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(54) Fuel Injection Nozzles

(57) A fuel injection nozzle tip 13 has a reduced end portion 16 of a bore which carries a fuel pressure actuated valve member. Where a symmetrical spray pattern is required but where it is not possible to mount the nozzle so that the axis 26 of the bore coincides with the cylinder or combustion chamber axis, the orifices 27,28 can be drilled at the required angle but the contour at the points of exit from the bore 16 would not be the same. This is overcome by making at least one orifice 29 in the form of a curved drilling so that the contour at each exit from the bore 16 is the same.

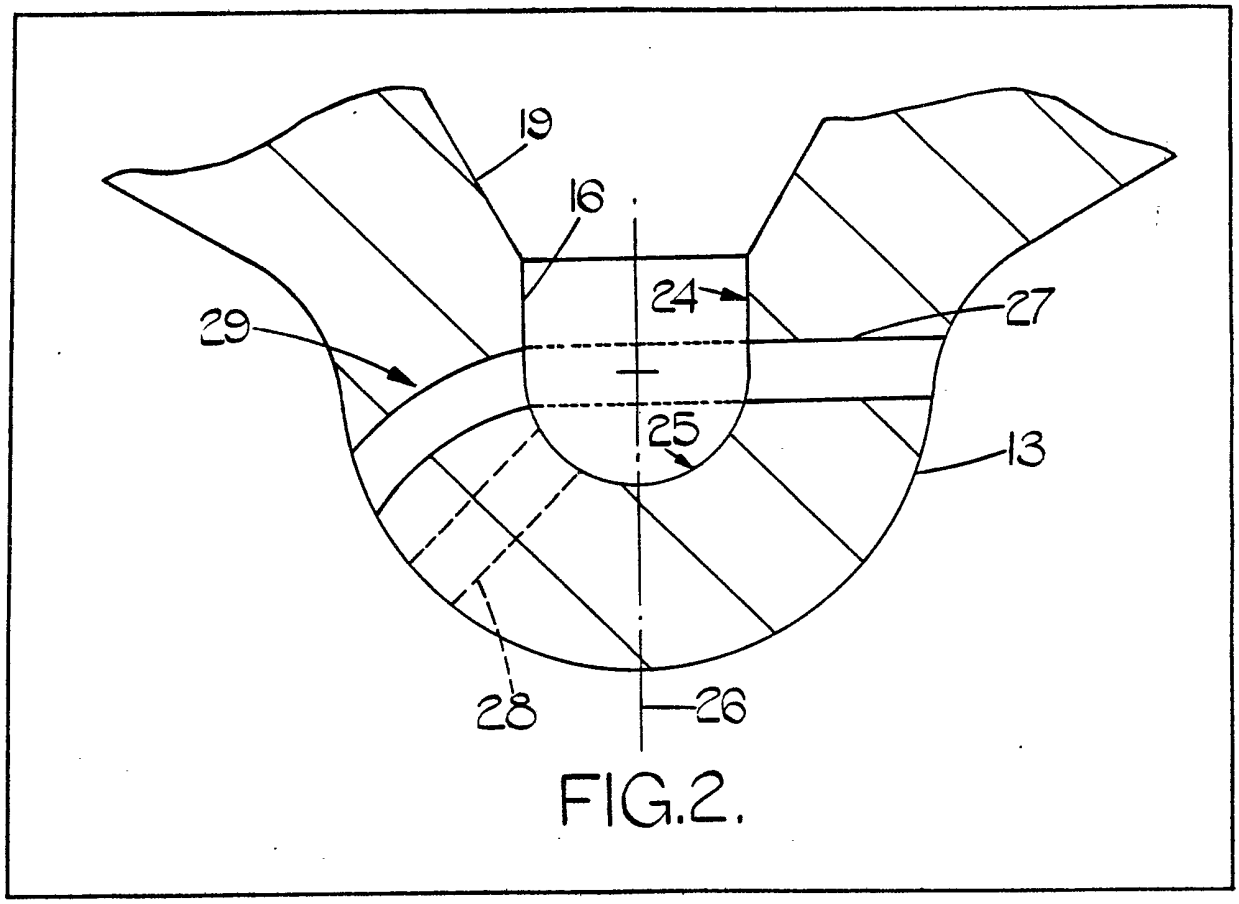


FIG.2.

GB 2 058 905 A

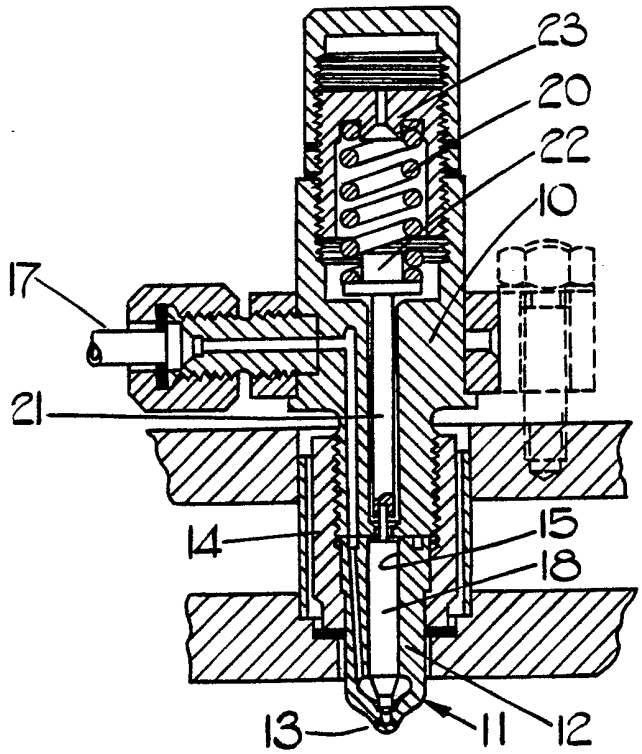


FIG.1.

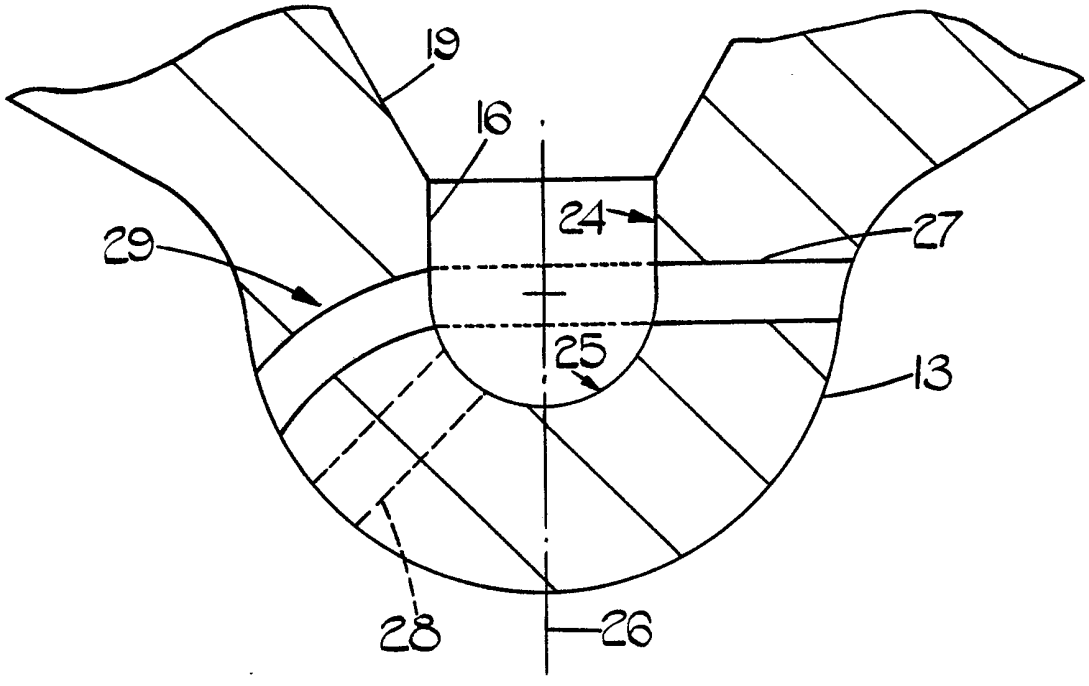


FIG.2.

SPECIFICATION

Fuel Injection Nozzles

This invention relates to fuel injection nozzles of the kind comprising a nozzle body of generally cylindrical form and having a tip at one end thereof, a bore extending into the body from the other end thereof, a reduced portion of said bore extending into said tip, a seating defined in said bore, a valve member slidable in said bore and shaped for co-operation with said seating, a fuel supply passage in said body, a surface on said valve member and against which in use fuel under pressure supplied through said passage can flow to act on said surface to lift the valve member from the seating thereby to permit fuel to flow into the reduced portion of said bore and outlet orifices extending from said reduced portion of the bore to the surface of said tip.

Such nozzles are well known in the art and where possible, the nozzle is mounted in the cylinder head of an engine so that the longitudinal axis of the bore coincides with the longitudinal axis of the cylinder or combustion chamber of the engine. As a result the outlet orifices can be symmetrically disposed about the longitudinal axis to provide a symmetrical spray pattern in the cylinder or combustion space. In some engines however the nozzle cannot be mounted in the manner indicated and in order to obtain a spray pattern which is symmetrical the positions of the outlet orifices have to be altered such that they are no longer symmetrically disposed about the longitudinal axis of the bore of the nozzle.

The reduced portion of the bore in the aforesaid tip, since it is formed by a twist drill or the like, is generally of right cylindrical form leading into a generally spherical end portion. In the case where the outlet orifices are symmetrically disposed about the longitudinal axis the contour of the reduced portion of the bore at the points of exit of the outlets from the reduced portion of the bore, will be substantially the same.

Since the outlet orifices are usually formed as straight drillings, then if the outer ends of the outlet orifices are not symmetrical, the points of exit of the outlet orifices from the reduced portion of the bore will not be symmetrical and the contour at the points of exit can be different. If the contour is different then it is found that the flow of fuel through the outlet orifices will not be the same and as a result the spray pattern will not be symmetrical.

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

According to the invention in a nozzle of the kind specified the outer ends of the outlet orifices are not symmetrically disposed about the longitudinal axis of the bore and one or more of said outlet orifices is formed as a curved drilling whereby the contour of the reduced portion of the bore at the points of exit of the outlet orifices from the reduced portion of the bore can be arranged to be substantially the same.

One example of a nozzle in accordance with the invention will now be described with reference to the accompanying drawings in which:—

Figure 1 is a cross-sectional side elevation of a known form of injector incorporating a fuel injection nozzle, and

Figure 2 is a section to a much enlarged scale of a portion of a nozzle.

Referring to Figure 1 of the drawings the injector comprises a generally cylindrical body portion 10 an end portion of which is of reduced diameter and is provided with a peripheral screw thread. In contact with the end of the body portion is a nozzle generally indicated at 11 and which includes a body portion 12 having a nozzle tip 13 at one end thereof. The other end of the nozzle body is carefully machined to form a fluid tight seal with the reduced portion of the body 10 and it is held in engagement with the body by means of a cap nut 14.

Formed in the nozzle body is a cylindrical bore 15 having a reduced portion 16 (Figure 2) extending into the nozzle tip. Moreover, adjacent the tip the bore defines an enlargement which communicates by way of a passage formed in the nozzle body and a further passage communicating therewith and which is formed in the body 10, with a fuel inlet 17 connected in use, to the outlet of a fuel injection pump.

Slidable within the bore 15 is a valve member 18 and this is provided with a shaped end portion which co-operates with a seating 19 (Figure 2) which is formed in the bore. Moreover, extending from the reduced portion 16 of the bore are outlet orifices which will be discussed in greater detail below.

The valve member 18 is biassed into contact with the seating by means of a coiled compression spring 20, the force exerted by which is transmitted to the valve member 18 by means of a push rod 21 which mounts a spring abutment 22 engaging with one end of the spring. The other end of the spring engages the base wall of a cup shaped member 23 which is retained relative to the body part 10.

In operation, when fuel under pressure is supplied through the inlet 17, the fuel pressure acts on the valve member 18 to urge the valve member away from its seating against the action of the spring 20. The flow of fuel can then take place to the engine by way of the aforesaid orifices.

As will be seen from Figure 2 the reduced portion of the bore 16 which is formed by means of a twist drill, comprises a generally right cylindrical portion 24 which terminates in a generally spherical portion 25. In Figure 2 the longitudinal axis of the bore is indicated at 26.

As previously explained every attempt is made in the design of an engine to ensure that the longitudinal axis 26 is coincident with the longitudinal axis of the cylinder or combustion chamber of the associated engine. In this case the

outlet orifices which are usually formed as straight drillings, will be symmetrically disposed about the longitudinal axis 26. In some instances however the designer of the engine, in order to try to save space or for some other consideration, specifies that the longitudinal axis 26 should not be coincident with the longitudinal axis of the cylinder or the combustion chamber but nevertheless requires a symmetrical spray pattern in the cylinder or combustion chamber. In such a case the outlet orifices one of which is indicated at 27, and the other of which is indicated at 28, are not symmetrically disposed about the longitudinal axis 26. The outer ends of the passages 27, 28 will however be symmetrically disposed about the longitudinal axis of the cylinder or combustion chamber. In theory therefore a symmetrical spray pattern should be produced but in practice the flow of fuel through the outlets 27 and 28 is not equal. This is because in the case of the outlet 28 its exit from the reduced portion of the bore is from the spherical portion 25 whilst in the case of the outlet 27 the exit is more or less from the right cylindrical portion 24.

In order to overcome this problem it is proposed that the contour at the points of exit of the outlets should be the same and therefore the outlet 28 is formed by means of a curved drilling indicated at 29. The exit of the drilling 29 from the reduced portion of the bore is aligned with the exit of the outlet 27 from the bore so that the contour of the bore at the exits is the same. In view of the curvature of the drilling 29 the drilling is arranged to terminate at a slightly different position on the surface of the tip 13 in order to achieve the same spray pattern.

In some nozzles it may be necessary to provide each of the outlets in a curved fashion. Conveniently the curved drillings are formed by electro-chemical machining processes.

Claims

1. A fuel injection nozzle comprising a nozzle body of generally cylindrical form and having a tip at one end thereof, a bore extending into the body from the other end thereof, a reduced portion of said bore extending into said tip, a seating defined in said bore, a valve member slidable in said bore and shaped for co-operation with said seating, a fuel supply passage in said body, a surface on said valve member and against which in use fuel under pressure supplied through said passage can flow to act on said surface to lift the valve member from the seating thereby to permit fuel to flow into the reduced portion of said bore, outlet orifices extending from said reduced end portion of the bore to the surface of said tip characterised in that the outer ends of said outlet orifices are not symmetrically disposed about the longitudinal axis of the bore and one or more of said outlet orifices is formed as a curved drilling whereby the contour of the reduced portion of the bore at the points of exit of the outlet orifices from the reduced portion of the bore can be arranged to be substantially the same.

2. A nozzle according to claim 1 in which the curved drilling is formed by an electro-chemical machining process.

3. A fuel injection nozzle comprising the combination and arrangement of parts substantially as hereinbefore described with reference to the accompanying drawings.

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