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L. E. JOHNSON

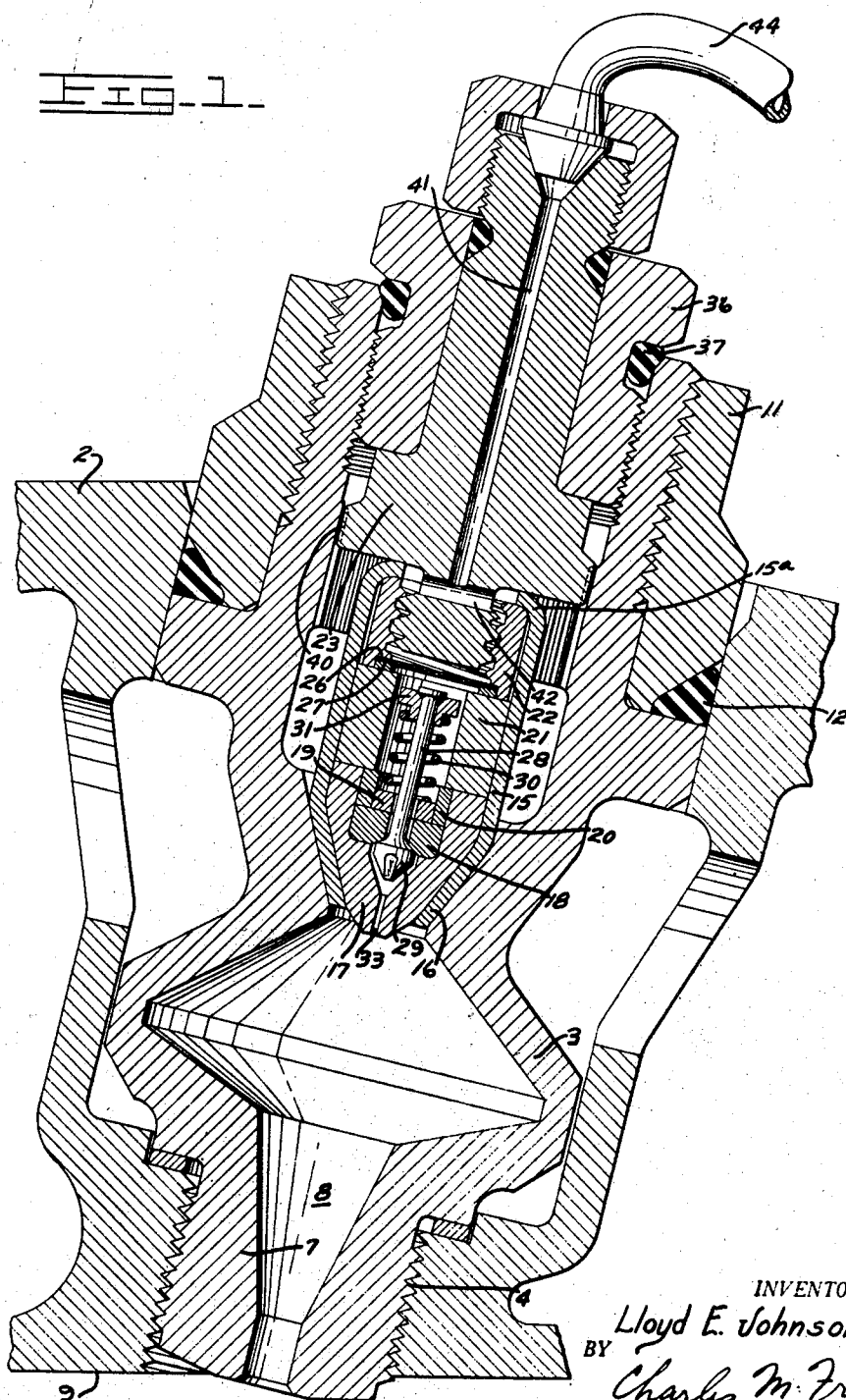
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FUEL INJECTION MECHANISM

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2 Sheets-Sheet 1

Fig. 1.



INVENTOR.

Lloyd E. Johnson

BY

Charles M. Fryer

ATTORNEY.

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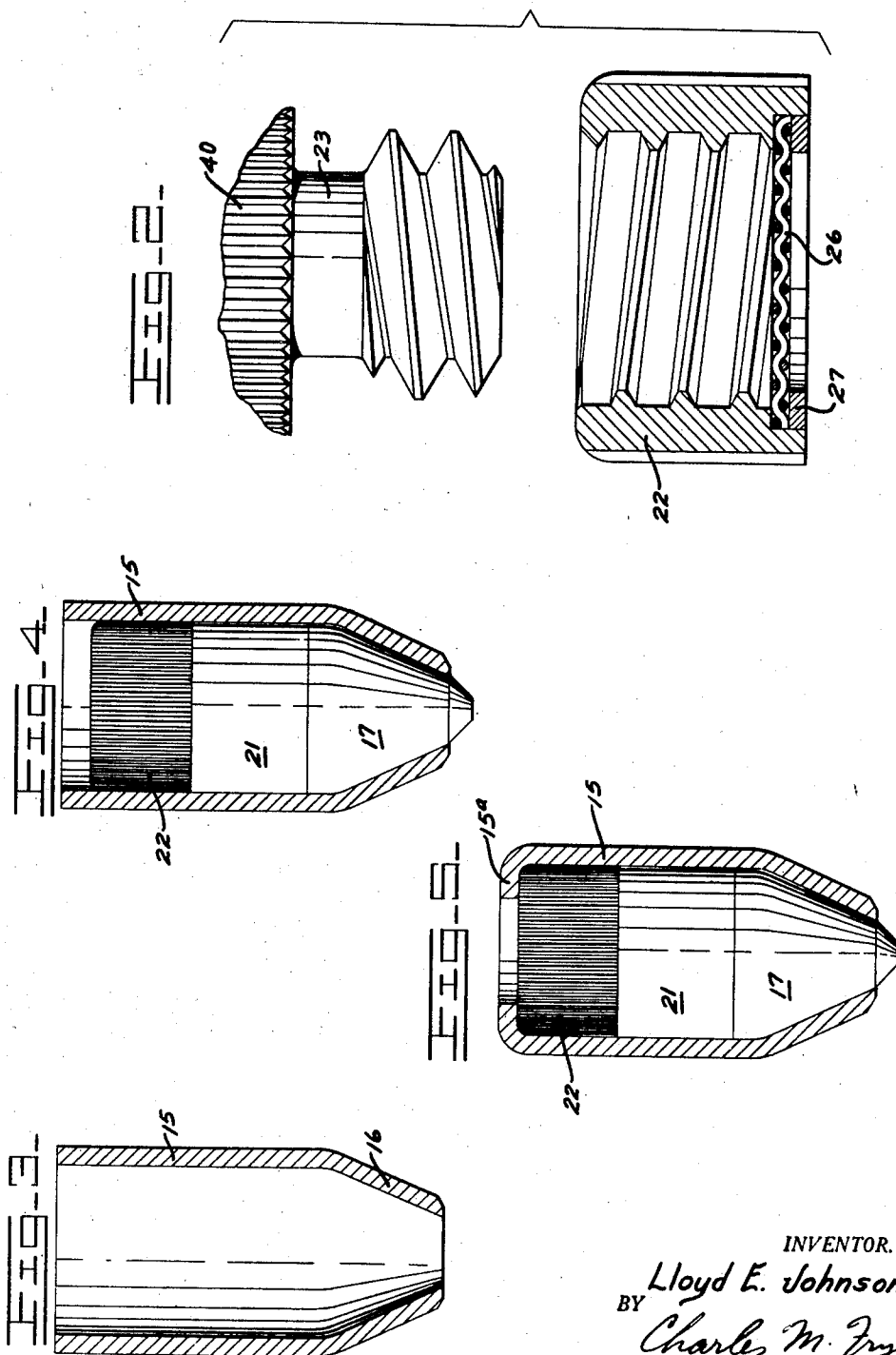
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INVENTOR.

Lloyd E. Johnson
BY Charles M. Fryer
ATTORNEY.

UNITED STATES PATENT OFFICE

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FUEL INJECTION MECHANISM

Lloyd E. Johnson, Peoria, Ill., assignor to Caterpillar Tractor Co., San Leandro, Calif., a corporation of California

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7 Claims. (Cl. 299—107.6)

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The present invention relates to fuel injection mechanisms and particularly to the construction and arrangement of injection nozzles and valves and this application is a continuation in part of my United States Patent No. 2,410,946, issued November 12, 1946, for Fuel Injection Mechanism.

It is an object of this invention to provide a fuel injection nozzle and mounting therefor in which the main nozzle and valve parts are contained by a capsule designed to conduct heat away from the nozzle parts, to maintain the parts in proper position, and to permit pressure to be applied in assembling the nozzle without distorting the position of the parts. Another object of the invention is to provide a fuel injection nozzle which is capable of being readily disconnected from an engine in a manner to permit it to be tested and observed in operation. Still further and more specific objects and advantages of the invention are made apparent in the following specification wherein reference is made to the accompanying drawings which disclose a preferred embodiment of the invention.

In the drawings:

Fig. 1 is a central sectional view through a portion of a cylinder head and through a precombustion chamber and fuel injection mechanism mounted in the cylinder head and embodying the present invention;

Fig. 2 is an enlarged fragmentary section of portions of a fuel supply bonnet and the nozzle assembly illustrated in Fig. 1;

Fig. 3 is an enlarged section of a capsule which contains the valve and nozzle parts before assembly of such parts therein;

Fig. 4 is a similar view after the parts have been inserted into the capsule; and

Fig. 5 is a similar view with an end of the capsule rolled or pressed into position for retaining the parts therein.

Referring first to Fig. 1 of the drawings, a portion of the cylinder head of an internal combustion engine is illustrated at 2 as having a recess for the reception of a conventional precombustion chamber 3 which is retained in place as by a threaded connection indicated at 4. Not all engines are provided with precombustion chambers and the illustration of such a chamber herein may be taken as typifying any conventional receptacle for a fuel injection nozzle. The cylinder head is designed for the reception of a coolant such as water which is circulated through the cylinder head and about the exterior of the receptacle or precombustion chamber 3 in the usual manner. The precombustion chamber includes a

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burner tube portion 7 provided with a tapered orifice 8 through which fuel from an injection nozzle is directed to the main combustion chamber of the engine cylinder, a portion of one wall of the main chamber being illustrated at 9. At the outer end of the precombustion chamber a threaded packing sleeve 11 is employed for imparting pressure to a sealing ring 12 which serves to prevent leakage of the cooling liquid which is contained within the cylinder head.

The principal parts of the injection valve and nozzle assembly are contained within a capsule 15 which is formed of ductile metal having good heat conducting properties such, for example, as copper. The valve and nozzle parts disposed within the capsule are similar in arrangement and operation to the same parts disclosed in my pending application hereinabove referred to. In assembling the capsule 15 and the parts contained by it, the capsule is first pressed or coined to the shape illustrated in Fig. 3 of the drawings which is substantially tubular with a conical portion 16 at one end. A hardened nozzle tip 17 is disposed within the conical portion 16 and its exterior surface is tapered to provide a close fit in intimate contact with the inner tapered wall of the portion 16 so that heat absorbed by the nozzle tip will be readily transferred through the heat conducting material of which the capsule is formed and transmitted directly to the water cooled wall of the precombustion chamber with which the exterior surface of the tapered portion 16 is also closely fitted. Within the bore of the nozzle tip 17 are a valve seat 18, an annular spacer 19, and a sealing ring 20 which may be formed of cold treated steel so that it is relatively soft and compressible as compared to the heat hardened nozzle tip and other parts within the capsule. Disposed in abutment with the nozzle tip and also contained by the capsule 15 is a sleeve 21 and beyond the sleeve and in abutment therewith is a nut 22. The nut 22 receives the threaded end of a fuel supply bonnet 23 for the purpose of connecting the entire capsule 15 and its assembled contents with the bonnet. The nut 22 also serves to contain a filter screen 26 and a ring 27 for retaining the screen in its proper position.

A check valve 28 is disposed within the capsule and has a head 29 normally held in closed or seated engagement with the seat 18 by a spring 30 which acts between a spring retainer 31 engaging the valve stem and the spacer 19.

Due to the construction and arrangement of the parts contained by the capsule 15 endwise

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thrust on the capsule is transmitted through the nut 22 and the spacer 21 directly to the nozzle tip 17 and is not transmitted to the valve seat 18 except through the relatively soft sealing ring 20. The ring 20 forms a seal sufficient to prevent the passage of fuel around the outer periphery of the seat 18 where it could enter the nozzle orifice shown at 33 even though the valve were in closed position. The sealing ring 20 also acts as a guide for centering the valve spring 30. Because of this arrangement which differs somewhat from that shown in my pending application herein referred to, it is possible to form the nozzle tip and capsule by which it is contained with relatively long gradually tapering surfaces and therefore to produce an intimate contact with the heat conducting material of the capsule when endwise thrust is imparted to it.

The fuel supply bonnet 23 is urged inwardly or thrust against the valve and nozzle assembly by an exteriorly threaded gland 36 which engages with an interiorly threaded surface adjacent the outer end of the precombustion chamber. A sealing ring 37 is preferably employed between this gland and the outer end of the precombustion chamber to insure against the entrance of dust or foreign matter toward the area where the valve and nozzle are contained. The supply bonnet 23 is held against rotation with relation to the precombustion chamber by complementary splines formed on both parts as indicated at 40.

After all of the parts contained by the capsule 15 have been assembled in position, the end of the capsule through which the parts were inserted is deformed as by a coining operation to provide a flange shown at 15a in Fig. 5 engaging the end of the nut 22 to prevent the removal of these parts. Because of the fact that the entire capsule is coined to precise dimensions, and the outside surfaces of the parts contained by it are closely fitted within it, the capsule serves to maintain the parts in exact alignment and to prevent rotation particularly of the nut 22. The exterior surface of the nut 22 may be knurled or serrated as best shown in Figs. 4 and 5 further to insure against its rotation within the capsule. The thrust which is imparted through the fuel supply bonnet is therefore transmitted directly through the heavier and more durable parts contained by the capsule to provide the intimate contact desired at its inner tapered end and to insure sealing between the nozzle parts when they are subjected to operating pressures.

The supply bonnet is provided with an axial passage 41 which communicates with a transverse passage 42 adjacent its inner end. These passages transmit fuel from a conventional fuel supply line 44 to the end of the capsule 15 where the fuel enters the threaded connection between the supply bonnet and the nut 22 through which it passes toward the filter screen 26 and eventually to the area of the valve 28. This valve is opened by fuel pressure in a conventional manner, as fully described in my pending application referred to herein. The construction of the threads on the supply bonnet and those on the nut 22 with which it engages is best illustrated in Fig. 2 of the drawings wherein the thickness of threads on the pitch line of each part is shown as considerably less than the spacing between the threads. When the parts are threaded together a loose fit or clearance is thus provided which creates a helical channel following the path of the thread through which an ample quantity of

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liquid fuel may pass. This threaded connection which provides a channel for the transmission of liquid has several advantages. In the first place it serves to direct the liquid fuel under high pressure against the filter screen 26 with a sweeping or tangent action which greatly reduces the possibility of rupturing the screen by the imposition of fluid pressure directly against it. This thread also permits the fuel supply bonnet and the capsule 15 containing the injection nozzle and valve to be rigidly connected with each other so that they may be removed as a unit from the precombustion chamber for testing purposes. This makes possible the removal and testing of the nozzle to determine its spray characteristics and to determine whether the valve is functioning properly. Furthermore, notwithstanding the fact that the fuel supply bonnet and nozzle assembly are firmly connected, when they have been placed in their proper position within the precombustion chamber, the fuel supply bonnet may be thrust inwardly by tightening of the gland 36 and although its inner end is thrust firmly against the outer end of the capsule 15 no strain is placed on its threaded connection with the capsule because of the loose nature of this threaded connection. Consequently, no damage or misalignment of the parts results from forcing the capsule into intimate heat transferring contact between its tapered end and the tapered seat in the precombustion chamber by which it is received.

I claim:

1. A fuel injection nozzle assembly comprising a nozzle tip, an internally threaded nut, a formed capsule enclosing said tip and nut for retaining them against separation, a fuel supply bonnet for directing fuel to said tip, and a threaded portion on said bonnet adapted to be received by said nut.
2. A fuel injection nozzle assembly comprising a nozzle tip, an internally threaded nut, a formed capsule enclosing said tip and nut for retaining them against separation, a fuel supply bonnet for directing fuel to said tip, a threaded portion on said bonnet adapted to be received by said nut, and a filter screen included in the capsule between the nozzle tip and the nut.
3. A fuel injection nozzle assembly comprising a nozzle tip, an internally threaded nut, a formed capsule enclosing said tip and nut for retaining them against separation, a fuel supply bonnet for directing fuel to said tip, a threaded portion on said bonnet adapted to be received by said nut, the threaded connection between the bonnet and nut being loosely fitted to provide a helical path for the flow of fuel, and a fuel channel through said bonnet and nozzle assembly including said helical path.
4. A fuel injection nozzle assembly comprising a nozzle tip, an internally threaded nut, a formed capsule enclosing said tip and nut for retaining them against separation, a fuel supply bonnet for directing fuel to said tip, a threaded portion on said bonnet adapted to be received by said nut, the threaded connection between the bonnet and nut being loosely fitted to provide a helical path for the flow of fuel, a fuel channel through said bonnet and nozzle assembly including said helical path, and a filter screen adjacent the discharge end of said helical path.
5. A fuel injection nozzle assembly comprising nozzle parts contained in a ductile capsule to provide a nozzle unit for disposal in a nozzle receptacle, one of said parts being an internally

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threaded nut, a fuel supply bonnet having an externally threaded part for engagement with said nut, the threaded connection between the bonnet and nut being loosely fitted to permit the bonnet to be advanced to press the nozzle into its receptacle, and a shoulder on the bonnet engageable with the capsule to effect firm engagement of the threaded connection and to form a seal between the bonnet and the capsule.

6. A fuel injection nozzle assembly which comprises, a plurality of nozzle parts including a tapered tip at one end, a capsule of ductile material of relatively high heat conductivity enclosing said parts and formed to envelop said tip and a portion of said other end, a cooled receptacle for the nozzle having a tapered seat for said tip, and means engaging the capsule at said other end for pressing the nozzle into said receptacle to establish intimate heat conducting contact at the tapered surfaces and for compressing the capsule to insure sealing between the nozzle parts.

7. A fuel injection nozzle assembly comprising, a nozzle tip, an internally threaded member, an injection valve assembly interposed between the tip and said member, and a formed capsule en-

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closing said tip, threaded member and valve assembly to retain them against separation.

LLOYD E. JOHNSON.

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