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FUEL INJECTION NOZZLES

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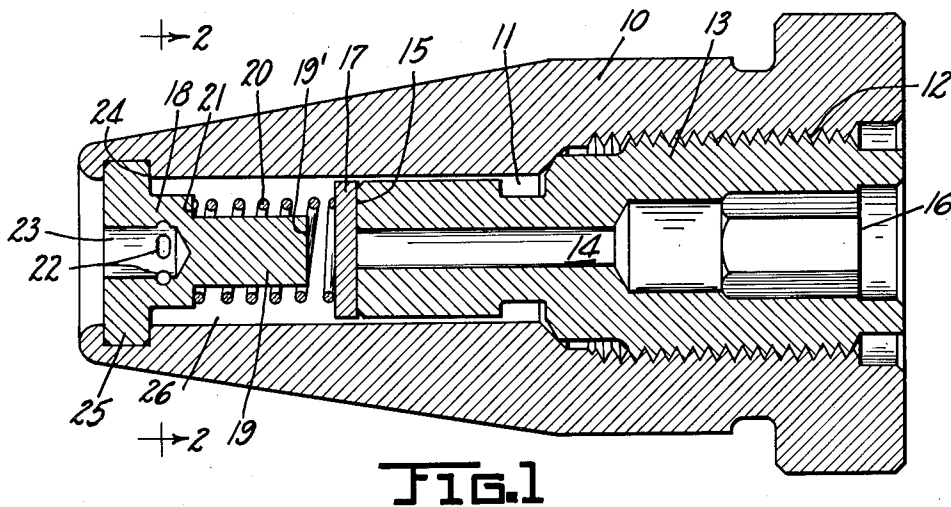


FIG. 1

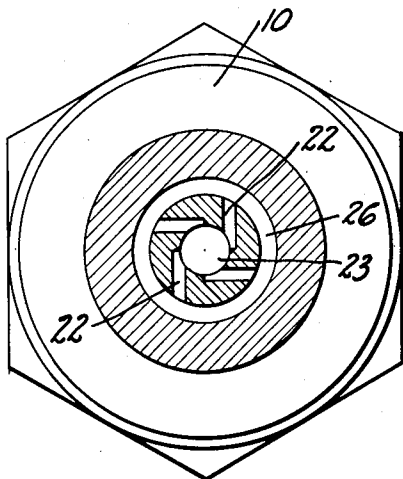


FIG. 2

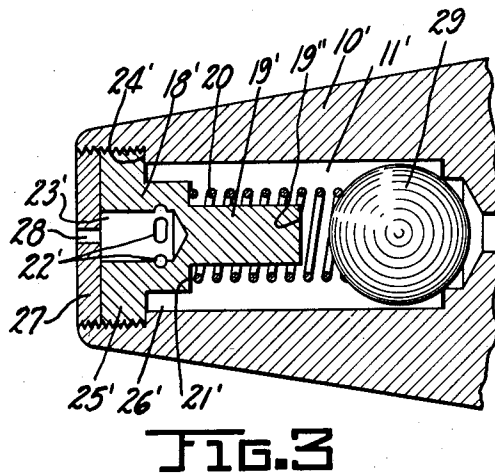


FIG. 3

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FUEL INJECTION NOZZLES

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2 Claims. (Cl. 299—107.6)

The type of nozzle to which the present invention relates is particularly adapted for spraying fuel either directly into the combustion chambers or into the fuel manifolds of reciprocating internal combustion engines and gas turbine engines. One of the problems which gave rise to the instant invention was to provide a nozzle for installations where mass production and low retail costs demand simplicity in design and economy in manufacture.

An object of the invention, therefore, is to provide a fuel injection nozzle which is efficient in operation and at the same time is usually simple in design and embodies a minimum number of parts.

Another object is to provide a fuel injection nozzle embodying an inlet passage controlled by a simple spring-pressed check valve and having a coating nozzle insert so constructed and arranged as to avoid disturbance of the spray cone due to fluctuation or instability of the check valve while the latter is unseated and held open due to a build-up in fuel pressure in the inlet passage.

The foregoing and other objects and advantages will become apparent in view of the following descriptions taken in conjunction with the drawing, wherein:

Figure 1 illustrates in substantially central longitudinal section a nozzle constructed in accordance with the invention,

Figure 2 is a section taken substantially on the line 2—2, Figure 1, and

Figure 3 is a substantially central longitudinal section of a modification, only the discharge extremity of the nozzle being shown.

Referring to Figures 1 and 2 of the drawing, a hollow nozzle body is indicated at 10, and in the particular form shown, it is adapted to be inserted in the combustion chamber or cylinder of a reciprocating internal combustion engine, where injection is usually timed to occur at the end of the compression stroke. A central elongated chamber 11 is defined by the body 10, which at one end is enlarged and internally threaded as at 12, to receive an externally-threaded fuel conduit and valve seat member 13 formed with a central passage 14, terminating in a valve seat 15. The entrance end of the passage is shown enlarged and formed with a wrench socket 16, to facilitate tightening of the member 13 in its socket. It is preferred to have the external threads of the member 13 and the coating threads 12 of the body 10 of a reduced or relatively steep helical angle, so that if a reasonable amount of torque is used in installation of said member, it will be held securely in place by friction. As will be obvious, the entrance end of the passage 14 is adapted to receive one of the fuel lines from an injection pump.

A check valve 17 is adapted to engage a seat 15 and close the discharge end of the passage 14 until sufficient pressure is built up to unseat said valve. As shown, the check valve 17 is in the form of a substantially flat disc, such type of valve being preferred since it has been found

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to effectively serve the desired function while tending toward economy in manufacture. A nozzle insert is indicated at 18; it is provided with a reduced inwardly projecting portion 19, terminating in a valve stop 19'. A spring 20 encircles the portion 19 and seats at one end on a shoulder 21, the opposite free end of the spring engaging the check valve. At its discharge end the nozzle insert is formed with a series of passages 22, which are formed at a tangent to a central swirl chamber or discharge opening 23, from which the fuel is discharged in the form of a substantially cone-shaped spray. To retain the insert 18 in position, it is preferred to form an annular shoulder 24 in the tip end of the valve body 10, against which a similar shoulder 25 formed on the insert engages, the end of the body 10 being peened over the latter shoulder.

Operation

When the pressure of fuel in the passage 14 attains a predetermined value as determined by the strength of the spring 20, it unseats the valve 17 and moves the latter against the stop 19', whereupon the fuel is free to pass through passage 26 and thence to the tangential passages 22, into the swirl chamber 23, from which it is discharged in a substantially cone-shaped spray. The characteristics of the spray, such as atomization, penetration and spray angle are determined by the proper size of the tangential holes 22 and their location in relation to the swirl chamber 23.

Due to the fact that the check valve 17 is limited in its opening movement and then brought up against the stop 19', the said valve remains fixed during the discharge of fuel and does not flutter or fluctuate and thus affect the nozzle spray, as would be the case were the valve supported by the spring only.

The simplicity of the nozzle assembly is obvious. The member 13 may be readily removed when it is desired to inspect and clean the nozzle. The valve seat member 13 may be readily fabricated to obtain the most effective length and area of passage 14 and seating surface for valve 17.

Figure 3 illustrates a modified construction in the nozzle insert and associated check valve of Figures 1 and 2. In the modification of Figure 3, parts which correspond to related parts in Figures 1 and 2 are designated by similar reference numerals except that a prime (') has been added.

An orifice plate 27 is removably secured over the discharge opening 23, and this together with the nozzle insert and associated check valve assembly are removable from the discharge end of the nozzle. The orifice plate may have an orifice 28 therein contoured to obtain a discharge spray having the desired characteristics as to shape, spray angle, etc. Also, instead of the flat check valve of Figures 1 and 2 a ball type is used as indicated at 29. The operation in Figure 3 is essentially the same as above described, the check valve 29 being limited in its opening movement as it is brought up against the stop 19'.

Although only two forms of the improved nozzle are shown, certain limited changes in design to suit different installations will be obvious to those having a knowledge of the art.

I claim:

1. A fluid spray nozzle comprising a hollow body having an inlet and an outlet; an internal annular recess in said body adjacent the outlet, a nozzle insert formed with an annular projection for engagement with said recess, an inwardly extending annular shoulder on said insert spaced from said body; an inwardly projecting portion on said insert spaced farther from said body

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than said shoulder; a helical spring of smaller diameter than said shoulder encircling said portion; a seat member secured in said body adjacent the inlet; a longitudinal passage through said member; a chamber defined by said insert, seat member and body; a valve in said chamber formed to seat on said member and to regulate communication between said passage and chamber; said valve urged in a seating direction by said spring and limited in movement in the opposite direction by said projecting portion; a cylindrical discharge orifice centrally located in said insert unrestrictedly in communication with said outlet; a plurality of passages in said shoulder tangentially intersecting said orifice and opening directly into said chamber.

2. A fluid spray nozzle comprising a hollow body having an inlet and an outlet; a nozzle insert secured in said body adjacent the outlet thereof; an inwardly extending annular shoulder on said insert spaced from said body; an imperforate stepped down portion on said insert projecting inwardly from said shoulder; a seat member secured in said body adjacent the inlet; a longitudinal passage through said member; a chamber in said body defined by said seat member and insert; a valve in said chamber adapted to seat on one of said members to control communication between said passage and

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chamber; a spring encircling said portion formed at one end to abut said shoulder; said valve urged in a seating direction by said spring, and limited in movement in the opposite direction by said projecting portion; a discharge orifice in said insert; and a plurality of passages in said shoulder tangentially intersecting said orifice and terminating in said chamber.

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