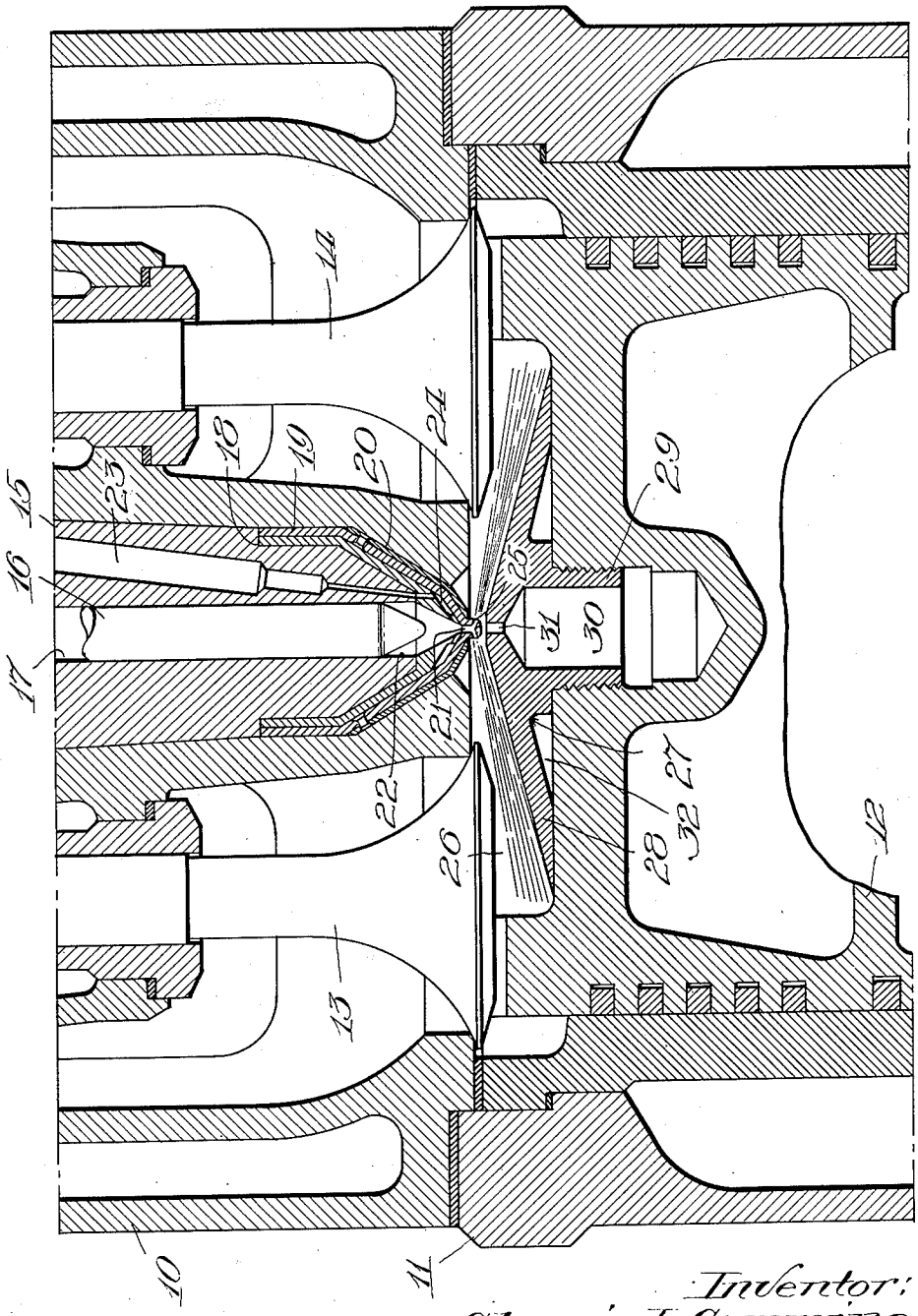
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OIL ENGINE

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OIL ENGINE

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3 Claims. (Cl. 123—30)

My invention relates to oil burning engines of the general type wherein the fuel is burned by the heat of the air compressed by the piston within the combustion chamber of the cylinder.

The efficiency and performance of an engine operating on the so-called Diesel cycle can be improved by raising the average working temperatures of the walls of the combustion chamber, or, in other words, by reducing the rate of heat loss from these walls to the water jackets of the cylinder. The situation created by this heat loss becomes acute in engines of the automotive type when the vehicle equipped therewith is drifting or coasting under closed throttle for, at such times, the heat in the walls, and particularly the top of the piston, is rapidly lost to the water jackets of the engine. When the throttle is again opened, some of the sprayed or injected fuel strikes the tops of the cooled pistons, resulting in poor combustion, a smoky exhaust, the formation of carbon in the chamber, a reduction in fuel economy and crank case dilution. The problem is aggravated in engines provided with pistons of aluminum or alloys having similar characteristics because of their higher thermal conductivity relative to cast iron, so that they lose heat more rapidly.

It is, therefore, the principal object of my invention to provide each piston with a separate member that substantially forms the top of the piston and accordingly one wall of the combustion chamber, but is to a large extent insulated from the piston so that the rate of heat loss therefrom will be substantially less than in a piston of integral construction.

A further object is to so shape and arrange the member in relation to the fuel sprays delivered into the combustion chamber that the top surface of the member substantially conforms to the adjacent side of the spray zone, so that the sprays move sweepingly across the top of the member.

A further object is to additionally construct and arrange the member so that, in conjunction with the head of the piston, it forms an auxiliary air chamber in which air is compressed during the compression stroke of the engine and discharged therefrom during the power stroke of the piston against the fuel nozzle to increase the turbulence of the fuel-air mixture and to thoroughly consume any fuel vapors which might otherwise cling to the surface of the nozzle in the event of insufficient turbulence.

These and further objects of my invention will be set forth in the following specification, reference being had to the accompanying drawing, and the novel means by which said objects are effectuated will be definitely pointed out in the claims.

In the drawing:

Figure 1 is a sectional elevation of a portion of the cylinder of an oil burning engine showing the piston substantially at the end of its compression stroke, and the relation thereto of the fuel injector and nozzle, the inlet and exhaust valves, and the relation of the shape of my improved member to the shape of the oil sprays discharged into the combustion chamber.

Referring to the drawing, the numeral 10 designates part of a cylinder head mounted in the usual manner on the top of a cylinder 11 which is provided with a reciprocating piston 12 of a four cycle engine of the Cummins-Diesel type, to which, for the purpose of illustration, I have shown the preferred embodiment of my invention applied. The usual air inlet and exhaust valves 13 and 14, respectively, are mounted for reciprocating movement on opposite sides of the cylinder axis according to the general relation shown in Fig. 1.

The fuel injector employed in the present instance is generally similar to that disclosed in my United States Letters Patents Nos. 1,561,913 and 1,762,653, although the invention is not to be considered as limited in this respect, since the injecting mechanism illustrated is to be generally regarded as the equivalent of any device for spraying the fuel oil into the combustion chamber.

In the form shown in the drawing, the fuel injector comprises a body member or plug 15, an injecting plunger 16 operable in a central bore 17 in the plug, an inner cup-shaped member 18 fitting over the member 15, a second cup-shaped member 19 fitting over the member 18, and a third or outer cup-shaped insulating member 20 fitting over the member 19. The lower end of the central bore 17 is closed except for a small opening 21 by the lower conical end of the member 18, so that when the plunger 16 is retracted to the position shown in Fig. 1, an atomizing or mixing chamber 22 is formed under the plunger. A charge of fuel oil is fed to the chamber 22 through a conduit 23 in the plug 15 and the passages 24 formed between the conical ends of the members 18 and 19 and which extend radially from the opening 21. The lower end of the cup 19 extends through a central opening in the cup 20 and is provided with ports 25 which communicate with a combustion chamber 26 and through which openings substantially

conical or balloon-shaped sprays of fuel are discharged in opposite directions across the chamber. In the form illustrated, the lower projecting tip of the cup 19 is located on the longitudinal axis of the cylinder 11.

The feature which more particularly constitutes my invention is designated by the numeral 27 which indicates a conical plate whose apex is located on the longitudinal center line of the piston 12 and, when the piston is at the end of its compression stroke, as indicated in the drawing, this apex is disposed close to the ports 25. The plate 27 is of shell-like construction and comprises a lateral apron 28 that covers the major portion of the top of the piston and a centrally disposed sleeve 29 that is threaded into the head of the piston and defines therewith an auxiliary air chamber 30 which communicates with the combustion chamber 26 through a short passage 31 in the apex of the plate. Between the apron 28 and sleeve 29 is provided an annular air space 32 which serves to partially insulate the plate from the head of the piston and, since the plate is a separate part and otherwise contacts the head of the piston in limited localities as defined by the end face of the apron 28 and the touching portions of the sleeve 29, the loss of heat from the plate 27 will be considerably less than from a piston of solid construction.

In describing the manner in which my improved plate coacts with the remaining portions of the oil engine structure, it will be assumed that the piston 12 has drawn a charge of air into the combustion chamber and that the piston is located at some point below that illustrated in the drawing, but is moving upwardly on its compression stroke. It will be further understood, that, during the suction stroke of the piston, a charge of fuel oil was forced in any approved manner from the passages 24 into the pointed end of the mixing chamber 22 and that while this charge of oil was being delivered into the indicated chamber, the plunger 16 was slowly elevated.

During the compression stroke of the piston, the temperature of the air increases rapidly and when the piston reaches the end of its compression stroke, the air may be compressed to as high as 500 to 550 pounds per square inch. During the foregoing movement also, air is driven into the auxiliary air chamber 30.

Shortly before the piston reaches top center on its compression stroke, the plunger 16 is driven downwardly by any suitable means to inject the entire mixture of fuel and air from the mixing chamber 22 through the ports 25 into the combustion chamber, it being understood that during the compression stroke of the piston, air has been driven through the ports 25 into the chamber 22 to thoroughly mix with the oil therein, as described more particularly in the above noted patents.

Preferably, the ports 25 are so arranged that they discharge conical or balloon-shaped sprays in opposite directions into the combustion chamber 26, that is, into the mass of hot, compressed air where combustion finally takes place and the piston forced downwardly on its power stroke. Moreover, during the working stroke of the piston, the relatively pure air entrained in the auxiliary air chamber 30 rushes out through the passage 31 and feeds fresh air to the zone around the ports 25, thus improving the mixture and distribution of the fuel sprays, providing for better combustion of the fuel vapors and the elimination of carbon deposits on the projecting end of the injector.

With the foregoing construction, the average working temperature of the plate 27 will exceed that which can be obtained with the usual piston construction, that is, a piston having a solid head and composed of any suitable metal or alloy, such as cast iron, aluminum, etc. The plate 27 being separately formed from the piston and contacting therewith only in limited areas, in conjunction with the insulation provided by the air in the annular space 32, insures that, when a vehicle equipped with an engine of this construction is drifting or coasting under a closed throttle, the plate 27 will retain its heat for a considerably longer period than would be possible with the standard piston construction. Accordingly, when the throttle is again opened, the combustion chamber, and particularly the top of the piston, is more favorably conditioned for promoting the vaporization of the fuel particles, particularly those which may contact the plate 27, thus insuring better combustion. As a further advantage in this respect, the conical surface of the plate 27 substantially conforms to the shape of the oil sprays, providing more efficient turbulence of the combustible mixture and insuring a sweeping movement of the lower portion of each spray across the hot plate.

The plate 27 may be formed of any approved metal, although steel has been found to be an appropriate material for use with aluminum or aluminum alloy pistons. Because of its shell-like construction, the plate 27 is conditioned for free expansion and contraction in all directions, so that it will be free from undue stresses due to such movements. The plate has been illustrated as forming a part of the auxiliary air chamber 30 which is more particularly described and claimed in my United States Letters Patent No. 1,762,653, although it will be understood that this feature may be omitted without affecting the operative character and advantages of the plate in other respects.

I claim:

1. In an oil burning engine, the combination of a cylinder, a piston operable therein, a fuel injector adapted to project the fuel in a conical spray across the combustion chamber of the cylinder, and a separate member substantially covering the head of the piston and carried thereby to form one wall of the chamber, the chamber surface of the member being substantially parallel to the adjacent side of the fuel spray to provide for a sweeping movement of the nearest portion of the spray across the surface when the piston is substantially at the end of its compression stroke and the member closely contacting the piston head in limited areas and being otherwise spaced therefrom to form dead air spaces whereby the chamber surface is maintained sufficiently hot to promote the vaporization and combustion of fuel particles that may contact the same.

2. In an oil burning engine, the combination of a cylinder, a piston operable therein, a fuel injector adapted to project the fuel in a conical spray across the combustion chamber of the cylinder, a separate member substantially covering the head of the piston and carried thereby to form one wall of the chamber, the chamber surface of the member being substantially parallel to the adjacent side of the fuel spray to provide for a sweeping movement of the nearest portion of the spray across the surface when the piston is substantially at the end of its compression

stroke and the member closely contacting the piston head in limited areas and being otherwise spaced therefrom to form dead air spaces whereby the chamber surface is maintained sufficiently hot to promote the vaporization and combustion of fuel particles that may contact the same, and an auxiliary air chamber formed by cooperating portions of the member and the head of the piston and having an opening communicating with the combustion chamber and adapted to be positioned relatively close to the delivery end of the injector when the piston is substantially at the end of its compression stroke, the air compressed in the air chamber during the compression stroke of the piston being discharged against the injector during the firing stroke of the piston.

3. In an oil burning engine, the combination of a cylinder, a piston operable therein, a fuel injector positioned on the longitudinal axis of the cylinder and adapted to project the fuel radiatingly in sprays into the combustion chamber of the cylinder, the sprays being conically arranged, and a separate, conical member having its apex in alignment with the injector substantially covering the head of the piston and carried thereby to form one wall of the chamber, the chamber surface of the member being substantially parallel to the adjacent sides of the fuel sprays to provide for a sweeping movement of the nearest portions of the sprays across the surface when the piston is substantially at the end of its compression stroke and the member closely contacting the piston head in limited areas and being otherwise spaced therefrom to form dead air spaces whereby the chamber surface is maintained sufficiently hot to promote the vaporization and combustion of fuel particles that may contact the same.

CLESSIE L. CUMMINS.