

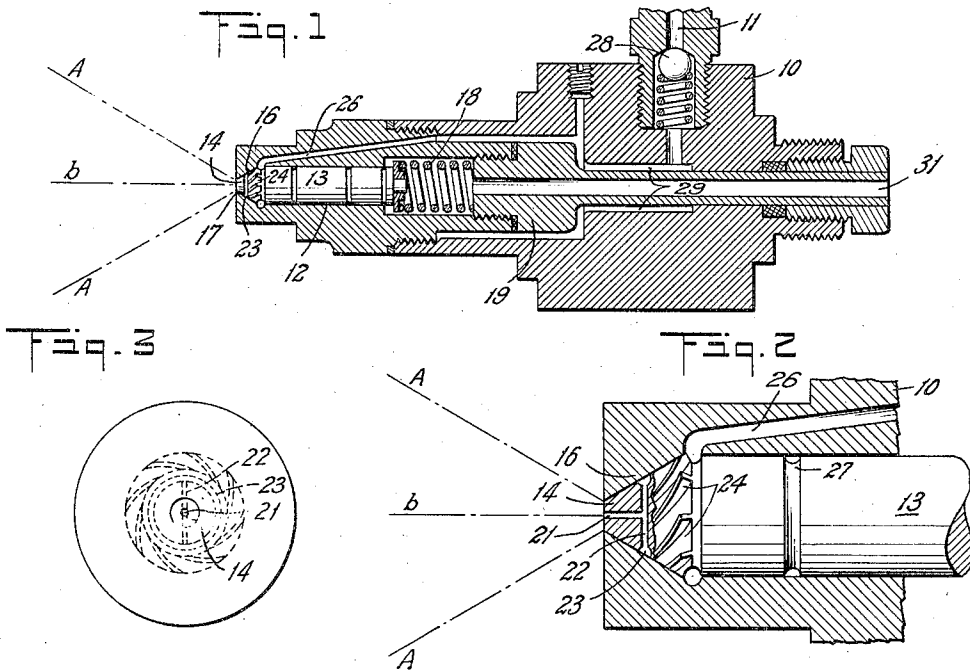
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FUEL INJECTOR

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FUEL INJECTOR

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This invention relates to internal combustion engines, and more particularly to fuel injectors therefor.

In certain types of fuel injection engines, it is desirable to use an ignition device to more completely ignite the charge, and it has been found that in such cases it is undesirable to locate the ignition device in the direct path of the main fuel spray, for if so located, the fuel from the main spray cools the device too quickly for consistent ignition. It is therefore preferable to locate the ignition device outside of the path of the main spray and to direct what may be termed a pilot spray toward the device, which is ignited prior to the main spray and serves as a torch to completely ignite the main fuel charge.

An object of the invention is to provide a novel fuel injector that divides its spray into two parts, one of which may be directed toward an ignition device.

Another object of the invention is to provide a novel fuel injector that delivers a hollow conical or sheath spray and a pilot spray from substantially the same origin.

Another object is to provide a novel fuel injector having both auxiliary and main orifices that come into operation successively.

Other objects and features of the invention will be apparent from the following description, in connection with which I have illustrated an embodiment of the invention in the accompanying drawing, in which—

Fig. 1 is a longitudinal section through one form of injector embodying the present invention;

Fig. 2 is an enlarged view of the end portion of the injector illustrated in Fig. 1;

Fig. 3 is an end view of the injector shown in Fig. 2;

Referring to the drawing, and more particularly with regard to Figures 1, 2, and 3, 10 represents the body of the injector having a fuel inlet 11, a cylindrical portion 12 within which is a piston 13 having a conical outer end 14 in a correspondingly converging seat 16 formed in the body portion of the injector. Piston 13 normally closes the fuel orifice 17 and is urged to its seat by spring 18, coacting between the valve and plug 19. The conical portion 14 of valve 13 is provided with an axial opening 21 communicating with a radial passage 22 which terminates in an annular groove 23 on the outer surface of the valve. Spiral grooves 24 are also preferably formed on the conical end of the valve for delivering fuel from the passage 26 and imparting

a whirling motion to it and causing it to be injected into the engine in a divergent conical spray, as illustrated by the broken lines in Figs. 1 and 2. Grooves 27 are also provided on the surface of the piston 13 for collecting fuel or oil and retaining it within the grooves for lubrication of the piston.

In the operation of the device, fuel supplied from a suitable pump, not shown, enters through inlet 11, passes the spring loaded check valve 28, into passage 29, from which it flows through passage 26 to the outer end of valve 13. A small amount of fuel enters annular groove 23 by means of spiral grooves 24 and is forced as an auxiliary spray into the engine, not shown, through axial passage 21 and in the direction of the broken line *b* in Figs. 1 and 2. The ignition device, not shown, is preferably located in a manner to be in the path of the fuel issuing from passage 21 and outside of the hollow conical spray represented by broken lines A—A.

At some predetermined point, the pressure acting on the outer end of valve 13 forces it inwardly and permits the fuel to be injected in a conical spray which is ignited by the priorly ignited pilot spray. Atmospheric passage 31 is provided in the body of the injector to allow valve 13 to move inwardly when the compression force of spring 18 has been overcome.

In some instances it is possible to dispense with check valve 28, but passage 21 is at all times in communication with the fuel passage 26, and it is preferred to incorporate a check valve for preventing the pressure of the engine gases to be transmitted to the fuel line 11.

While one embodiment of the invention has been illustrated and described, it is understood that this showing and description are illustrative only and that the invention is not limited to the forms shown and described, or otherwise, except by the terms of the following claims.

What is claimed is:

1. A fuel injector comprising a body having a conical orifice, a valve seated therein adapted to inject a hollow conical spray, means forming an annular groove between the valve and its seat, and said valve having an auxiliary passage substantially axial of the conical orifice, and in communication with the annular groove, and means for supplying fuel to the groove to inject fuel through the auxiliary passage when the valve is closed.

2. A fuel injector comprising a body having a conical orifice, a conical valve seated therein adapted to inject a hollow conical spray, said

valve having an auxiliary passage substantially axial of the valve cone, and a radial passage intersecting the axial passage and terminating on the conical seat of the valve.

5 3. A fuel injector comprising a body having a convergent orifice, a valve seated therein, said valve having means thereon for injecting a divergent spray, means including an annular groove adjacent the valve, and said valve having an auxiliary orifice axially located therein, said orifice being in communication with said groove, and said orifice being in constant communication with the body of the injector.

10 4. A fuel injector comprising a body portion having a convergent conical orifice, a conical valve seated therein, said valve constructed to coact with the body portion to inject a hollow divergent spray of fuel, means forming an annular groove between the valve and its seat, means forming spiral grooves on said valve providing constant communication between the annular groove and the interior of the body portion, said spiral grooves being arranged within the conical orifice to impart a whirling motion to the main spray, and said valve having an auxiliary fuel passage in constant communication with the annular groove.

15 5. A fuel injector comprising a body portion having a convergent conical orifice, a conical valve seated therein, said valve constructed to coact with the body portion to inject a hollow divergent spray of fuel, means forming an annular groove between the valve and its seat, means forming spiral grooves on said valve providing constant communication between the annular groove and the interior of the body portion, said spiral grooves being arranged within the conical orifice to impart a whirling motion to the main spray, and said valve having a fuel passage in constant communication with the annular groove, said passage having its exit orifice extending axially of the valve cone to inject fuel centrally of the main spray.

20 6. A fuel injector comprising a body portion having a convergent conical orifice, a conical valve seated therein, said orifice constructed to coact with the valve to inject a hollow divergent spray of fuel, means forming an annular groove between the valve and its seat, means forming an axial auxiliary passageway in the valve having its orifice directed axially of the main spray for by-passing a small quantity of fuel around the valve seat and injecting it in an axial direction from within the boundary of the divergent spray, means forming a transverse passageway connecting the groove with the axial passageway, and said body portion having a conduit therein for conducting fuel under pressure to said groove.

25 7. A fuel injector comprising a body portion having a convergent conical orifice, a conical valve seated therein, said orifice constructed to coact with the valve to inject a hollow divergent spray of fuel, means forming an annular groove between the valve and its seat, means forming an axial auxiliary passageway in the valve having a communication with said groove for by-passing a small quantity of fuel around the valve seat and injecting it in an axial direction from within the boundary of the divergent spray, said body portion having a conduit therein for conducting fuel under pressure to said groove, a spring coacting between the inner end of said valve and said body portion for closing said orifice, and means for exposing the inner end of said valve to atmospheric pressure.

30 8. A fuel injector comprising a body portion having a convergent conical orifice, a conical valve seated therein, said orifice coacting with said valve to inject a hollow divergent spray of fuel, means forming an annular groove between the valve and its seat, means for connecting the groove to a source of fuel, means forming an axial auxiliary passageway in the valve in communication with the groove for by-passing a small quantity of fuel from the groove around the valve seat and injecting it from within the boundary of the divergent spray, said passageway having its exit orifice directed axially of the main divergent spray.

35 9. A fuel injector comprising a body portion having a convergent conical orifice, a conical valve seated therein, said orifice coacting with said valve to inject a hollow divergent spray of fuel, means forming an annular groove on the conical portion of the valve, means for connecting the groove with a source of fuel, means forming an axial auxiliary passageway in the valve in communication with the groove for by-passing a small quantity of fuel from the groove around the valve seat and injecting it from within the boundary of the divergent spray, said passageway having its exit orifice directed axially of the main divergent spray.

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