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Roosa

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[54] **FUEL INJECTOR AND METHOD FOR MAKING SAME**

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[51] **Int. Cl.** **F02m 55/00**

[58] **Field of Search** 137/509; 239/533

[56] **References Cited**

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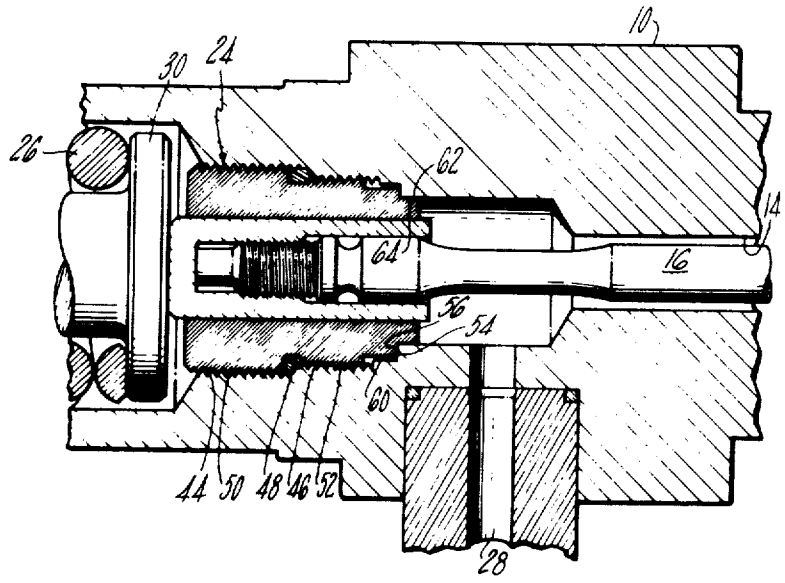
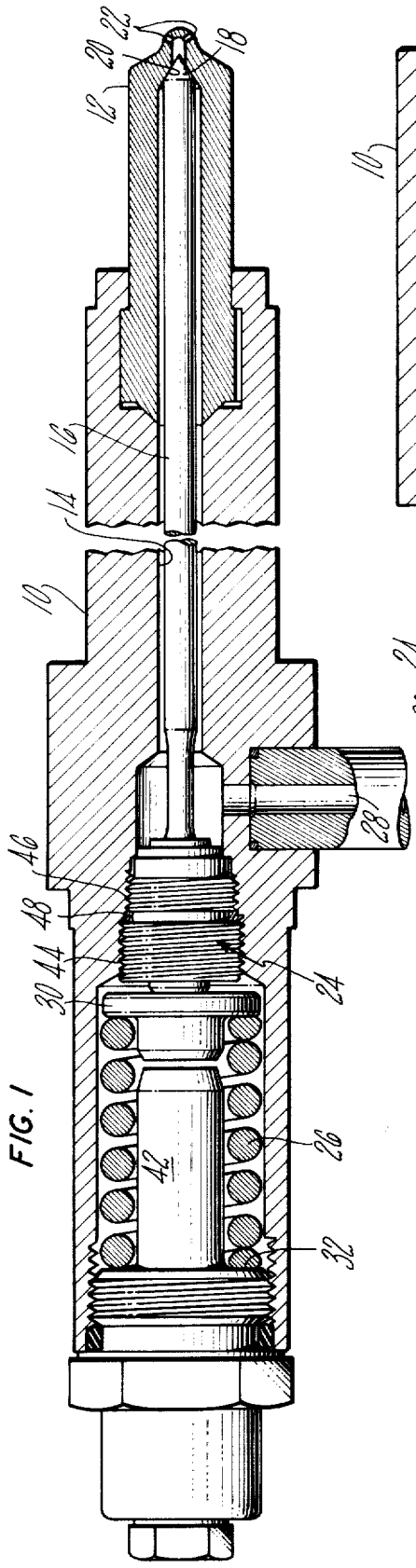
[57] **ABSTRACT**

A precision fuel injector having an inwardly opening pressure operated valve positioned in a bore forming a valve chamber and guided for reciprocal movement to open and close the valve wherein a threaded stepped cylindrical valve guide sleeve at the end of the valve chamber opposite the valve tip mounts the valve and cooperates with a mating portion of the bore to form an annulus filled with an initially flowable settable sealant. The sealant is pressurized during assembly of the guide sleeve and is forced into the clearance between the threads of the guide and the threads of the bore on both sides of the annulus to increase the length of the seal and to lock the guide sleeve in place. The blind end of the guide sleeve bottoms against a shoulder in the bore to establish a predetermined minimum cross-section of the annulus to minimize the possibility of fracture of the sealant ring therein due to differential expansion, and a pilot extending from the end of the guide sleeve and closely fitted within the surrounding bore protects the sealant against corrosion by the repetitive high impact hydraulic forces within the valve chamber.

5 Claims, 2 Drawing Figures

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32

FIG. 1

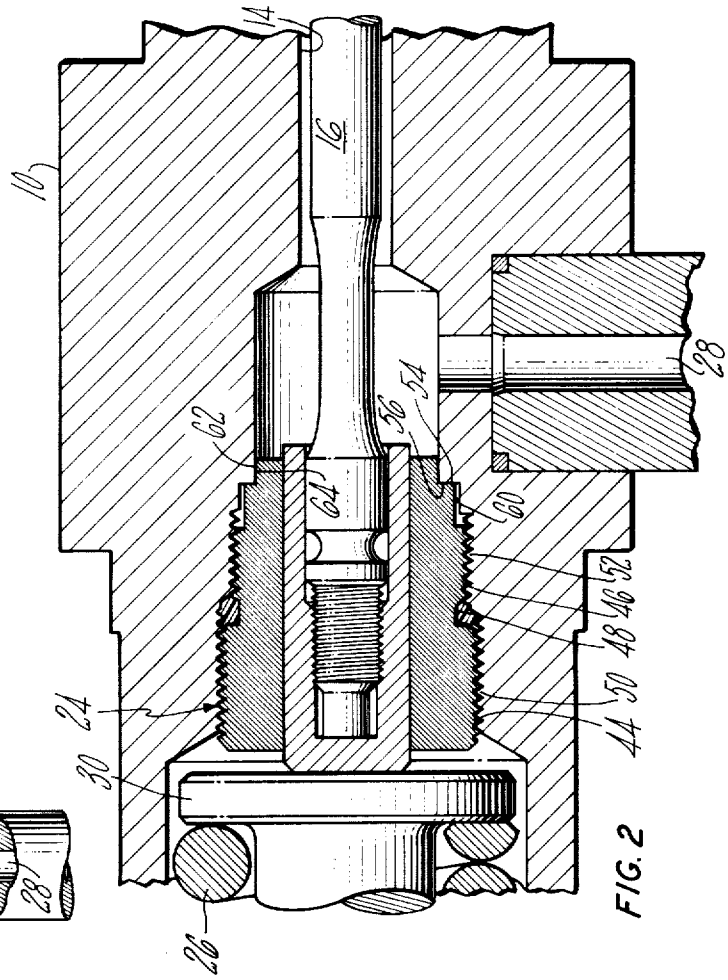
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FIG. 2

FUEL INJECTOR AND METHOD FOR MAKING SAME

This invention relates to fuel injectors for internal combustion engines.

Fuel injectors of the type contemplated by this invention have a plunger or valve which is lifted from its seat by the pressure of fuel delivered to the injector by an associated high pressure pump in measured charges in timed relation with the associated engine.

It is an object of this invention to provide an improved arrangement for mounting a valve guide sleeve for such an injector.

Another object of this invention is to provide a novel method for using a sealant for securing a guide sleeve in the bore of a fuel injector and sealing and locking the same in position without escape of the sealant past the blind end of the insert.

Other objects will be in part obvious and in part pointed out more in detail hereinafter.

The invention accordingly consists in the features of construction, combination of elements and arrangement of parts which is exemplified in the construction hereafter set forth, and the scope of the invention is indicated in the appended claims. In the drawing:

FIG. 1 is a fragmentary cross-sectional view of a fuel injector embodying the present invention; and

FIG. 2 is an enlarged fragmentary cross-sectional view showing the valve guide of FIG. 1. The exemplary injector shown in the drawing and embodying the present invention is of the pressure-operable type and includes an elongated tubular body **10** having a discharge tip **12** rigidly positioned at one end thereof. The tubular body **10** further provides a central longitudinal bore extending throughout its length to form a valve chamber **14.** Located within the valve chamber **14** is a rod-like plunger or valve **16** having a conical tip **18** which cooperatively engages a valve seat **20** to control the discharge of fuel from the valve chamber **14** through discharge orifices **22.** A valve guide sleeve generally indicated at **24** is positioned within the bore of the tubular body **10** at one end of the valve chamber **14** to slidably mount and align the valve **16** with the valve seat **20** for rapid reciprocal movement under the influence of fuel pressure within the bore **14** acting against the bias of spring **26.** The injector is provided with a fuel inlet **28** communicating with the valve chamber **14** for the delivery of discrete charges of high pressure fuel to the bore **14** from an associated high pressure charge pump, not shown.

As shown in FIG. **1,** the upper end of the valve **16** engages a spring seat **30** which is in turn engaged by biasing spring **26.** The other end of biasing spring **26** is similarly provided with a spring seat **32** to cause the spring to exert an axial force on the valve **16.** An extension **42** of the spring seat **32** limits the lift of the valve **16** away from the valve seat **20.**

In accordance with this invention, novel means are provided for locating and sealing the valve guide sleeve **24** in assembled position in the injector body. As shown in FIG. **2,** the guide sleeve **24** is provided with a pair of axially spaced stepped cylindrical threaded portions **44, 46** with an intermediate annular recess **48** therebetween with the threads on portions **44, 46** being formed on the same helix but having different pitch diameters. Mating threaded cylindrical wal portions **50, 52** are provided within the bore of the injector. The shoulder **54** at the end of guide sleeve **24** bottoms on a mating shoulder **56** provided in the bore.

Prior to assembling the guide sleeve **24** in the injector body **10,** a measured amount of an initially flowable settable sealant, for example, an epoxy resin, is applied to the threaded portion **46** of the guide sleeve **24.** As the guide sleeve **24** is inserted axially into its assembled position, the threaded end portion **46** of the guide sleeve **24** threadably engages the mating threads **52** of the bore. During the initial axial movement of the guide sleeve, the threads **52** wipe the sealant from the end portion **46** into the annular recess groove **48** to completely fill the recess.

As the guide sleeve **24** is threaded to its final assembled position, the shoulder **54** is bottomed on the shoulder **56** and the sealant within the annulus **48** is pressurized to impart a hydraulic pressure on the sealant and force it into the clearances between the threads on both sides of the annulus. The amount of sealant utilized is sufficient to cause the sealant to be squeezed in between the mating threads **44, 50** and **46, 52,** respectively, to lengthen the seal and lock the guide sleeve **24** in the injector body. The bottomed shoulders **54, 56** guard against the entry of sealant into the valve chamber **14.** In this regard any excess sealant will be collected in the annulus **60** at the end of the threads.

The sealant thus positioned between the guide sleeve **24** and the injector body sets, or is treated so as to cause it to set, to provide a void free annular ring of sealant to permanently seal and lock the guide sleeve **24** in position. The bottoming of the shoulders **54, 56** establishes the cross-section of the sealant ring in annulus **48** at a predetermined minimum to minimize the tensile stress thereon, and the possibility of fracture, due to differential expansion.

The bottomed shoulders **54, 56,** as well as pilot **62** which engages the surrounding annular surface **64** of the bore with a close fit, serve to isolate the sealant from the valve chamber **14.** This construction which impedes or throttles the flow of fuel from valve chamber **14** to annulus **60,** protects the sealant from corrosion by the repetitive high impact hydraulic forces occasioned by the delivery of the sequential measure of high pressure fuel delivered by the charge pump for injection to the engine.

From the foregoing, it will be apparent that this invention provides a novel arrangement and method for sealing and locking a guide sleeve within a bore or aperture of an injector body in a manner which assures a leak-proof seal therebetween while guarding against the escape of the sealant beyond the blind end of the guide sleeve and into the valve chamber.

As will be apparent to persons skilled in the art, various modifications and adaptations of the structure above-described will become readily apparent without departure from the spirit and scope of the invention, the scope of which is defined in the appended claims.

I claim:

1. In a fuel injector, a tubular body having a valve chamber, a valve guide mounting a pressure operable valve disposed in the valve chamber and a spring biasing the valve toward a valve seat having a discharge orifice, the improvement wherein the valve guide is a generally cylindrical sleeve having an end portion and a pair of axially displaced cylindrically shaped threaded outer surface portions separated by a step, and the portion of the valve chamber remote from the valve seat

is provided with a bore having a pair of stepped surface portions which cooperate with the stepped surface portions of said sleeve to form an annular therebetween when the end portion of the guide sleeve bottoms on a mating shoulder provided by the bore to guard against the entry of sealant into the valve chamber, each of said stepped surface portions of said tubular body being threaded and respectively engaging one of the stepped threaded portions of said sleeve, and an initially flowable settable sealant disposed in said annulus to be entrapped and compressed therein during assembly as the guide sleeve is assembled in the injector to form a void-free ring of sealant filling the annulus and to force the sealant into the clearances between the threads in both directions from the annulus, the threads of the stepped surfaces of said valve guide and said tubular body being formed on the same helix but having different pitch diameters.

2. An injector as recited in claim 1 wherein a groove is provided between the stepped threaded outer surface portions of the guide sleeve to axially space said threads of different pitch diameters.

3. An injector as recited in claim 1 including throttling means for throttling the flow of fuel from said valve chamber toward said sealant to protect the sealant against corrosion.

4. An injector as recited in claim 3 wherein said throttling means comprises a pilot formed on the end portion of on said valve guide which is closely received in said bore.

5. The injector of claim 4 including an annulus between said pilot and the mating threads of said stepped surfaces.

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