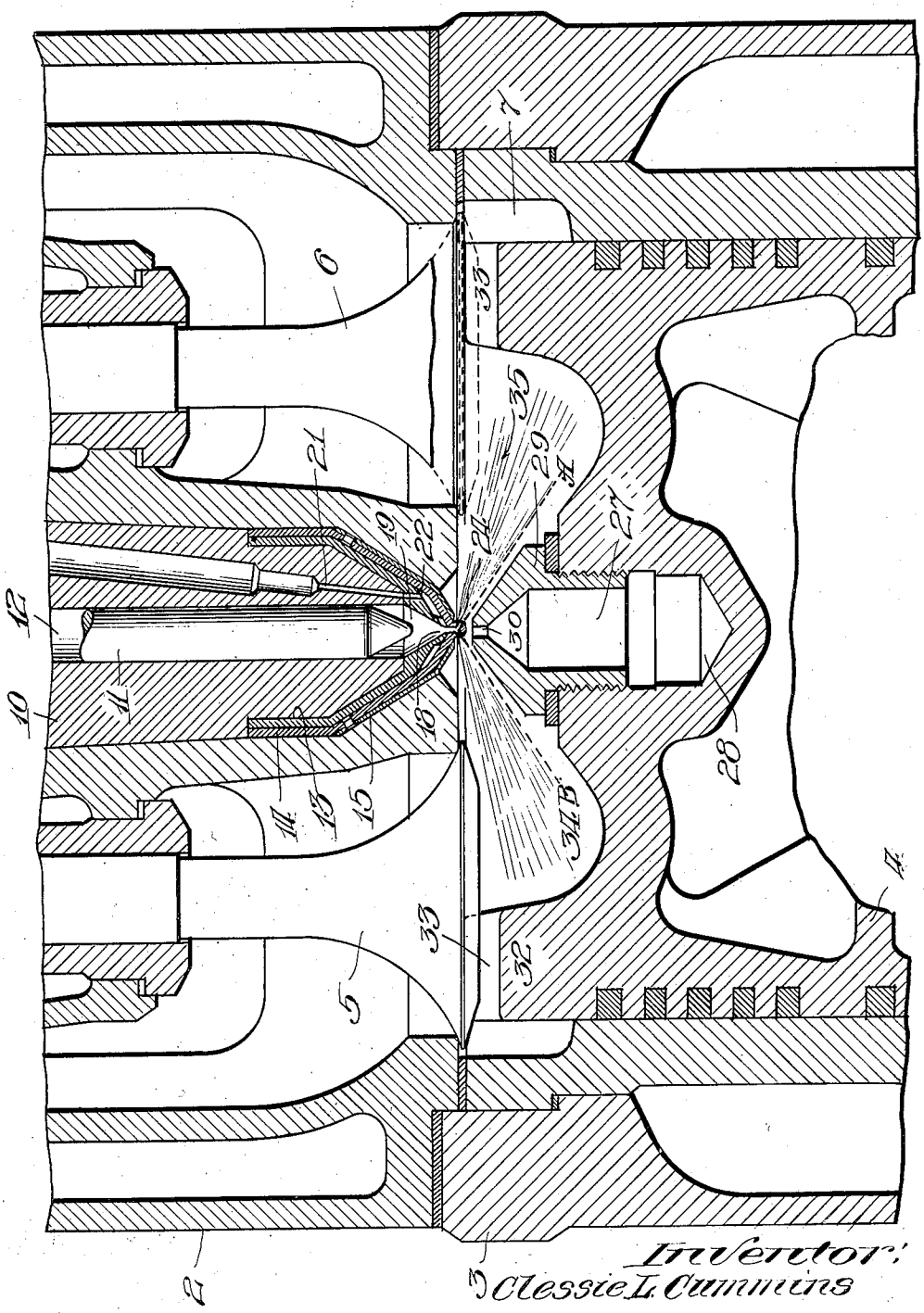
July 5, 1932. C. L. CUMMINS 1,865,841

OIL ENGINE

Filed March 6, 1930



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Patented July 5, 1932 1,865,841

UNITED STATES PATENT OFFICE

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OIL ENGINE

Application filed March 6, 1930. Serial No. 433,603.

My invention relates to oil burning engines.

The principal object of my invention is to provide for proper distribution and admixture of the fuel charge throughout the air in the combustion space with the result that more perfect combustion takes place, the efficiency of the engine being thus greatly improved.

Another object of my invention is to provide an auxiliary air chamber projecting from the head of the piston and constructed and arranged with respect to the ejector so that the air chamber supplies substantially fresh air to the zone adjacent the end of the ejector and the charge of fuel ejected by the ejector is not sprayed against the casing forming the air chamber.

With the above and incidental objects in view, the invention consists of certain novel features of construction and combination of parts, the essential elements whereof are recited in the appended claims and the preferred form of embodiment of which is described in detail hereinafter and illustrated in full in the accompanying drawing, which forms part of this specification.

Said drawing illustrates, in section, part of a cylinder head 2 and the upper parts of a cylinder 3 and reciprocating piston 4 of a four-cycle engine of the Cummins type to which for the purpose of illustration, I have shown the preferred form of embodiment of my invention applied. An air intake valve 5 and an exhaust valve 6, which is shown broken away at its lower end, may be of any improved construction. The upper end of the cylinder wall is provided with recesses 7 to accommodate movement of these valves.

The fuel injector, in general, is similar to that disclosed in my U. S. Patents No. 1,561,913 and No. 1,762,653, and may comprise a body member or plug 10, an injecting plunger 11 operable in a central bore 12 of the plug, an inner cup-shaped member 13 fitting over and about the lower end of the plug 10, a second cup-shaped member 14 of generally similar shape, fitting over the member 13, and a third or outer cup-shaped insulating member 15 fitting over the member 14. The lower end of the central bore 12 in the plug is closed, except for a small opening 18, by the lower conical end of the cup-shaped member 13, so that when the plunger 11 is retracted or elevated to the position illustrated in Fig. 1 an atomizing or mixing chamber 19 is formed under the plunger. A charge of fuel oil is fed to the mixing chamber 19 through a conduit 21 in the plug 10 and passages 22 formed between the cups 13 and 14. The lower protruding end of the cup 14 extends through a central opening in the cup 15 and is provided with very restricted ports 24 communicating with the combustion chamber of the engine. The inner conical surface of the lower end of the cup 15 has a close grounded fit with the bottom conical surface of the cup 14.

The operation of the injecting mechanism is preferably about the same as that described in my aforesaid Patent No. 1,561,913. During the suction stroke of the piston 4, air is drawn into the cylinder past the air inlet valve 5 and durng the same stroke a charge of fuel oil is forced in any desirable manner from the passages 22 between the cups 13 and 14 into the pointed end of the mixing chamber 19. While the liquid charge of oil is being deposited in the lower end of the chamber 19 the plunger 11 is slowly elevated. During the compression stroke of the piston, part of the heated air, compressed in the combustion space of the cylinder and heated due to its compression, is forced to flow through the ports 24 and 18 into the chamber 19 where the oil is entrained and thoroughly mixed with the air. Near the beginning of the power stroke of the piston, the plunger 11 is lowered by any suitable means, to eject

the entire mixture of fuel and air from the chamber 19 through the ports 24 into the combustion space where the combustible charge is ignited or exploded, thus driving the piston downwardly.

In order to prevent the ports 24 from becoming partially or entirely clogged or closed by the formation of carbon, and a coating of carbon from forming on the lower projecting end of the injector and the surrounding surface of the cylinder head, I provide an auxiliary air chamber 27 on the piston head. The head of the piston is provided with bore 28 having its upper portion threaded.

A hollow member 29 has its upper portion conical shaped and its lower cylindrical portion is externally threaded and screwed into the threaded portion of the bore 28. The member 29 together with the lower part of the bore 28 forms the air chamber 27 which is closed except for a nozzle or opening 30 at the upper end of the conical portion of the member 29.

As fully explained in my Patent No. 1,762,653, during the compression stroke of the piston air from the combustion space is forced into the air chamber 27 through its opening 30 and during the combustion stroke this air in the chamber which is relatively pure, rushes out through the opening 30, to feed fresh air to the zone around the lower end of the ejector, thus effecting improved distribution and admixture, better combustion and the elimination of carbon deposit on the projecting end of the ejector.

The upper end of the piston has an upwardly extending circumferential rim 32 which is flat on its upper face. When the piston is at the end of its compression stroke, as shown in the drawing, the clearance between the flat face of the rim 32 and the bottom face of the cylinder head is as small as practical, the rim being recessed at 33 to clear the exhaust and inlet valves 5 and 6.

As the piston approaches top center on the compression stroke, the air above the rim 32 is driven towards the center of the cylinder from all directions thus setting up a turbulence of the air within the combustion space, which at the end of the compression stroke, is formed almost wholly by the annular chamber 34 in the upper end of the piston, the chamber being formed around the casing 29 by the rim 32.

The fine broken lines 35 indicate approximately the spray of the fuel charge ejected radiatingly through the ports 24 in the ejector. The spray is conical in shape and generally speaking, the contour of the chamber 34 is such as to conform to the shape of the spray so that the spray is well distributed without directly striking the casing 29, cylinder head or piston. The turbulence of the air set up by the rim 32 and the action of the air chamber aids in furthering the distribution. I have found that it is highly beneficial to keep the spray from striking the projecting casing 29 forming the air chamber. As this casing projects into the combustion chamber it becomes very hot and should part of the spray strike it, its top would burn off and its life thus shortened and the efficiency of the engine impaired. For convenience, I would refer here to the conical space within the center of the spray (i. e., between the lines marked A and B in the drawing) as the zone within the fuel spray.

The length of the fuel spray is somewhat limited as the charge is injected at a time when the air in the combustion space is highly compressed. As the size of the engine cylinder increases in diameter the width of the rim 32 may be widened so that the diameter of the chamber 34 is generally such as to accommodate the length of the fuel spray, the chamber being deepened to accommodate the compressed air and the increased conical spread of the spray.

I claim:

1. In an oil burning engine, the combination of a cylinder and a piston operable therein, of a fuel ejector having an end projecting into the combustion space and adapted to inject the fuel charge radiatingly into the combustion space in the form of a conical spray at about the end of the compression stroke of the piston, an auxiliary air chamber on the head of the piston, projecting into the combustion space and having an opening in close proximity to and in axial alignment with the projecting end of the injector at the end of the compression stroke of the piston, the direction of the conical spray and the shape and the projecting end of the air chamber being so related that the spray does not contact with the wall of said chamber.

2. In an oil burning engine, the combination of a cylinder and a piston operable therein, of a fuel injector having an end projecting into the combustion space and provided with a plurality of restricted radiating ports through which the fuel charge is sprayed in the form of a cone, an auxiliary air chamber on the head of the piston, projecting into the combustion space and having a conical end with an opening in the apex thereof, the conical end being wholly in the conical zone within the fuel spray at the end of the compression stroke of the piston so that the fuel is not sprayed on the walls of the chamber.

3. In an oil burning engine, the combination of a cylinder and a piston operable therein, a fuel ejector having an end discharging into the combustion space and adapted to inject the fuel charge radiatingly into the combustion space in the form of a conical spray defining a conical space opposed to the head of said piston, means car-

ried by the piston head substantially in alignment with said conical space and defining an auxiliary air chamber, said chamber-defining means having a conically-shaped outer wall within said conical space of lesser dimensions than said conical space, said ejector end and piston being so related that said chamber-defining means does not directly contact said spray in any operable position of said piston.

In testimony whereof, I have subscribed my name.

CLESSIE L. CUMMINS.