July 8, 1924. 1,500,464

F. B. MORRISON

INTERNAL COMBUSTION ENGINE

Filed June 23, 1922

FIG. I.

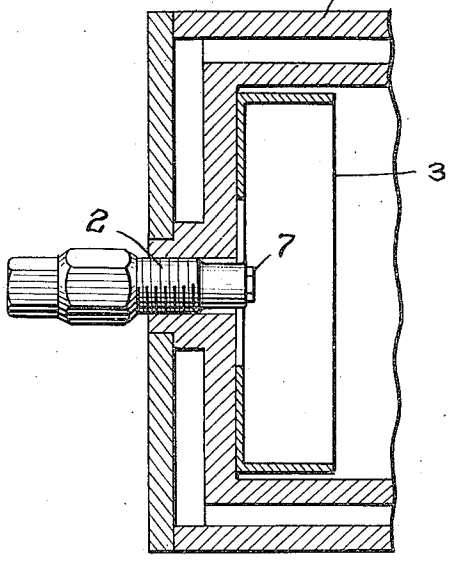


FIG. III.

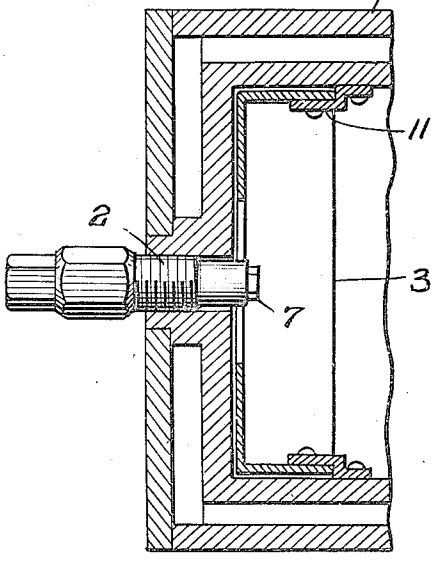
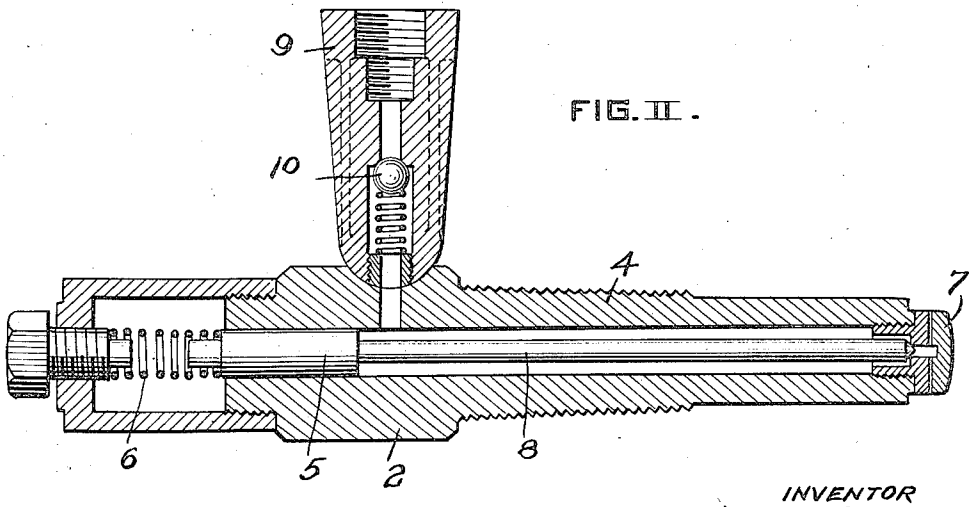


FIG. II.



WITNESSES

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UNITED STATES PATENT OFFICE.

FRANK B. MORRISON, OF MARION, OHIO, ASSIGNOR TO THE POWER MANUFACTURING COMPANY, OF MARION, OHIO, A CORPORATION OF OHIO.

INTERNAL-COMBUSTION ENGINE.

Application filed June 23, 1922. Serial No. 570,373.

To all whom it may concern:

Be it known that I, FRANK B. MORRISON, residing at Marion, in the county of Marion and State of Ohio, a citizen of the United States, have invented or discovered certain new and useful Improvements in Internal-Combustion Engines, of which improvements the following is a specification.

My invention relates to the injection of oil into and to the ignition of fuel within the cylinder of an internal-combustion engine of oil consuming type. The objects of the invention are the injection at proper times and under proper pressure, and through a proper orifice, of successive oil charges of proper quantity, and the maintenance at proper temperature of a firing bowl within the cylinder.

The invention is illustrated in the accompanying drawings. Figure I is a view in medial and longitudinal section through the end of the cylinder of an internal combustion engine, showing in elevation the spray plug and in section the firing bowl; Figure II is a view to larger scale in medial and longitudinal section through the spray plug; Figure III is a view similar to Fig. I, illustrating a variation in the arrangement of the firing bowl.

Referring first to Figures I and III, one head and a portion of the adjacent wall of the cylinder of an internal combustion engine are indicated at 1. It will be observed that cylinder head and cylinder wall are water-jacketed. The spray plug 2 extends axially through the cylinder head; and the firing bowl 3 is arranged at that end of the cylinder.

Referring to Figure II, the spray plug will be seen to consist essentially of a cylindrical body 4 with an axial bore. Within the bore a close fitting piston 5 is reciprocable, the outer end of the plug is capped and a compression spring is arranged between the inner wall of the cap and the outer end of piston 5. The plug is also provided with a cap 7 at its opposite or inner end, said cap 7 having a closed axial bore of smaller size and in continuation of the bore of the body of the plug, and spray orifices (preferably more than one) opening radially from the axial bore of the cap. The axial bore in the cap 7 is so formed as to provide a valve seat for the end (preferably conical) of the stem 8 of piston 5, the spring 6 holding the valve closed. An oil duct from a suitable pump leads through a nozzle 9 into the bore within plug 4 at the end of piston 5 opposite to the spring 6. The nozzle is provided with a check valve shown as a ball 10.

The operation of this portion of the apparatus will be understood readily. The pump which effects injection of oil will ordinarily be driven by the engine of which the apparatus shown constitutes a part. The pump drives a stream of oil under pressure through nozzle 9 and into the bore of the plug 4. The pressure which the pump exerts upon the oil within the plug drives piston 5 outwardly against the pressure of spring 6, thereby opening the valve formed within the cap 7, and spurts the charge of oil radially outward through cap 7 into the engine cylinder. When the oil pump has completed its stroke, the internal oil pressure is relieved and the spring 6 closes the valve in cap 7. Preferably a plurality of radial jetted openings are provided in cap 7, and it will be observed that since the potential value of the spring 6 may be adjusted, the force with which the oil is jetted into the cylinder may be regulated. The firing bowl is made of a substance, preferably metallic, such as gray iron or steel, suitable to be heated by the successive explosions within the cylinder, and by virtue of its heated condition to vaporize the inspurted oil and to immediately ignite the explosive mixture formed by the oil vapor and the air already present. The walls of the firing bowl are of such mass that its vaporizing and igniting function will not be destroyed or impaired by the cooling effect either of the air which replaces the spent gases after each explosion or of the inspurted oil. It is so shaped and located within the cylinder as to be beyond the range of movement of the piston, in order to receive the jet or jets of inspurted oil, and to occupy the variable heat-transmitting relation to the cylinder walls now to be described.

This firing bowl 3 has an end wall and a marginal cylindrical wall conforming closely in shape and dimensions to the walls at the end of the cylinder chamber, but is sufficiently spaced from the cylinder wall that a tendency for it to become heated beyond the desired temperature expresses itself in expansion, bringing the body of the bowl

closer to the adjacent cylinder wall (the cylinder wall being preferably water-cooled) with the consequence and effect that heat communication from the wall of the bowl to the wall of the cylinder is so accelerated as to correct and counteract such objectionable tendency, while on the other hand a tendency toward too low a temperature expresses itself oppositely, namely, the bowl contracts and recedes from the cylinder wall, giving up heat less rapidly, so that its temperature tends to rise. This thermal condition of the bowl, receiving heat from explosion and giving up heat to the cylinder wall, and thus functioning to maintain a substantially constant temperature, I term in the claim thermal equipoise.

As shown in Figure I bowl 3 is mounted with its bottom disk abutting against the head of the cylinder and its marginal flange spaced at a narrow interval from the cylinder walls. A layer of heat insulating material may, if found desirable, be interposed between the bottom disk of the bowl and the head of the cylinder. As shown in Figure III the bowl is carried by brackets 11 and is in this case sustained at a narrow interval from the cylinder head and walls throughout its whole extent.

It will be observed that when the parts are assembled the spray plug extends axially within the firing bowl, and that the jets emitted by the plug have free access, and are directed to impinge directly upon the marginal cylindrical flange of the bowl.

Operation will readily be understood. On firing, the piston is driven powerfully to the end of the cylinder opposite that shown in Figs. I and III, and the cylinder chamber is then filled with hot spent gases. When the piston makes its next traverse these spent gases are expelled; on the next succeeding traverse fresh air is drawn in; and then, on the fourth traverse this fresh cylinder full of air is compressed. As the piston reaches the end of this fourth compression stroke the oil pump makes its injection stroke, and jets of oil are spurted in through spray plug 2 to impinge on firing bowl 3. Here the oil is vaporized; it mingles at once with the compressed air, and, an explosive mixture being formed, the temperature is such that explosion follows. The heat released by explosion heats the structure and particularly the firing bowl, and that to such a temperature that, under the conditions, the firing bowl is effective to accomplish the ends described. As has been explained, tendencies of the bowl to run too cold or too hot correct themselves by means of the thermal expansion and contraction of the bowl, with consequent increased and diminished rates of heat dissipation. The intensity of the jet of the inspurted oil may be varied by varying the intensity of spring 6 in the spray plug.

The invention is well suited to an oil engine of low compression.

In case any of the injected oil fails to vaporize at once, it still is carried by the hot firing bowl; it does not reach the water-cooled walls of the cylinder.

The firing bowl is so arranged that it is completely scavenged in the course of the cycle of operations.

The actual size of the space at which the firing bowl normally stands separated from the cylinder wall (or head) will vary with the size of the engine and with the particular kind of engine—whether two-cycle or four-cycle (I have indicated a four-cycle engine in the foregoing description of operation, but this will be understood to be a matter of exemplary description, and not a limitation confining the invention in its applicability to four-cycle engines). The width of this space will depend somewhat on the degree of compression attained, and of course will vary, as between various materials of which the bowl may be formed.

With careful attention to the thermal effect, it will be perceived that it is due to unequal thermal expansion and contraction of bowl and cylinder. For convenience the expansion and contraction of bowl alone has been considered, but the relativity of the matter will be understood.

When in the claim I speak of cylinder walls I mean to include of course the cylinder head as well.

I claim as my invention:

In an oil engine the combination of a cylinder having a head and water-cooled walls, a firing bowl arranged within the cylinder and in spacial relation of thermal equipoise to the walls thereof, whereby tendency of the bowl to manifest departure from its intended condition of temperature, expressing itself in variation of the space interval between bowl and cylinder wall, is corrected by a compensating variation in the rate of heat dissipation, a spray-plug extending axially through the cylinder head and adapted to deliver a jet of oil radially upon said firing bowl, and means for driving a jet of oil under pressure from said plug.

In testimony whereof I have hereunto set my hand.

FRANK B. MORRISON.

Witnesses:
K. J. Willis,
Velma Holter.