

[54] FUEL INJECTION NOZZLES

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239/96, 533, 584

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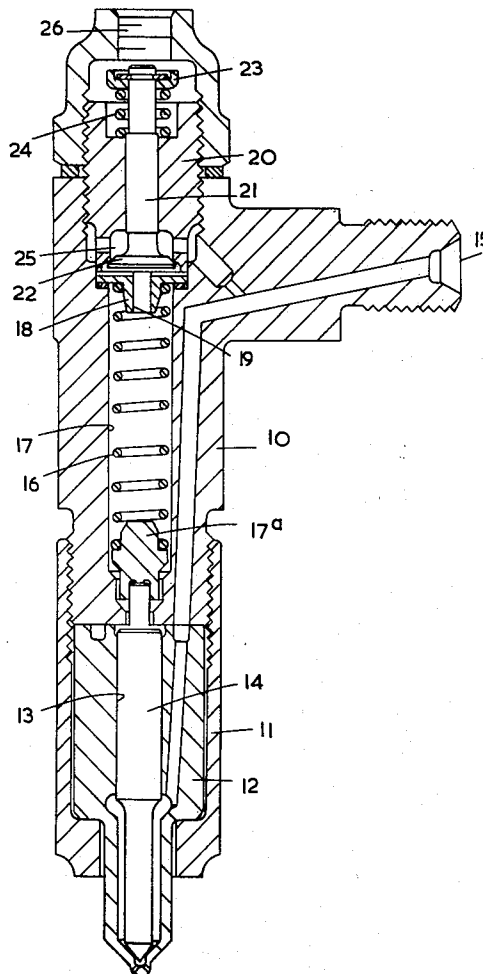
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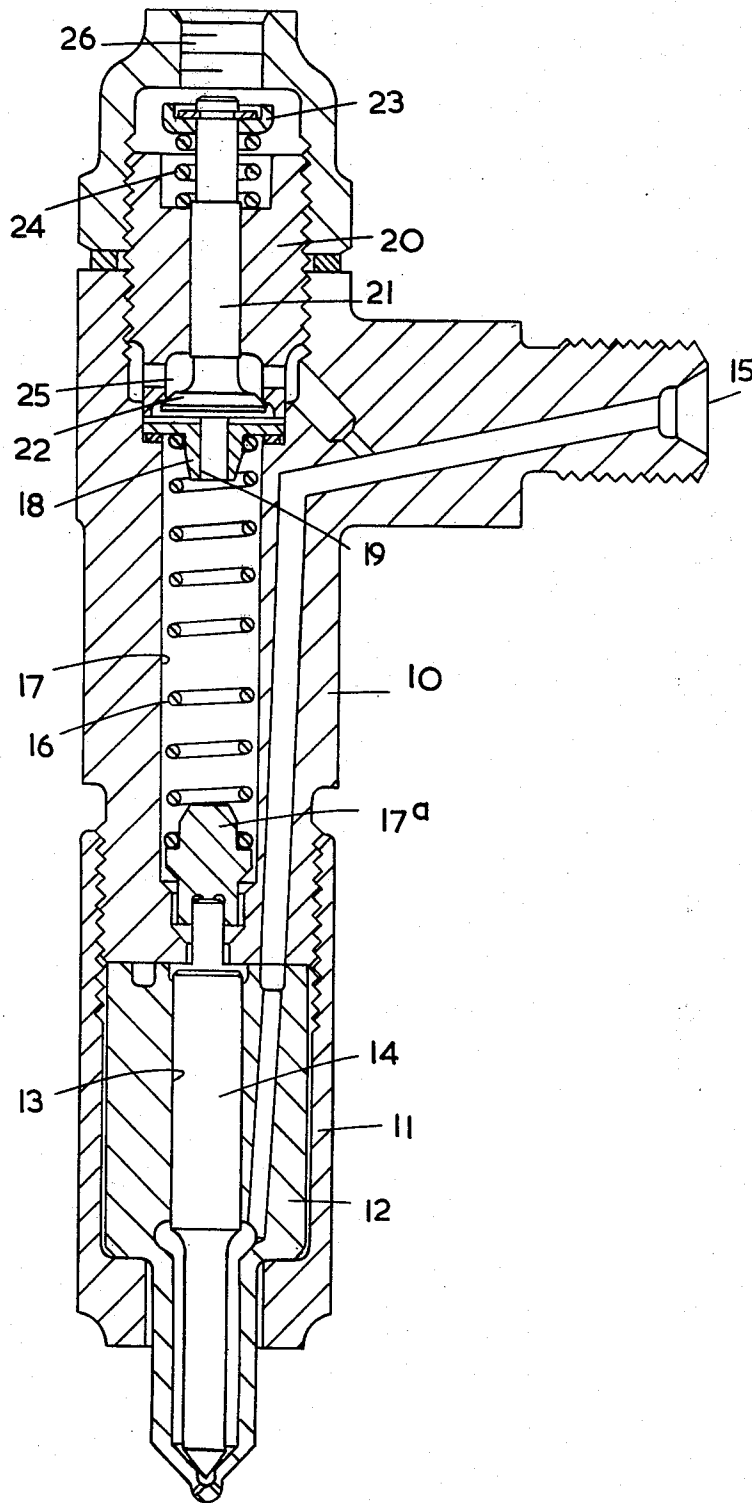
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ABSTRACT

A fuel injection nozzle comprises a valve member which co-operates with the seating to control the flow of fuel through an orifice from an inlet. Resilient means is provided to urge the valve member into contact with the seating, and a non-return valve is provided so that fuel from the inlet can be applied to a surface of the valve member to assist the resilient means in maintaining the valve member in contact with the seating. The pressure which is applied to the valve member by way of the valve is controlled by the valve so that it is a proportion of the pressure at the inlet.

10 Claims, 1 Drawing Figure





FUEL INJECTION NOZZLES

This invention relates to fuel injection nozzles of the kind comprising a valve member which co-operates with a seating to control the flow of fuel through an orifice from an inlet, resilient means acting on the valve member to urge it into contact with the seating, said valve member having a surface against which fuel under pressure from the inlet acts to lift the valve member from the seating against the action of the resilient means and thereby to permit flow of fuel through said orifice from the inlet.

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

According to the invention a fuel injection nozzle of the kind specified is characterised by the provision of a non-return valve through which fuel from said inlet can pass to act on a further surface on said valve member, the force developed on said valve member as a result of the fuel under pressure acting on said member, acting to assist the action of said resilient means, said non return valve acting to regulate the pressure acting on said further surface.

One 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 to which is secured by means of a cap nut 11, a nozzle head 12. Formed in the nozzle head is a bore 13 and slidable within the bore is an injection valve member 14 of stepped form.

The narrower portion of the valve member is shaped to co-operate with a seating defined at the end of the bore 13 and downstream of the seating the bore communicates with a drilling or drillings which constitute orifices through which liquid fuel in use, flows to a combustion chamber of an associated engine. In view of the fact that the valve member is of stepped form, a pressure actuated surface is defined against which liquid fuel under pressure from an inlet 15 can act to lift the valve member away from the seating.

The movement of the valve member away from the seating is opposed by the action of a coiled compression spring 16 one end of which is mounted on an abutment 17a positioned on an extension of the valve member 14. The spring 16 is accommodated within an axially extending chamber 17 formed in the nozzle body. The other end of the spring 16 is engaged about a spring abutment 18 in which is formed a central drilling 19. Moreover, the abutment 18 is maintained in position against a step defined in the wall of the bore 17 by means of a valve housing 20 which is in screw thread engagement with the nozzle body 10.

The valve housing 20 has an axially extending bore which provides support for the stem 21 of a pressure-reducing non-return valve, the valve stem at its end nearer the valve member 14, mounting a head 22 and at its other end, a spring abutment 23 between which and an adjacent surface on the housing 20, is interposed a coiled compression spring 24.

The valve housing 20 beneath the valve head 22 defines a recess 25 which communicates with the fuel inlet 15. Moreover, the valve head 22 co-operates with a seating defined about the recess and it is urged into contact with this seating by means of the spring 24.

In use, ignoring for the moment the action of the non-return valve, fuel under pressure flowing to the inlet 15 will act upon the aforesaid surface of the valve member 14 and will lift it against the action of the spring 16 to permit flow of fuel through the aforesaid orifices into the combustion chamber of the engine.

The non-return valve, when subjected to the pressure of fuel delivered to the inlet 15, lifts against the action of its spring 24 to allow fuel under pressure to flow into the bore 17. As a result of this, the fuel under pressure within the bore 17 acts on the end surface of the valve member 14 to assist the action of the spring 16 in urging the valve member 14 into contact with its seating. It will be understood that the force developed by the pressure of fuel acting on the end surface of the valve member 14, together with the force developed by the spring 16 must not exceed the force exerted on the valve member 14 in the direction to lift the valve member 14 from its seating. The difference in the peak pressure supplied to the inlet 15 and the pressure within that portion of the bore 17 which contains the spring 16, depends upon the design of the non-return valve, and particularly the dimensions of the head 22, and the valve stem 21. It will be noted that the end of the valve stem 21 remote from the head is exposed to a drain 26, and therefore the ratio of the peak injection pressure to the pressure within the bore 17 depends upon the effective area of the valve head exposed to the pressure within the bore 17 and the area of the underside of the valve head which is exposed to the peak injection pressure. The non-return valve acts to regulate the pressure in the bore 17.

In a modification not shown, the spring 24 is omitted together with the abutment 18. In this case, the valve head 22 is shaped to define an abutment for the spring 16.

In the example shown, together with the modification described in the preceding paragraph, the volume of the bore 17 accommodating the spring 16 must be carefully chosen so that the displacement of the valve member 14 into the bore as it lifts from its seating, does not result in any substantial increase in the pressure within the bore 17.

I claim:

1. In a fuel injection nozzle including a body having a fuel inlet and an outlet, an injection valve element movable in the body to control flow through the outlet, spring means biasing said valve element toward a closed position with respect to said outlet, said valve element having a pressure-actuating surface portion facing the outlet and exposed to inlet pressure whereby inlet pressure is effective to counter the closing effect of said spring means, and means including a pressure-reducing valve responsive to inlet pressure and acting on the injection valve element in a closing direction to augment the closing bias of the spring means.

2. A nozzle as claimed in claim 1 in which said pressure-reducing valve has an outlet communicating with a further surface to urge said injection valve element in a closing direction and whereby the pressure acting on said further surface is a proportion of the pressure at said inlet.

3. A nozzle as claimed in claim 2 in which said pressure-reducing valve includes a head and a stem connected to the head, the end of said stem remote from the head being exposed to a low pressure, said head being shaped for co-operation with a seating, the face

of said head remote from the stem being subjected to the pressure acting on said further surface and acting to close the head onto the seating, and the opposite face of the head being subjected to the pressure of fuel at said inlet.

4. A nozzle as claimed in claim 3 including further resilient means acting to urge said head into contact with the seating.

5. A nozzle as defined in claim 2 wherein the injection valve element and the pressure-reducing valve are manually slidable in the body, the body having a chamber between said injection valve element and pressure-reducing valve, the outlet of the pressure-reducing valve communicating with said chamber.

6. A nozzle as defined in claim 2 wherein the injection valve element and the pressure-reducing valve are manually slidable in the body, the body having a chamber between said injection valve element and pressure-reducing valve, the outlet of the pressure-reducing valve communicating with said chamber, and said spring means comprising a compression spring located in said chamber between said valves.

7. A nozzle as defined in claim 2 wherein the injection valve element and the pressure-reducing valve are manually slidable in the body, the body having a chamber between said injection valve element and pressure-reducing valve, the outlet of the pressure-reducing

valve communicating with said chamber, said spring means comprising a compression spring located in said chamber between said valves, said spring means reacting against the injection element in a closing direction outwardly with respect to the body, the pressure-reducing valve being closable by movement in the opposite direction.

8. A nozzle as defined in claim 2 wherein the injection valve element and the pressure-reducing valve are manually slidable in the body, the body having a chamber between said injection valve element and pressure-reducing valve, the outlet of the pressure-reducing valve communicating with said chamber, said spring means comprising a compression spring located in said chamber between said valves, said spring means reacting against the injection element in a closing direction outwardly with respect to the body, the pressure-reducing valve being closable by movement in the opposite direction, inlet pressure being directed against pressure-reducing valve in an opening direction which tends to move it inwardly with respect to the chamber.

9. A nozzle as defined in claim 6 including additional spring means reacting against said pressure-reducing valve in a closing direction.

10. A nozzle as defined in claim 8 wherein said spring means reacts oppositely against both valves.

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