the heat therein, but freely give it up to the gases in the chamber 12 if they are cooler than said heat-retaining member. I will preferably provide the pipe 11 with a check-valve 22 and also employ a suitable check valve 23 at the entrance to the duct 13. I have also shown a space or chamber 24 beneath the cylinder head 25 and the heat-retaining member 21, said chamber 24 having communication with the chamber 16 through a suitable duct or passage 26. The engine herein shown is designed to work on the four-cycle principle.

Upon each up-stroke of the piston 2 a fuel charge will be sucked into the chamber 12, and upon each down stroke this fuel charge will be forced into the inlet duct or passage 13 past the check valve 23. Assuming that an explosive charge had just been delivered to the working end of the cylinder through the inlet valve 4 and has been ignited, then during the downward working stroke of the piston the charge in the chamber 12 will be forced around into the passage 13 past the check valve 23. This charge will be retained in the passage 13 because the pressure of the gas in the working end of the cylinder 1 will hold the inlet valve 4 closed. During the next up-stroke of the piston 2 the exhaust valve 5 may be opened by any suitable means, and the cylinder will be exhausted and simultaneously a second combustible charge will be drawn into the chamber 12 through the carbureter 10. The exhaust gases pass through the passage 16 into the jacket chambers 15 and 24 and thence out through the exhaust port 18, and during their passage they serve to heat the heat-retaining material 19 and also to heat the chamber 12. During the next down stroke a suction will be generated in the working end of the cylinder 1 sufficient to open the inlet valve 4 and allow the explosive charge confined in the passage 13 to pass into the cylinder, and during this same down stroke a second charge which has been drawn into the chamber 12 will be forced into chamber 13 and around into the working end of the cylinder. During the next up-stroke another charge will be drawn into the chamber 12 and the two previous charges which have been delivered to the working end of the cylinder will be compressed ready to be ignited at the proper time. It will thus be seen that with the construction shown a charge of combustible fluid will be drawn into the chamber 12 at each up-stroke of the piston, and that during the downward working stroke of the piston the charge in the chamber 12 will be forced around into and retained in the passage 13, while during the next down-stroke of the piston both the charge of combustible fluid which is in the chamber 13 and the second charge which has been drawn into the chamber 12 will be forced around into the working end of the cylinder. It will further be seen that owing to the presence of the heat-retaining members 19 and 21 the temperature of the chamber 12 and the passage 13 will be maintained substantially uniform, so that the combustible charges which are admitted to the working end of the cylinder will always be at substantially the same temperature. By such an arrangement it is possible to use the heavier oils as fuel, for any unvaporized oil which is retained in the charge as it is delivered to the chamber 12 will be vaporized by the heat in said chamber and in the passage 13 before the charge is delivered to the working end of the cylinder.

The object in having the auxiliary chamber 24 is to provide means for keeping the heat-retaining member 21 thoroughly heated.

I have provided at 33 a temperature indicator by which the temperature of the member 21 can be determined.

My invention also provides means whereby if the chamber 12 tends to get too hot for the proper operation of the engine, the exhaust gases can be discharged from the passage 16 before they are delivered to the jacket 15. I accomplish this herein by providing a thermostatically-operated valve 35 which controls a discharge port 36 that communicates with the passage 16 and which is normally closed, but which is adapted to be opened when the temperature in the chamber 12 or the temperature of the heat-retaining member 21 exceeds a predetermined amount. While any suitable thermostat means for operating the valve 35 may be employed, I have illustrated for this purpose a construction wherein the valve is mounted on a lever 37 pivoted at 38 and connected at its lower end to the arm 39 of a thermostat 40 that is associated with the heat-retaining member 21. The thermostat is so adjusted that when the temperature of the member 21 rises to a predetermined point, the expansion of the thermostat will rock the lever 37 and open the valve 35, after which the exhaust gases will be largely discharged through the port 36, instead of through the jacket 15 and port 18. When the temperature of the heat-retaining member 21 falls below a predetermined amount, then the thermostat will close the valve 35 again, thus compelling all the exhaust gases to pass through the jacket 15.

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

1. In an internal combustion engine, the combination with a cylinder, of a piston

therein, one end of the cylinder constituting the working end thereof and the other end constituting a heating chamber for the combustible fluid, means to deliver a combustible fluid charge to said chamber, a passage forming communication between said chamber and the working end of the cylinder, a jacket surrounding said chamber, and means whereby the exhaust gases from the engine are exhausted through said jacket, the heat of said exhaust gases operating to heat the charges of combustible fluid delivered to said chamber.

2. In an internal-combustion engine, the combination with a cylinder, of a piston therein, one end of the cylinder constituting the working end thereof and the other end constituting a heating chamber for the combustible fluid, means to deliver a combustible fluid charge to said chamber, a passage forming communication between said chamber and the working end of the cylinder, a jacket surrounding said chamber, means whereby the exhaust gases from the engine are exhausted through said jacket, the heat of said exhaust gases operating to heat the charges of combustible fluid delivered to said chamber, and a heat-retaining member situated within said chamber.

3. In an internal combustion engine, the combination with a cylinder, of a piston therein, one end of the cylinder constituting the working end thereof and the other end constituting a heating chamber for the combustible fluid, means to deliver a combustible fluid charge to said chamber, a passage forming communication between said chamber and the working end of the cylinder, a jacket surrounding said chamber, an exhaust passage leading from the working end of the cylinder to said jacket and through which said inlet passage extends, and a jacket of heat-retaining material surrounding said inlet passage whereby the exhaust gases serve to heat the combustible charges delivered to the chamber and inlet passage.

4. In an internal combustion engine, the combination with a cylinder, of a piston therein, said cylinder presenting at one end a working chamber and at the other end a heating chamber, means to deliver a combustible charge to the heating chamber, means constituting communication between the heating chamber and the working end of the cylinder, a jacket for the heating chamber, an exhaust passage leading from the working end of the cylinder to said jacket and through which the products of combustion are exhausted, a by-pass port leading from said exhaust passage, and a thermostatically-controlled valve for said port.

5. In an internal combustion engine, the combination with a cylinder, of a piston therein, said cylinder presenting at one end a working chamber and at the other end a heating chamber, means to deliver a combustible charge to the heating chamber, means constituting communication between the heating chamber and the working end of the cylinder, a jacket for the heating chamber, an exhaust passage leading from the working end of the cylinder to said jacket and through which the products of combustion are exhausted, a by-pass port leading from said exhaust passage, a valve for said port, and a thermostat in said heating chamber by which the valve is controlled.

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

GEORGE H. HINCHLIFFE.

Witnesses:
BERTHA F. HEUSER,
LOUIS C. SMITH.