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[54] **FUEL INJECTION NOZZLES**

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[51] **Int. Cl.** **B05b 1/30**

[58] **Field of Search** 239/533, 90, 96

[56] **References Cited**

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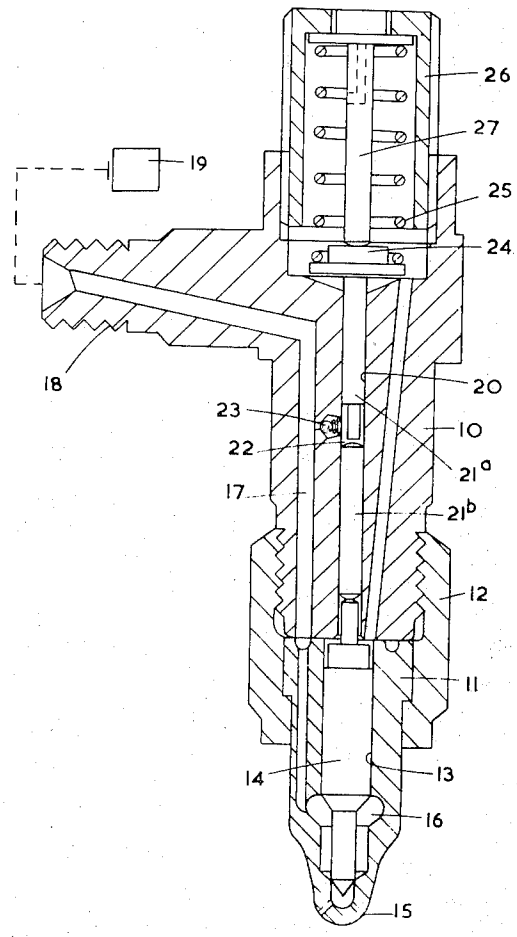
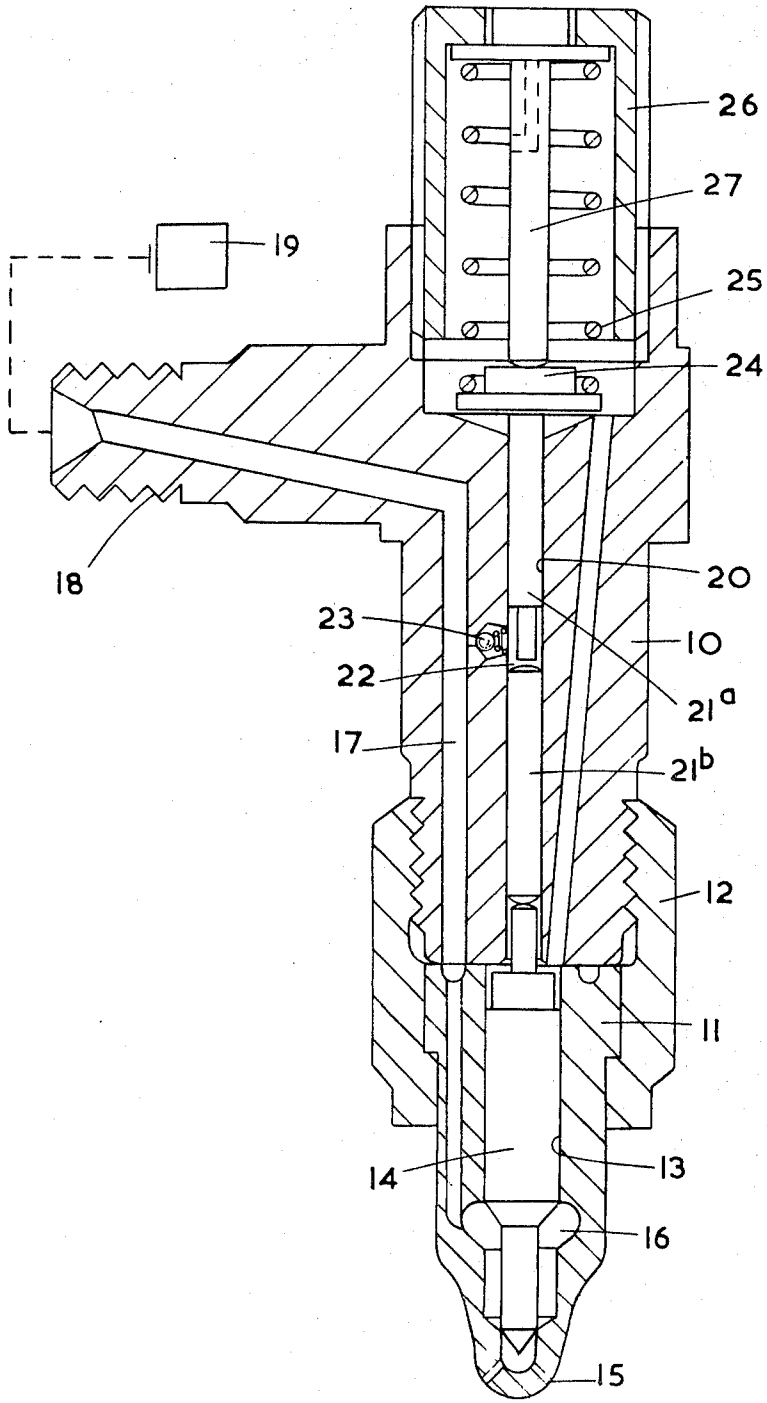
[57] **ABSTRACT**

A liquid fuel injection nozzle unit for an internal combustion engine includes a valve member movable towards a seating to prevent fuel flow through an outlet from an inlet the valve member is engaged by a push rod which is subjected to the fluid pressure in the inlet by way of a non-return valve, the area of the push rod exposed to the fluid pressure being less than that of the valve member which is exposed to the fluid pressure whereby the valve member will be lifted from its seating to allow flow through said outlet.

2 Claims, 1 Drawing Figure

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FUEL INJECTION NOZZLES

This invention relates to fuel injection nozzles for use with compression ignition engines, the nozzles being of the kind comprising a nozzle body having a nozzle head at one end thereof, a valve member slidable within the head and movable under the action of fuel under pressure away from a seating to allow flow of fuel from an inlet through an outlet, and a spring for effecting movement of the valve member into contact with the seating.

The object of the invention is to provide such a nozzle in a simple and convenient form.

According to the invention in a nozzle of the kind specified the valve member or an elongated member acting intermediate the valve member and the spring, is divided to define a space to which fuel under pressure can be supplied from said inlet by way of a non-return valve, the arrangement being such that when the pressure of fuel supplied to the inlet is low the nozzle operates in the conventional manner, the spring being operative to close the valve member onto the seating but as the pressure of fuel increases a point is reached at which the pressure within the space compresses the spring its maximum extent where after the valve member is closed onto the seating by the action of pressure of fuel within the space.

An example of a fuel injection nozzle in accordance with the invention will now be described with reference to the accompanying drawing which shows a sectional side elevation of the nozzle. Referring to the drawing, there is provided a nozzle body **10** which at one end mounts a nozzel head **11**, the head being retained relative to the body by means of a retaining member **12** which is in screw-thread engagement with the body.

Formed in the nozzle head **11** is a bore **13** in which is slidably mounted a valve member **14.** The end of the bore defines a seating for the valve member **14** and when the valve member is moved away from the seating, fuel can flow from the bore through an outlet **15** into a combustion space of an associated engine. The bore is enlarged to provide an annular chamber **16** and this communicates by way of a passage **17** continuing through the body **10,** with an inlet **18.** The inlet is connected to a pump **19** which is driven in timed relationship with the associated engine.

Extending within the body **10** is a drilling **20** having a diameter smaller than that of the bore **13** and located within the drilling is a divided elongated push member **21***a*, **21***b*. The end of the portion **21***a* of the push member is of reduced diameter and the adjacent end of the other portion of the push member is of spherical form. There is thus defined with the wall of the drilling **20** an annular space **22** to which fuel under pressure may be supplied from the inlet **18** by way of a spring-loaded non-return valve **23.**

The upper portion **21***a* of the push member mounts an abutment **24** for a coiled compression spring **25.** The compression spring is located within a cap member **26** which is in screw-thread engagement with the body. Extending within the spring is a stop member **27** which can co-operate with the spring abutment **24** to limit the extent by which the spring can be compressed. The chamber containing the spring communicates with either the atmosphere or a source of fuel at a low pressure by way of a drilling formed in the stop member **27,** and also communicating with the space containing the spring is the end of the bore **13** remote from the outlet **15.**

In operation, when the pump is at rest the two portions of the push member will be in abutment with each other and the valve member **14** will be retained upon its seating by the action of the spring **25.** When fuel is supplied to the inlet as for instance when the engine is being started fuel under pressure will be supplied to the aforesaid space **22** but the force acting to separate the two portions of the push member created by this pressure, will be insufficient to overcome the force exerted by the spring. As a result, the nozzle will operate in the conventional manner and the valve member will be returned to its seating when the flow of fuel ceases, by the action of the spring **25.**

As the pressure of fuel delivered by the pump **19** increases a point will be reached at which the force developed by the pressure of fuel within the space **22** is sufficient to separate the two portions of the push member so that the spring abutment **24** is moved into contact with the stop **27.** When this occurs the spring plays no further part in the operation of the nozzle and the movement of the valve member **14** onto its seating at the end of the injection period is achieved by the pressure of fuel within the space **22.** It will be appreciated that the pressure of fuel applied to the valve member **14** to lift it from its seating will be substantially equal to the pressure of fuel within the aforesaid space. However, the area of the lower portion **21***b* of the push rod which is exposed to the pressure in the space is substantially smaller than the area of the valve member which is exposed to the same pressure. As a result of this when fuel under pressure is supplied to the inlet **18** the valve member **14** will move in the direction away from its seating to permit flow of fuel through the outlet **15.**

The volume of the space **22** must be sufficient to prevent an excessive rise in pressure when the portion **21***b* of the push member is moved by the action of valve member **14** and small enough to allow the pressure in space **22** to drop owing to leakage when the engine speed is lowered. The action of the one way valve **23** is to trap fuel in the space **22** at the peak pressure occuring during the delivery of fuel by the pump.

The nozzle described possesses the important feature that the nozzle opening pressure is a function of the peak inlet pressure as also is the closing pressure when the abutment is in contact with the stop, and this has the effect of increasing the effective rate of injection of fuel at high speeds.

Furthermore, once the spring has ceased to operate then the moving mass of the construction is less than that of a conventional injector.

By careful choice of the spring load and the diameter of the push member the pressure at which the effect of the spring becomes zero can be predetermined.

In the particular example, it is to be noted that a push member is interposed between the valve member and the spring. However, in some instances the push member is dispensed with and the valve member is made of increased length. In this instance the valve member itself would be divided to define the aforementioned space, it being appreicated that it would be necessary to provide a step on the valve member to produce the differential force required to effect opening of the valve member.

I claim:

1. A fuel injection nozzle for use with compression ignition engines, the nozzle comprising a nozzle body having a nozzle head at one end thereof, an inlet in the body, a valve member slidable within the head; a seating defined in the head, a spring for effecting movement of the valve member onto the seating, the valve member being lifted from the seating by fuel under pressure supplied to the inlet and acting on the end of the valve member adjacent the seating, connection means disposed intermediate the valve member and spring, said connection means being divided to define a space, passage means through which fuel under pressure can be supplied from said inlet to said space, a non-return valve disposed in said passage means, the arrangement being such that when the pressure of fuel

supplied to the inlet is low the nozzle operates in the conventional manner with the spring being operative to close the valve member onto the seating but as the pressure of fuel increases a point is reached at which the pressure within the space compresses the spring its maximum extent whereafter the valve member is closed onto the seating by the action of the pressure of fuel within the space, the area of the connection means subjected to the pressure of fuel at the inlet being less than area of the valve member subjected to said pressure.

2. A nozzle as claimed in claim 1 including means limiting the deflection of said spring.

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