

[54] **FUEL INJECTION NOZZLE UNIT FOR
INTERNAL COMBUSTION ENGINES**

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239/415

[56] **References Cited**

UNITED STATES PATENTS

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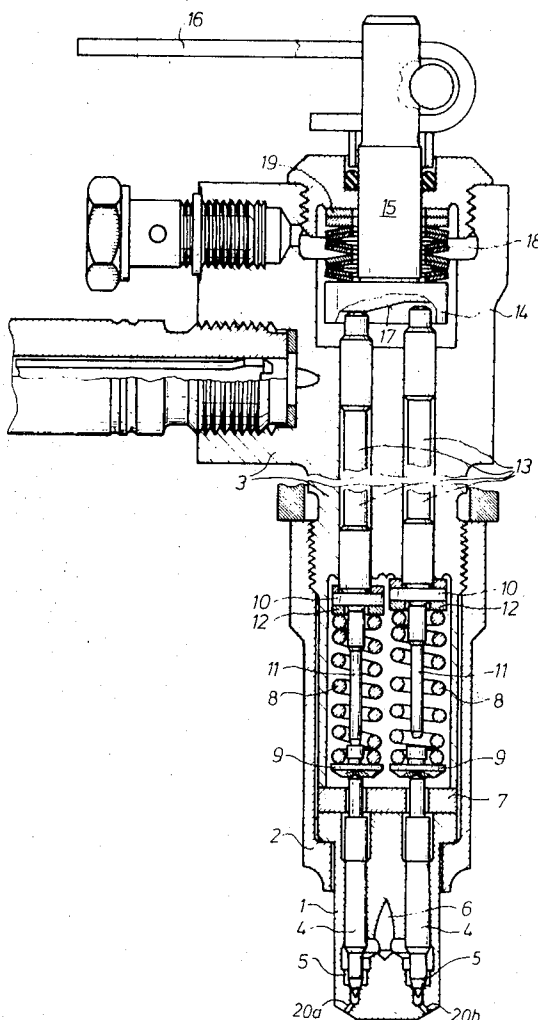
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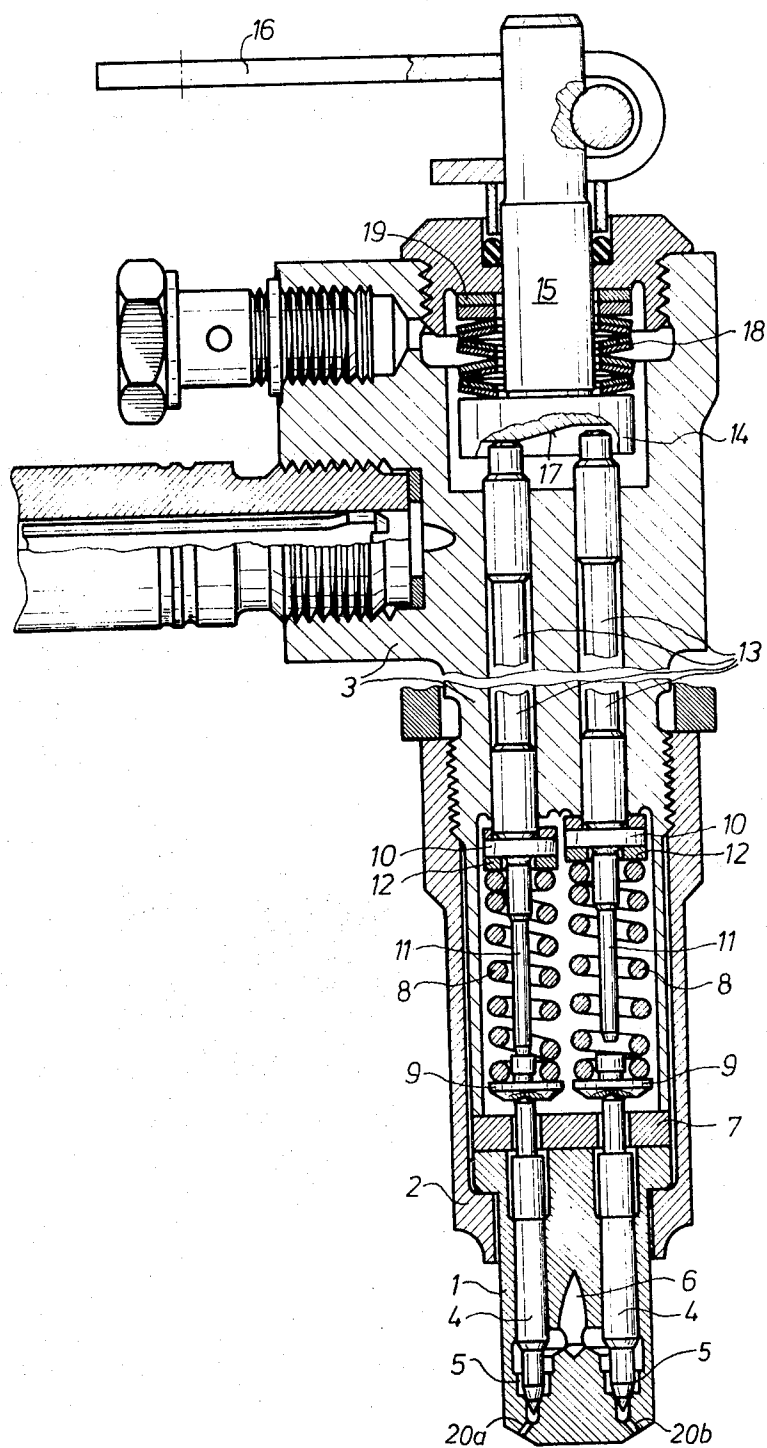
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[57] **ABSTRACT**

There is described a fuel injection nozzle unit having two valve needles each controlling a separate nozzle opening and each having a stroke that is limited by an associated abutment. The abutments are simultaneously adjustable from the outside of the nozzle unit whereby one or the other valve needle may be rigidly locked in its closed position.

5 Claims, 1 Drawing Figure





FUEL INJECTION NOZZLE UNIT FOR INTERNAL COMBUSTION ENGINES

BACKGROUND OF THE INVENTION

This invention relates to a fuel injection nozzle unit for internal combustion engines and is of the type that comprises two valve needles disposed in a single nozzle body and limited in their motion by abutments. With each valve needle there is associated a separate, independent pressure chamber supplied with fuel through a common feed conduit.

In diesel engines in which the combustion is effected by the Meurer process, the fuel is injected against the wall of the spherical combustion chamber. If the engine is hot, there occurs a partial vaporization of the fuel, but if the engine is cold and particularly when, in addition, it idles, the wall temperature is insufficient to bring about a vaporization and, accordingly, a complete combustion of the fuel. The result is an increased concentration of uncombusted poisonous components in the exhaust gas (blue smoke).

SUMMARY OF THE INVENTION

The invention seeks to develop a fuel injection nozzle which may find particularly advantageous use in engines operating according to the Meurer process and with which the fuel during warm-up run of the engine is not directed against the cold cylinder wall, but rather, it is injected towards the center of the spherical combustion chamber in which a favorable fuel-air mixture buildup is effected by virtue of the prevailing air swirl. It is a desideratum, however, that the nozzle should also be adapted for use in engines in which, because of the large differences in the injected fuel quantities for the different operational conditions (turbo charged engines), a conventional nozzle does not provide for an optimal jet preparation.

In a known fuel injection nozzle as disclosed, for example, in German Pat. No. 1,252,968, a non-projecting pin is used which has a groove that extends at an inclined angle with respect to the axis of the nozzle bore. The groove serves as an injection opening of constant cross section. The valve needle is rotatable together with the aforementioned inclined groove and thus the direction of injection may be changed. Such a structure is relatively complex and there is a danger of charring between the pin and the nozzle bore. Further, because of the constant flow passage section of the groove, an optimal matching with the combustion requirements is not possible. In another known fuel injection nozzle, such as disclosed in German Pat. No. 1,042,964, by means of different opening pressures of the needles and different flow passage sections of the nozzle openings, fuel quantities injected during the same cycle are divided into an advance and a main quantity. Although in this manner it is feasible to change as a function of load the ratio between the small and the large fuel quantities, it is, however, not possible to change this ratio in a temperature-dependent manner.

Briefly stated, according to the invention the aforementioned abutments which limit the stroke of the valve needles are adjustable interdependently of one another in such a manner that during operation one or the other valve needle may be blocked in its closed position. The adjustment of the abutments may be effected by hydraulic, electric, pneumatic or any other means and may be performed simultaneously for all nozzles in the

engine. In this manner not only a load-dependent but also a temperature-dependent change in the direction of injection may be achieved.

BRIEF DESCRIPTION OF THE DRAWING

The invention will be better understood, as well as further objects and advantages will become more apparent, from the ensuing detailed specification of an exemplary embodiment taken in conjunction with the sole FIGURE which illustrates an axial view partly in cross section of a preferred embodiment according to the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

A nozzle body 1 is clamped to a nozzle holder 3 by means of a sleeve nut 2. In the nozzle body 1 there are disposed two valve needles 4, the associated pressure chambers 5 of which are supplied with fuel by a common feed channel 6. Between the nozzle body 1 and the nozzle holder 3 there is disposed an intermediate disc 7 which determines the maximum possible stroke of the valve needles 4. The latter are biased by closing springs 8 with the interposition of spring seat discs 9. The spring characteristics and the opening pressures may be different in one and the same nozzle unit if required by operational conditions. At their ends remote from the valve needles, the springs 8 engage spring seat discs 10 which in the direction of the associated valve needle 4 have pin-like extensions 11 determining the maximum spring compression. Between each spring 8 and its associated spring seat disc 10 there is provided a washer 12 which, dependent upon its thickness, determines the spring bias and thus the opening pressure. Each spring seat disc 10 is axially displaceable by a separate rod 13 which, at its other end, engages a sole cam disc 14 which, in turn, is rotatable by means of a shaft 15 and a lever 16. The cam face 17 of the disc 14 is designed in such a manner that in one or the other extreme position of the cam disc 4, one or the other valve needle 4 is lockingly pressed against its valve seat and thus the admitted fuel is capable of displacing only the other valve needle against the force of the spring 8. The rigid locking connection between the cam disc 14, the rod 13, the spring seat disc 10, the pin extension 11, the spring seat disc 9 and the valve needle 4 is effected by several sets of spring washers 18. By replacing the flat washers 19, the force serving for the rigid lock may be changed. By means of the spring washers 18 the manufacturing tolerances between the moving components are compensated.

The nozzle unit is mounted in such a manner in the combustion chamber that one nozzle opening, for example, that designated with 20a, is oriented towards the chamber wall, while the other nozzle opening, designated with 20b, is directed towards the center of the combustion chamber.

The lever 16 may be connected with a mechanism (not shown) that senses the temperature of the cylinder wall of the engine and accordingly, causes the lever 16 to shift. It thus will be apparent that the temperature responsive mechanism may be set in such a manner that below a certain predetermined wall temperature the lever 16 will be in one extreme position (shown in the figure) in which fuel injection may take place only through the nozzle opening 20b oriented towards the center of the combustion chamber, because the valve

needle 4 associated with the nozzle opening 20a is now rigidly locked; further, above a certain predetermined chamber wall temperature, the lever 16 will be in another extreme position in which fuel injection may take place only through the nozzle opening 20a oriented towards the chamber wall, since now it is the valve needle 4 associated with the nozzle opening 20b which is rigidly locked.

By the term "rigid lock" there is meant the exertion of such a total closing force by springs 18 and 8 on one or the other valve needle that the valve lifting force of the fuel pressure in the associated pressure chamber 5 is not capable of causing an upward movement (opening) of the valve needle.

That which is claimed is:

1. In a fuel injection nozzle unit of the known type that has (a) a nozzle body, (b) two valve needles reciprocally disposed in said nozzle body, (c) a valve seat associated with each valve needle, (d) resilient means associated with each valve needle to urge the latter against its valve seat, (e) an abutment means associated with each valve needle for determining the limit of the stroke thereof, (f) a separate pressure chamber associated with each valve needle and (g) a common feed conduit means for supplying fuel to said pressure chambers, the improvement comprising means for interdependently adjusting said abutments externally of said nozzle unit for affecting the stroke of each valve needle.

2. An improvement as defined in claim 1, wherein said abutment means includes a cam disc rotatably disposed in said nozzle unit, said cam disc having a cam face oriented towards said valve needles and cooperating therewith for affecting the length of their stroke.

3. An improvement as defined in claim 2, wherein between each valve needle and said cam disc there is disposed a rod cooperating with and displaceable by said cam face.

4. An improvement as defined in claim 1, including

A. a spring associated with each valve needle and constituting said resilient means, each spring having a first end and a second end,

B. a first spring seat affixed to each valve needle and receiving said first end of the associated spring,

C. a second spring seat associated with each first spring seat and receiving said second end of the associated spring, each second spring seat being movable towards and away from its associated first spring seat and having a rigid component oriented towards its associated valve needle, the free space between said rigid component and said valve needle being equal to the stroke thereof,

D. a sole cam member movably disposed in said nozzle unit and at least indirectly connected to each said second spring seat for simultaneously varying said distance upon movement of said cam member and

E. means connected to said cam member and extending at least in part externally of said nozzle unit for moving said cam member by exerting an external force on said last-named means.

5. An improvement as defined in claim 1, including

A. a sole cam member movably disposed in said nozzle unit,

B. rigid means associated with said cam member and with each valve needle and movable individually into contact therewith upon the camming action of said cam member and

C. spring means urging said cam member and said rigid means towards the valve needles, the force of said last-named spring means being so designed that the total force exerted on a valve needle when said rigid means is in contact therewith is greater than the lifting force exerted on the last-named valve needle by the fuel pressure in the associated pressure chamber.

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