

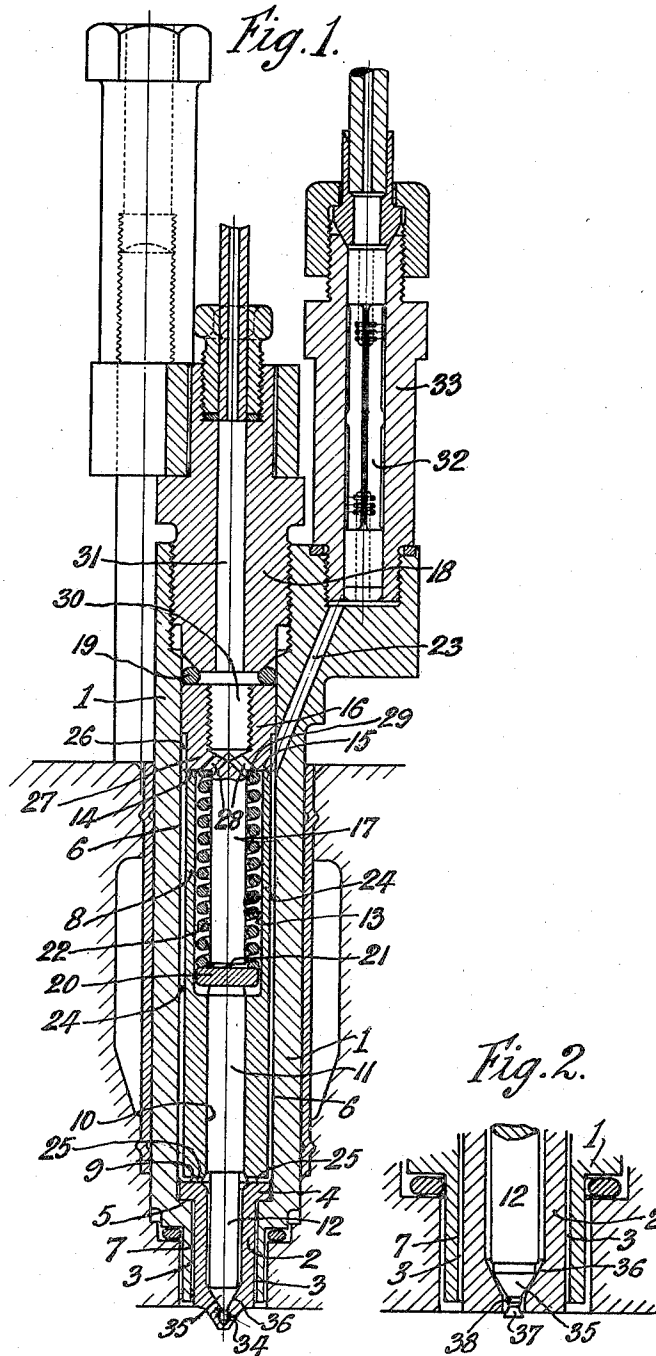
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FUEL INJECTOR OR ATOMIZER FOR INTERNAL COMBUSTION ENGINES

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FUEL INJECTOR OR ATOMIZER FOR
INTERNAL COMBUSTION ENGINES

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This invention relates to fuel injectors or atomizers for airless or solid injection compression ignition oil engines and particularly to those of the type in which a spring loaded fuel injection or needle valve is adapted to be lifted from its seat by the pressure of the fuel oil delivered by a pump to open a delivery orifice or orifices through which the fuel passes to the working or combustion chamber of the engine. Injectors or atomizers of this type are described in the specifications of British Letters Patent No. 20,582 of 1909 and 9,382 of 1915.

The object of the present invention is to provide an improved fuel injector or atomizer of the above type particularly with a view to ensuring the accurate seating of the needle valve at all times and also simplifying the construction whereby assemblage, removal and replacement of the parts will be facilitated.

According to one feature of the present invention, the needle valve seats in a sleeve which is closed at its inner end to form a nozzle having a suitable delivery aperture or apertures and is mounted in the bore of the injector or atomizer body at the delivery end with a small clearance, the construction and arrangement being such that in assembling the parts, as the loading spring is being placed in position, the pressure it exerts upon the needle valve thrusts the latter on to its seat so that if the latter is not central with the valve the seating sleeve is adjusted automatically by the valve itself so as to seat the valve accurately, whilst the engaging surfaces between the seating sleeve and the interior of the injector or atomizer body permit the seating sleeve to be held firmly in its correct position for seating the valve accurately upon pressure being applied to it solely in a direction parallel with the axis of the valve in subsequently securing the seating sleeve in position, whereby accurate seating of the valve will be effected automatically.

Preferably, the inner end of a cartridge sleeve fitting without play but removably secured within the atomizer body or casing and housing the sliding needle valve, bears against the said valve seating member, the engaging surfaces between the cartridge sleeve and the seating sleeve as well as those between the latter and the interior of the body of the injector or atomizer permitting the pressure for securing the seating sleeve in its correct position for seating the valve accurately, to be applied through the cartridge sleeve parallel with the axis of the valve.

Where the lift of the needle valve is limited by a stop pin or peg, I prefer to arrange this

to project into the outer part of the cartridge sleeve with its head held hard against the outer edge of the latter, preferably by a plug screwed into the outer end of the body or casing of the injector or atomizer, and with the engaging surfaces fitting squarely one against the other.

According to another feature of the present invention, a readily removable cartridge sleeve which bears upon a seating sleeve closed at its inner end to form a nozzle having a suitable delivery aperture or apertures and mounted at the delivery end of the body of the injector or atomizer, houses in addition to the piston of the needle valve, a stop pin or peg for limiting the lift of said valve, and also the loading spring, so that the whole of these parts can be assembled in the body or casing of the injector or atomizer as a single unit, whereupon the unit is adapted to be secured in position preferably through the head of the stop pin or peg, as by a plug screwed into the outer end of the body or casing of the injector or atomizer.

Preferably, a loose disc is fitted within the cartridge sleeve between the outer end or top of the piston of the needle valve and the inner end of the stop pin, whereby the lift of said valve may be very accurately determined by suitably reducing the thickness of the disc or substituting a disc of the required thickness as found necessary, whilst the atomizer spring which encircles the stop pin and bears at its outer end preferably against the head of the latter, bears at its inner end against said disc, thereby obviating the transmission of side thrust to the needle valve by the spring.

Fuel oil is delivered to the piston of the needle valve through a longitudinal passage or passages formed by providing a channel, channels, groove or grooves in either the outer periphery of the cartridge sleeve or the inner periphery of the injector or atomizer body or casing or partly in one and partly in the other, and also through one or more inwardly directed channels, passages or ducts formed preferably at or near the inner edge of the cartridge sleeve.

To permit any oil that may leak past the piston of the needle valve to escape freely, I prefer to bore an inclined hole or holes from the inner or under face of the head of the stop pin or peg, preferably on a centre line or lines passing through the annular edge between the said inner or under face of the head of the stop pin or peg and the periphery of the latter, to an axial or longitudinal bore or passage in said head, which is in communication with a bore or passage

through a plug screwed into the outer end of the bore of the atomizer or injector body or casing hard against the said head.

The accompanying drawing shows two forms of atomizer according to the present invention, Figure 1 being an axial vertical sectional elevation of one form and Figure 2 a sectional elevation of a modified form of nozzle.

In carrying out the present invention as illustrated in Figure 1, the body 1 of the atomizer is bored longitudinally from end to end with a stepped down portion near the nozzle end where a flanged seating sleeve 2 is fitted with a small clearance at 3 and with its flange 4 fitting against the annular flat shoulder 5 formed between the two diameters 6 and 7 of the said bore. The inner end of the seating sleeve 2 is closed to form an integral nozzle portion having delivery apertures or orifices 34. A cartridge sleeve 8 is made a sliding fit in the main or larger bore 6 of the atomizer body 1 with its inner end bearing at 9 upon the outer face of the flange 4 of the seating sleeve 2. The inner end portion of the cartridge sleeve is bored at 10 to receive the piston portion 11 of the needle valve 12, whilst the outer end portion is formed of much larger internal diameter at 13 than the lower portion and is preferably machined. Upon the outer edge 14 of the cartridge sleeve bears the inner or under side 15 of the head 16 of a stop pin or peg 17 which projects axially into the outer end portion of the cartridge sleeve with its inner end disposed near to the outer end of the needle valve. A plug 18 screwed into the outer end of the atomizer casing 1 against the head 16 of the stop pin 17 through a copper packing ring 19, binds said head hard against the outer edge of the cartridge sleeve which in turn bears at its inner end 9 hard against the flange 4 of the seating sleeve 2 in order to maintain the latter in position. A loose disc 20 is fitted within the outer end portion of the cartridge sleeve between the outer end of the piston portion 11 of the needle valve 12 and the inner end 21 of the stop pin or peg with a predetermined clearance and between this disc 20 and the inner or under side 15 of the head of the stop pin or peg 17 the spring 22 of the needle valve 12 is arranged about the stop pin itself.

Fuel is admitted preferably towards the outer end of the atomizer body through an edge type filter 32 mounted in a filter body 33 which is screwed into a socket of the atomizer body and is disposed parallel with the axis of and closely adjacent the latter. The filter may however be arranged at right angles to the atomizer body. A filter of the edge type is described in the provisional specification of my co-pending application for British Letters Patent No. 466 of 1937. After leaving the edge filter 32, the fuel passes through a passage 23 to a point at the outer end of the cartridge sleeve 8 and in order to convey it from there to the inner or under side of the piston portion 11 of the needle valve, one or more straight longitudinal grooves 24 is or are cut in the exterior periphery of the cartridge sleeve and communicating therewith is or are a groove or grooves 25 disposed at the inner end of the cartridge sleeve and opening into the interior of the latter. Instead of the groove or grooves 25, a port or ports may be provided in the cartridge sleeve 8. Where more than one longitudinal groove 24 is provided as illustrated, communication between these grooves and the fuel inlet is effected through an annular chamber 26 formed beyond the outer end of the cartridge sleeve be-

tween the bore 6 of the atomizer body and a reduced part 27 of the head of the stop pin 17.

To permit fuel oil that may lead past the needle valve 12 to escape freely from the atomizer, inclined holes 28 are bored on centre lines passing through the annular edge 29 between the inner or under side 15 of the head 16 of the stop pin or peg 17 and the periphery of the latter, to the coned end of an axial hole 30 in the head 16. The bore 30 is screw threaded to permit the insertion of a suitable tool for removing the head 16 and stop pin or peg 17 when required as for inspection or replacement of parts. The adjacent plug 18 screwed into the outer end of the atomizer body 1 is similarly provided with a central bore 31.

In Figure 2 the valve is of pintle form, that is to say the coned face 35 of the valve is extended beyond the sleeve 2 to provide another and inverted cone 37, of which the shape determines the angle of spray. Between the two coned faces is a cylindrical portion 38, shaped to provide a minimum clearance with the sleeve 2, to avoid the formation of carbon deposits. It will be seen that the angle of the coned face 35 does not coincide with the seat 36—the difference in angles being however very slight. This difference in angle allows the valve to close more readily, as theoretically the valve seats along a circular line. If it seated all along the coned face 36 the pressure of the fuel would have to act along the whole of the face 36 against the loading spring pressure tending to hold the valve closed.

With the foregoing constructions and arrangements, it will be understood that in assembling the parts, the pressure of the loading spring 22 upon the piston portion 11 of the needle valve 12 causes the face 35 of the latter, which is coned at an acute angle, to bear hard upon its seat 36 so that if it does not then seat accurately, it adjusts the position of the seating sleeve 2 automatically to bring about accurate seating. Upon subsequently securing the stop pin 17 in position by the screwed plug 18, the seating sleeve 2 will be firmly secured in its adjusted or correct position for seating the needle valve 12 accurately. To ensure that the seating sleeve 2 will not be shifted from that position during said securing operation, the engaging surfaces 14 and 15 between the head 16 of the stop pin 17 and the cartridge sleeve 8, between the latter and the flange 4 of the seating sleeve 2 and also between the latter and the annular flat shoulder 5 within the atomizer body, are accurately machined to fit squarely one against the other. In replacing the parts after cleaning for example, the accurate seating of the needle valve 12 will be ensured thereby maintaining the efficiency of the atomizer and obviating any increase in the fuel consumption of the engine to which it is applied, contrary to the case of known constructions of fuel atomizer.

Furthermore, wear between the piston portion 11 of the sliding needle valve 12 and the cartridge sleeve 8 will be lessened as the loose disc 20 obviates the transmission of lateral pressure to the needle valve 12 by the loading spring 22. Again, in the case of wear, replacement of the cartridge sleeve 8 can be readily carried out at small cost and without affecting the adjusting of the valve seating sleeve 2 automatically when reassembling the parts.

According to modifications of the construction particularly described above, the longitudinal

groove or grooves for conveying the fuel oil from the inlet, may be provided in the interior periphery of the injector or atomizer body or partly in the latter and partly in the exterior periphery of the cartridge sleeve. Furthermore, instead of a central bore in the head of the stop pin and through the said securing plug, I may provide each of these members with a longitudinal passage or passages arranged otherwise. Again, communication between the central bore or other longitudinal passage or passages through the said securing plug and the interior of the outer portion of the cartridge sleeve, may be effected through one or more holes drilled from the inner end to the outer end of the head of the stop pin or "vice versa." Although I prefer to construct the head of the stop pin or peg with its inner or under face flush with the outer edge or top of the cartridge sleeve, I may in some cases construct said head so that it projects and fits into the outer or upper part of the cartridge sleeve for a predetermined distance and provide for the escape of any fuel oil that may leak past the piston of the needle valve by forming on or in the exterior of that part of the said head that fits into the cartridge sleeve, a flat, flats, groove or grooves communicating through an inwardly or radially directed hole or holes with an axial or longitudinal bore or passage in said head from which the leakage of fuel oil passes through the hollow plug screwed into the outer end of the bore of the injector or atomizer body or casing.

What I claim is:

1. An atomizer comprising a casing, a nozzle member and a valve axially movable with respect to said nozzle member, the nozzle member providing a seating for said valve and being mounted in the casing so that during assembly it has freedom of lateral movement to enable the valve to be properly registered with respect to its seating, and means for clamping the nozzle member in the position of proper registration.

2. An atomizer comprising a casing, a nozzle member supported with lateral clearance in the casing, a valve axially movable in the nozzle member, and nozzle member providing a seating for the valve, said lateral clearance enabling movement of the nozzle member to effect, during assembly, correct registration of the valve with respect to its seating, a thrust member mounted for axial movement in said casing, and means for clamping the said nozzle member in position through the intermediary of said thrust member.

3. An atomizer comprising a casing, a nozzle member supported loosely in said casing and providing a seating for a valve, a clamping device, a thrust member intermediate said nozzle member and said device, a valve having a piston portion housed and guided in said thrust member, and resilient means urging said valve on to its seating, the arrangement being such that the clamping device in one part of its movement operates upon the resilient means and in a subsequent part of its movement upon said thrust member.

4. A fuel atomizer comprising a casing, a nozzle member supported loosely in said casing and providing a seating for a valve, a clamping device, a thrust member slidably mounted in said casing intermediate said nozzle member and said device, a valve having a piston portion slidably housed in said thrust member, and resilient means housed in said thrust member for urging said valve on to its seating, the arrangement being such that the clamping device in one part of its movement operates on the resilient means

and in a subsequent part of its movement on said thrust member, said thrust member being so arranged with respect to the casing as to leave therebetween fuel ducts, leading to said valve, said clamping device being bored to provide a fuel leak passage.

5. An atomizer comprising a casing, a nozzle member mounted with lateral clearance in said casing and providing a seating for a valve, a clamping device, a thrust member slidably mounted in said casing intermediate said nozzle member and said clamping device, a valve having a piston portion slidably housed and guided in said thrust member, a compression spring housed in said thrust member, a plug member slidably mounted in said casing intermediate said thrust member and said clamping device, the whole arrangement being such that said clamping device initially operates on said valve through the intermediary of the spring and plug member, and subsequently on said nozzle member through the intermediary of said thrust member and plug member.

6. An atomizer comprising a casing, a nozzle member mounted with lateral clearance in said casing and providing a seating for a valve, a clamping device, a thrust member slidably mounted in said casing intermediate said nozzle member and said clamping device, a valve having a piston portion slidably housed and guided in said thrust member, a compression spring housed in said thrust member, a plug member slidably mounted in said casing intermediate said thrust member and said clamping device, a stop pin on said plug member extending into said thrust member, a loose disc between said spring and said piston portion, said pin limiting the lift of said valve by contacting with said disc, the whole arrangement being such that during assembly said clamping device in its clamping movement initially operates on said valve through the intermediary of the spring and plug member, and subsequently on said nozzle member through the intermediary of said thrust member and plug member.

7. An atomizer comprising a casing, a ledge within said casing at right angles to the axis thereof, a nozzle member fitting with lateral clearance within said casing, a flange on said member fitting with lateral clearance within said casing and seating on said ledge, a seating for a valve within the nozzle member, a thrust member mounted for axial movement in the said casing, a valve mounted for longitudinal movement, a piston portion on said valve slidably guided in said thrust member, resilient means for urging said valve axially into engagement with said seating, said lateral clearances allowing movement of said nozzle member to enable the valve to be properly registered with respect to its seating and a clamping device for moving said thrust member axially into contact with said flange to hold said nozzle member firmly in such position of proper registration.

8. A fuel atomizer comprising a hollow casing, a ledge within said casing providing a step down boring in said casing a nozzle member fitting with lateral clearance within the smaller bore of said casing, a flange on said member fitting with lateral clearance within the larger bore of said casing and seating on said ledge, a clamping device screwing into said casing, a thrust member intermediate said device and nozzle member, a valve, a piston portion on said valve having its stem slidably housed and guided in said thrust member, a compression spring in

said thrust member, a disc loosely mounted in said thrust member between said spring and piston portion, a plug member slidably mounted in said casing intermediate said clamping device and said thrust member, a stop pin on said plug member extending into said thrust member, said clamping device during assembly operating on said valve to register it with

its seating through the intermediary of the plug member and compression spring, and subsequently on said nozzle member to hold it correctly positioned through the intermediary of said plug and thrust member, said thrust member being so arranged within said casing as to leave therebetween fuel ducts leading to said valve. 5

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