United States Patent

Messerschmidt

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[54] **SEALING MEANS FOR FUEL INJECTION VALVES**

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[51] **Int. Cl.**.....**F16k 31/12**

[58] **Field of Search**.....137/509; 251/214; 239/533; 123/188 R, 188 P, 188 S, 188 SC

[56] **References Cited**

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[57] **ABSTRACT**

In a fuel injection valve the valve needle is slidably held by a guide sleeve having a spherical head that cooperates with a spherical support in the valve body to permit a slight swiveling motion of the sleeve and thus a centering of the valve needle with respect to its valve seat. Below its spherical portion, the said head is also supported by an internal shoulder of the valve body with the interposition of a metallic ring and an axially and radially sealing packing ring.

5 Claims, 2 Drawing Figures

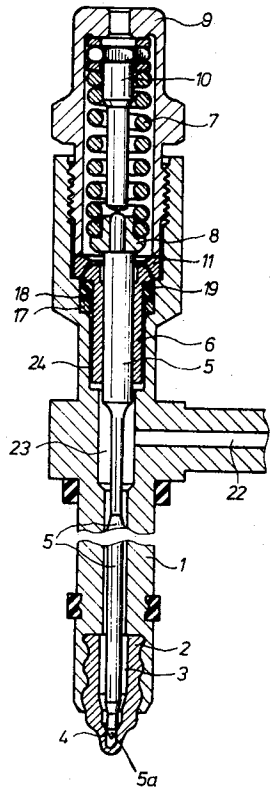

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Fig. 1

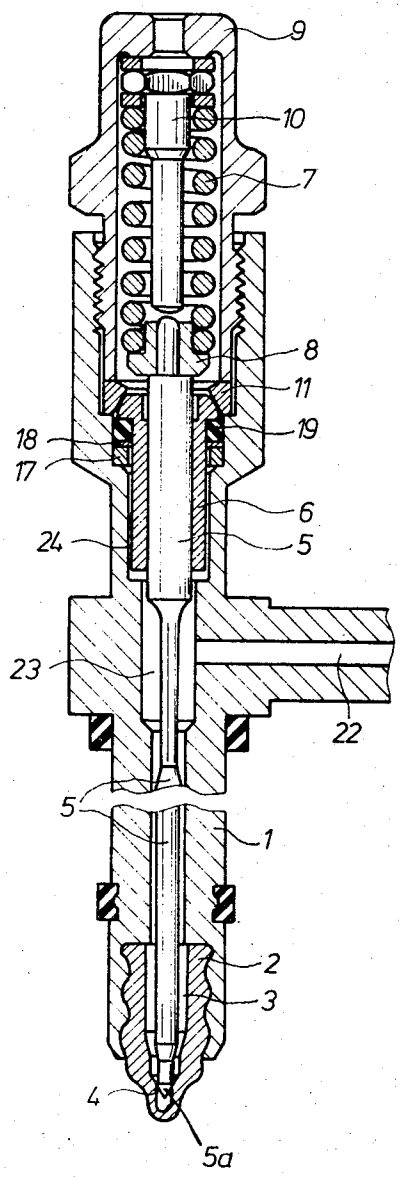

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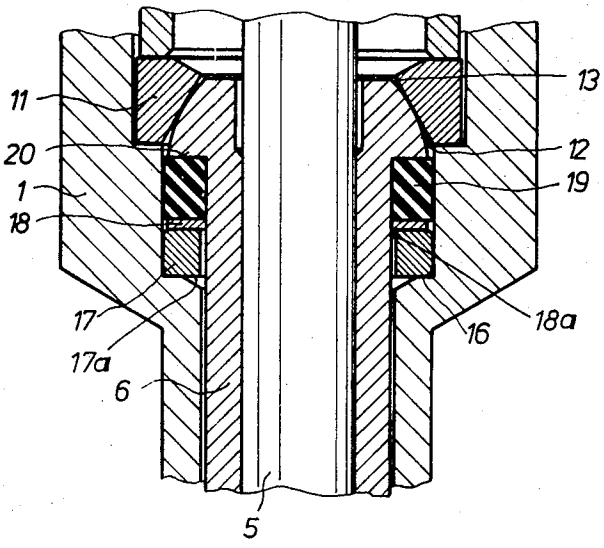
Fig.2



SEALING MEANS FOR FUEL INJECTION VALVES

This invention relates to a fuel injection valve and is of the type that has a guide sleeve positioned in a valve body and receiving, for a fluid tight reciprocation, a valve needle, one terminus of which cooperates with a valve seat. The guide sleeve is urged against a support shoulder in the valve body through an interposed elastic element which surrounds a cylindrical portion of the guide sleeve. The latter is further provided with a spherical head portion which permits a free motion of said valve terminus.

Fuel injection valves of the aforeoutlined structure (also disclosed in German Pat. No. 1,090,031) have the advantage that the valve needle, by virtue of the spherically supported, slightly swivelable guide sleeve, automatically centers itself with respect to the valve seat as the fuel injection valve closes. The area of engagement between the spherical head of the guide sleeve and a support face in the valve body serves simultaneously as a sealing means. It is a disadvantage of fuel injection valves of this type that the smallest soiling of the sealing face by foreign particles may adversely affect the sealing and thus the proper operation of the fuel injection nozzle. If, in order to avoid this disadvantage, the sealing face is designed small, that is, the area of engagement is very narrow, then high specific pressures appear which, although they improve the sealing, require a special handling of the supporting or bearing components.

It is an object of the invention to provide an improved fuel injection valve which, although it incorporates the advantageous centering spherical support for the valve needle guide, is void of the aforeoutlined difficulties with regard to the sealing.

Briefly stated, according to the invention, the aforementioned elastic element is constituted by a packing ring which seals radially as well as axially. Between the packing ring and a support shoulder of the guide sleeve or the valve body there is disposed a metallic ring which ensures a uniform deformation of the elastic ring, thus obtaining a sealing in both an axial and a radial direction.

The invention will be better understood, as well as further objects and advantages of the invention will become more apparent, from the ensuing detailed specification of a preferred, although exemplary, embodiment taken in conjunction with the drawing, wherein:

FIG. 1 is an axial sectional view of the entire fuel injection valve according to the preferred embodiment; and

FIG. 2 is an axial sectional view on an enlarged scale of some of the components shown in FIG. 1.

In an axially hollow valve body 1 of a bar-shaped fuel injection valve there is fixedly held a nozzle body 2 which contains a pressure chamber 3, a valve seat 4 and nozzle openings (not shown). Within the valve body 1 there is disposed an elongated valve needle 5 which is guided in a fluid-tight manner by a surrounding guide sleeve 6. The conical tip 5a of the valve needle 5 is continuously urged towards the valve seat 4 by a closing spring 7 with the inter-position of a spring seat disc 8. The spring 7 engages with its other end an inner face of a sleeve nut 9 which is threaded into the valve body 1 and which contains an abutment pin 10 for limiting the stroke of the valve needle 5.

The valve body 1 is tightened by means of the sleeve nut 9 to a washer 11, the inner conical face 12 of which is in engagement with a spherical outer portion 13 of the guide sleeve 6, as best shown in FIG. 2. In this manner the valve needle 5, during the closing movement, centers itself automatically as soon as the conical tip 5a of the valve needle 5 is in engagement with the conical seat 4 as best shown in FIG. 1.

Referring once again to FIG. 2, the valve body 1 is provided with a shoulder 16 which supports a metal ring 17. The latter is, along its entire outer cylindrical face, in a close contacting engagement with the valve body 1, while it has a small clearance with respect to the guide sleeve 6. The metal ring 17 is in contact with a second metal ring 18 which, conversely to the metal ring 17, is, with its inner face, in contact with the guide sleeve 6, while it has a radial clearance with respect to the nozzle body 1. The two metal rings 17, 18 exert a force on an elastic packing ring 19 which engages a shoulder 20 of the guide sleeve 6 and which is slightly compressed, thus sealing in both a radial and an axial direction. The second metal ring 18 in the first place, prevents portions of the elastic packing ring 19 from being forced into the annular gap between the metal ring 17 and the guide sleeve and, in the second place, ensures a low resistance to the swiveling motion of the guide sleeve 6 since, during such motion, the two metal rings 17, 18 radially slide on and with respect to one another.

The fuel forwarded under pressure to the fuel injection valve in pulses from a fuel injection pump through a pressure conduit (not shown) is admitted through a conduit 22 to an annular chamber 23 disposed between the valve needle 5 and the valve body 1 and therefrom to the pressure chamber 3. In addition, the pressurized fuel is admitted through an annular clearance 24 defined between the valve body 1 and the guide sleeve 6 to the exposed radial faces 17*a*, 18*a* of the metal rings 17 and 18, respectively. Thus, the pressurized fuel urges the metal rings 17, 18 against the packing ring 19 which, during each delivery thrust, is compressed and thus fully seals. At the moment of the delivery thrust the mobility of the guide sleeve 6 is somewhat impeded which, however, has no significance since its centering function is not needed during the opening movement of the valve needle 5 (which occurs in response to the delivery thrust). After the drop of pressure following the delivery thrust, by the time the conical tip 5*a* of the valve needle 5 reaches the valve seat 4 and has to be centered, the pressure of the fuel is removed from the sealing ring 19 and thus the guide sleeve 6 regains its mobility.

That which is claimed is:

1. In a fuel injection valve of the type that has (a) a hollow valve body, (b) a valve needle reciprocating in said valve body, (c) a valve seat cooperating with said valve needle, (d) an internal shoulder forming part of said valve body and (e) a guide sleeve positioned in said valve body for a fluid tight guiding of said valve needle; said guide sleeve has a spherical head portion to permit a centering of said valve needle with respect to said valve seat and a face of engagement cooperating with said internal shoulder for supporting said guide sleeve, the improvement comprising,

A. an elastic packing ring surrounding said guide sleeve and disposed between said internal shoulder of said valve body and said face of engagement of said guide sleeve; said packing ring having circumferential and radial sealing faces and

B. means for compressing said packing ring to effect a seal in both radial and axial directions.

2. An improvement as defined in claim 1, wherein said means for compressing said packing ring includes a metal ring disposed between said packing ring and said internal shoulder of said valve body.

3. An improvement as defined in claim 1, wherein said means for compressing said packing ring includes a metal ring disposed between said packing ring and said face of engagement of said guide sleeve.

4. An improvement as defined in claim 1, wherein said means for compressing said packing ring includes two metal rings having radial faces in contact with one another; one of said metal rings has a radial face in contact with a radial face of said packing ring; one of said metal rings has an outer face in circumferential contact with an inner wall of said valve body and an inner face radially spaced from said guide sleeve; the other of said metal rings has an outer face radially spaced from said inner wall of said valve body and an inner face in circumferential contact with said guide sleeve.

5. An improvement as defined in claim 1, wherein said means for compressing said packing ring includes a metal ring having a first face cooperating with said packing ring and a second, opposed face including an exposed portion; said improvement includes means for admitting fuel under pressure to said metal ring for exerting a force on said exposed portion to urge said metal ring against said packing ring.

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