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FUEL INJECTION NOZZLE AND ADJUSTING MEANS THEREFOR

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fig. 1

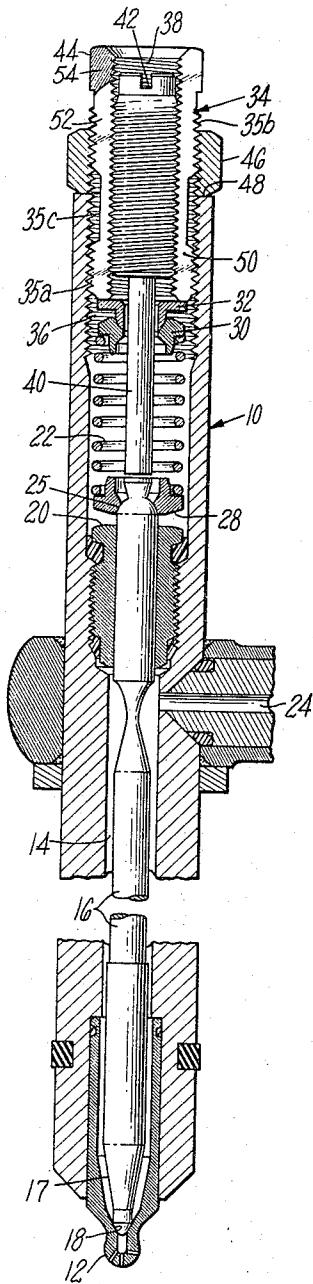


fig. 2

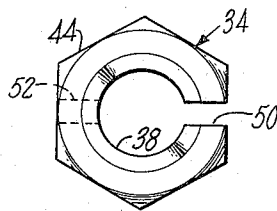
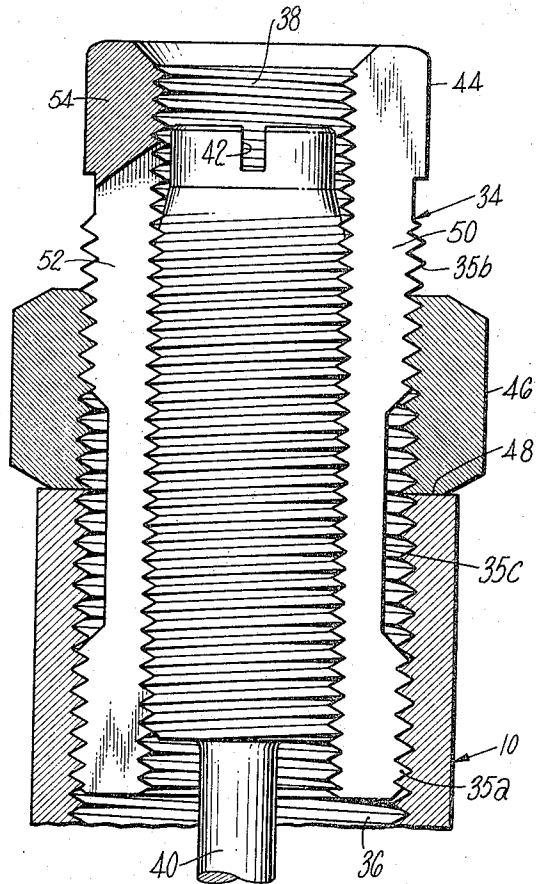


fig. 3

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1

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FUEL INJECTION NOZZLE AND ADJUSTING
MEANS THEREFORVernon D. Roosa, P.O. Box 1440,
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This invention relates generally to fuel injection nozzles for internal combustion engines and to an improvement on the nozzle described in my prior Patent 3,224,684 issued Dec. 21, 1965, and entitled, "Fuel Injection Nozzle."

In the operation of fuel injection nozzles of the type contemplated by this invention, the plunger or valve is lifted from its seat by the pressure of the fuel delivered to the nozzle from an associated high pressure charge pump which provides timed high pressure charges of fuel to the nozzle. The discharge of fuel from the nozzle is dependent upon the force exerted by a biasing spring which urges the valve against the valve seat as well as the amount of lift or movement of the valve from the valve seat under the influence of the fuel pressure. It is therefore important to provide a readily adjustable arrangement for setting the spring force and lift for the nozzle and to maintain the desired settings during long periods of use. Accordingly, it is a primary object of the present invention to provide such an arrangement.

Another object of the present invention is to provide an improved locking arrangement for concentrically disposed threaded members to maintain the same in the desired axially adjusted relationship.

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 portion of a fuel injection nozzle embodying the present invention;

FIG. 2 is an enlarged fragmentary cross-sectional view of the improved valve lift and spring bias adjusting arrangement of the present invention; and

FIG. 3 is the top view of the spring bias adjusting member of the invention of intermediate enlargement.

Referring to the drawing, in which like numerals refer to like parts throughout the several views, the exemplary nozzle shown therein and embodying the present invention is generally similar to that illustrated in my aforementioned prior Patent 3,224,684 and includes an elongated generally tubular body member 10, having a nozzle tip 12 rigidly fixed at one end thereof, and a central longitudinal bore 14 extending throughout its length. Located within the central bore 14 is a rod-like plunger stem or valve 16 which cooperates with a valve seat 18 formed in the nozzle tip 12 to control the discharge of fuel from the nozzle body 10. A valve guide 20 fixedly positioned within the bore 14 of the body 10 at a position remote from the valve seat 18 slidably mounts and precisely aligns the valve 16 so as to permit rapid reciprocal movement thereof within the bore 14 under the influence of the fuel pressure within the bore 14 against the bias of spring 22. The valve is provided with a fuel inlet 24 communicating with the bore 14 of the nozzle body 10 for delivery of high pressure fuel thereto adjacent the guide 20 from an associated charge pump, not shown.

As illustrated in FIG. 1, the upper end of the valve 16 is provided with a partspherical surface 25 which swivelly engages a spring seat 28 having a complementary parti-

2

spherical surface. The other end of the spring 22 is similarly provided with a spring seat 30 which swivelly engages an adjustable annular washer 32 with the washer 32 and the spring seat 30 providing complementary partspherical engaging surfaces to accommodate lack of squareness of the ends of the spring 22 or axial misalignment between the valve 16 and the annular washer 32.

The annular washer 32 is seated against the end of an externally and internally threaded adjustable retainer sleeve 34 the external threads 35a of which are threadably received in the internal mating threads 36 of the tubular body 10.

The internal threads 38 of retainer sleeve 34 threadably receive an externally threaded pin 40 providing an adjustable lift stop for the valve 16. With this arrangement, the nozzle valve opening pressure may be adjusted as desired by merely turning the retainer sleeve 34 in or out until the desired biasing force is provided by the spring 22, and the valve lift may be independently adjusted by axially adjusting the pin 40 with respect to the retainer sleeve 34. A screwdriver slot 42 may be provided in the end of lift stop pin 40 and a polygonal head 44 may be provided on the retainer sleeve 34 to maintain these members at the desired adjusted settings while the lock nut 46 which is threaded on the external threads 35b of the retainer sleeve 34 is tightened against the end shoulder 48 of the tubular body 10 to maintain the retainer sleeve 34 and the lift stop pin 40 in adjusted position.

When the nozzle has been assembled and placed in operation, charges of fuel under high pressure are introduced through inlet 24 and pass relatively freely along the annular passageway provided between the valve 16 and the bore 14 to the tip 12 of the valve. The high fuel pressure acts against the tapered end 17 of the valve 16 and overcomes the bias of spring 22 to move the valve upwardly to the extent permitted by the valve lift stop pin 40, and the discharge of the charge of fuel through the orifices in the tip 12 takes place.

When fuel pressure acting against the tapered surface 17 is reduced by the discharge of the fuel, the spring 22 overcomes the hydraulic pressure acting on the tapered surface 17 and returns the valve to closed position.

In accordance with this invention, novel means are provided for maintaining the retainer sleeve 34 and the lift stop pin 40 in adjusted position during the operation of the associated engine despite the vibrations and other forces which are encountered. As best shown in FIG. 2, the retainer sleeve 34 is shown as being longitudinally slotted at two diametrically opposed positions with the slot 50 completely severing the retainer sleeve 34 from end-to-end and the slot 52 terminating below the upper end to leave a connecting portion 54 between the two longitudinal portions of the sleeve to maintain the retainer sleeve 34 as a unitary construction. An important feature of this invention is the removal or absence of external threads on the sleeve 34 along an intermediate portion 35c thereof between the threaded portions 35a and 35b. The unthreaded portion 35c is of sufficient length and positioned so as to span the end shoulder 48 on the nozzle body 10 irrespective of the build-up of manufacturing tolerances and variations in the parts of the nozzle and to accommodate the required range of adjustment of the biasing force of spring 22 for any planned application of the nozzle.

By reason of the absence of external threads from the intermediate portion 35c of retainer sleeve 34, the lock nut 46, when tightened into engagement with the end shoulder 48 of the nozzle body 10 elongates the intermediate externally unthreaded longitudinal portion 35c of the retainer sleeve 34. Such elongation is distributed uniformly throughout the entire length of the unthreaded

intermediate longitudinal portion 35c of the sleeve which has a length equal to the pitch of a plurality of threads 38 and in the illustrative embodiment is shown as being equal to the pitch of about fourteen threads 38 or about twelve threads 35b, 35c. As a result, the unthreaded portion 35c prevents the concentration of stress in the retainer sleeve 34 and the steep rate of build up of stress on the retainer sleeve 34 as the locking nut 46 is tightened. In effect, the provision of the unthreaded portion provides a low rate of build up of stresses in the walls of the retainer sleeve 34 per unit of angular movement of the lock nut 46 with respect to the nozzle body 10 so that the lock nut 46 may be tightened further with respect to the nozzle body without imposing destructive forces. As a result, a slight loosening of lock nut 46 will not free the retainer sleeve to change its adjustment. Moreover, since the intermediate portion 35c of the retainer sleeve 34 is internally threaded, the effect of the elongating of this intermediate portion is to gradually change the pitch of the internal threads 38 on the intermediate portion 35c to lock the lift stop pin 40 in adjusted position. Since in the illustrated preferred embodiment the retainer sleeve 34 is longitudinally slotted at 50, 52, the tightening of lock nut 46 will also assist in locking the lift stop pin 40 due to the clamping forces resulting from the contraction of the sleeve 34 when the lock nut 46 is tightened.

From the foregoing it is apparent that this invention provides a fuel nozzle having an improved arrangement for securing and maintaining the spring bias adjusting sleeve 34 and the lift stop adjusting pin at the desired settings. Further, it is apparent that the improved lock arrangement will operate effectively over long periods of use without a change in adjustment.

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.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. In a fuel injection device, a nozzle body having a valve chamber, a plunger valve of smaller cross section than said chamber disposed in the chamber, a guide supporting the plunger valve for reciprocating movement longitudinally within the chamber, a spring biasing the plunger valve toward a valve seat having a discharge orifice and adjusting and locking means for setting the spring biasing force and the lift of the valve from the valve seat, said adjusting and locking means comprising an externally and internally threaded spring adjusting sleeve threadably engaging mating threads provided by the nozzle body, a concentric lift stop pin threadably engaged with the inner threads of said sleeve, and a lock nut threadably engaged with the outer threads of said

sleeve and engageable with a shoulder provided by said nozzle body wherein the improvement comprises a longitudinal portion of the spring adjusting sleeve spanning said shoulder provided by the nozzle body being externally unthreaded to permit elongation and a gradual change in pitch of the internal threads upon the tightening of the lock nut so as to lock the stop pin in position.

2. A device as recited in claim 1 wherein the longitudinal length of said externally unthreaded portion is at least equal to the pitch of a plurality of the external threads of said spring adjusting sleeve.

3. A device as recited in claim 1 wherein said spring adjusting sleeve is longitudinally split from end to end.

4. In a clamping device for a fuel injection nozzle, the combination of an annular sleeve having internal and external threaded portions, one of said internal and external threaded portions engaging the mating threads of a first concentrically disposed member which is axially adjustable relative to said annular sleeve, the other of said internal and external threaded portions having a longitudinal intermediate unthreaded portion and a pair of threaded end portions, one of said pair of threaded end portions engaging the mating threads of a second concentrically disposed member, the other of said pair of threaded end portions engaging the mating threads of a lock member, said lock member further engaging a shoulder on said second concentrically disposed member with the longitudinal intermediate unthreaded portion spanning said shoulder.

5. The combination recited in claim 4 wherein said one of said internal and external threaded portions is threaded along the longitudinal intermediate unthreaded portion of the other of said internal and external threaded portions.

6. The combination recited in claim 4 wherein said annular sleeve is longitudinally slotted from end to end.

7. The combination recited in claim 4 wherein said longitudinally intermediate unthreaded portion is provided on the external surface of said annular sleeve.

8. The combination recited in claim 4 wherein wrench receiving means are provided on said annular sleeve and said first concentrically disposed member respectively for holding the same against rotation while said lock member is being tightened.

References Cited

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