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INJECTOR NOZZLE FOR INTERNAL COMBUSTION ENGINES

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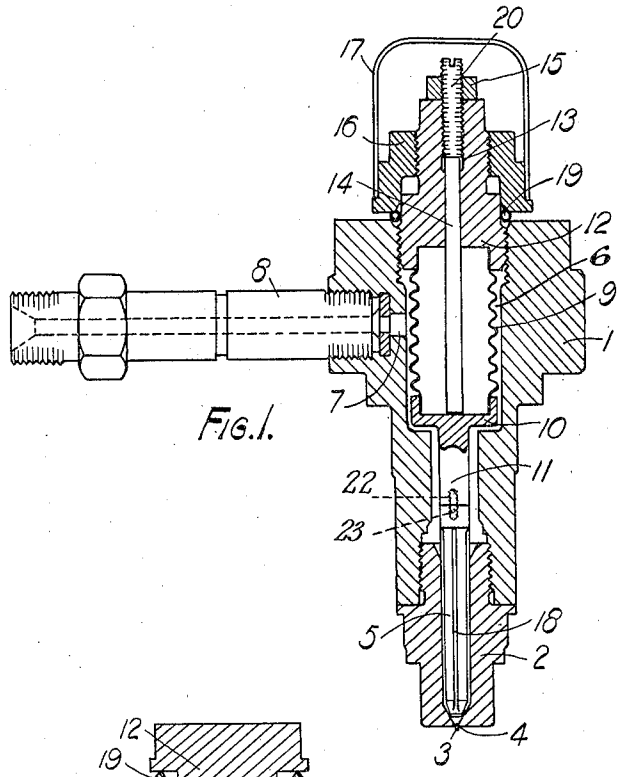


FIG. 1.

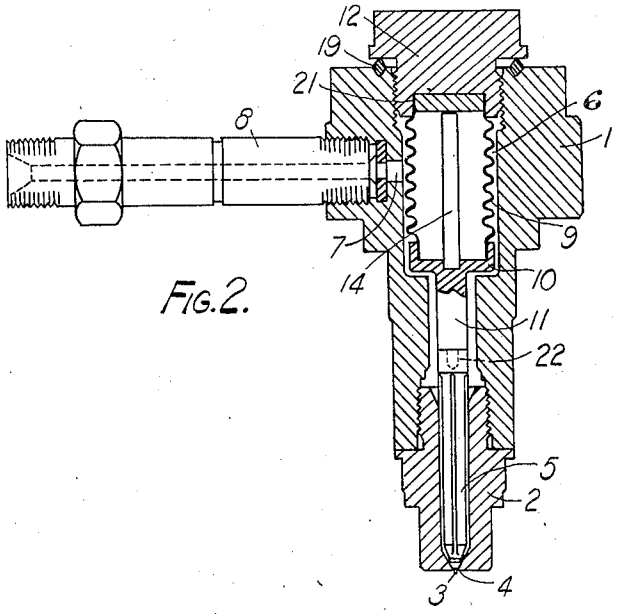


FIG. 2.

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INJECTOR NOZZLE FOR INTERNAL COMBUSTION ENGINES

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2 Claims. (Cl. 299—107.6)

The invention relates to injector "nozzles" or atomizers for injecting liquid fuel into the cylinders of internal combustion engines of the type in which liquid fuel is sprayed directly into the combustion chamber or chambers.

Atomizers of this type are generally provided with a needle valve serving as regulating means for the flow of fuel and also to assist atomization of the fuel, which needle is retained resiliently on a seating to close the atomizer nozzle by means of spiral spring, or a diaphragm of thin sheet metal. The needle is raised from its seating against the biassing force of the spring or diaphragm due to the pressure of the fuel, when it is injected into the combustion chamber under pressure from a pump or other similar device. In atomizers employing sheet metal diaphragms for retaining the needle on its seating, trouble is frequently experienced through the diaphragm fracturing due to fatigue of the metal, and where a spiral spring is employed, the leakage of fuel past the atomizer needle into the spring chamber necessitates the draining of this chamber.

The present invention has for its object to provide an improved construction of atomizer or injector nozzle for internal combustion engines in which the above mentioned disadvantages are eliminated.

According to the invention the injection needle of a fuel injector is biassed on to its seating by means of a closed, transversely corrugated tubular member which is disposed within the body of the injector substantially in axial alignment with the needle, and with one end in intimate contact therewith or secured thereto and the other end secured to the atomizer body. Conveniently, the cylinder is constructed of a corrugated thin metal tube, the end of which nearest the needle is secured in a fluid tight manner to a disc having an upstanding flange around its periphery which embraces a cylindrical end of the tubular member. The disc may be provided with a depending stem adapted to be connected to the flattened head end of the needle. Preferably a mechanical connection is provided between these two parts, such for example as may be obtained by a screwed member substantially loosely fitting into the adjacent ends of the parts so that the stem in rising lifts the needle with it. Alternatively, the stem may be provided at its lower end with a threaded spigot adapted to engage loosely, a correspondingly threaded hole in the head end of the needle. These arrangements provide a certain degree of flexibility between the two parts, and render unnecessary the extremely accurate fitting usually essential between the needle and its guide along the whole length thereof. Where no mechanical connection is provided between the parts, the abutting end faces of the needle and the depending stem must be accurately ground so that when the two faces are pressed together by the corrugated member, a joint is obtained therebetween which will remain substantially fluid-tight.

Preferably the upper end of the tubular member is also cylindrical, so that it may be secured in a fluid-tight manner in a circular recess formed in the end of an externally threaded plug, the latter being adapted to be screwed into the body portion of the injector in a fluid-tight manner. The plug may be provided with a central bore through which passes a rod extending to near the inner face of the disc secured to the other end of the tubular member. This rod may serve as a stop to limit the contraction of the tubular member when under fluid pressure, and is conveniently screwed at its outer end into the plug so that its lower end is adjustable relatively to the movable end of the tubular member. A suitable locking device, such as a lock nut may be provided on the exterior end of the rod. A cap may enclose the upper end of the plug and preferably this cap makes a fluid-tight joint between itself, the outer side of the plug and the injector body. A copper or other suitable washer may be interposed between these parts.

The plug member may be screwed into or out of the body of the injector to increase or decrease the biassing pressure of the corrugated tubular member.

Where the upper end of the tubular member is closed entirely, a stop may be provided within the body of the injector to co-operate with the exterior of the flanged disc secured to the movable end of the tubular member, and a rod may be secured within the tubular member to one or other of the end discs so as to extend to close to the other disc, to limit the contraction of the tubular member.

The invention is illustrated by way of example in the accompanying drawing, Fig. 1 of which shows in cross-sectional elevation a preferred embodiment of fuel injector according to the invention, and Fig. 2 of which shows a modified form of injector.

Referring to the drawing, the atomizer comprises a body portion 1 into the lower end of which is screwed a nozzle portion 2, provided at its lower end with a nozzle 3 communicating with a seating 4 for an injector needle 5 which slidably

fits a central cylindrical bore in the nozzle portion 2. The needle 5 is provided with four longitudinal grooves 18 extending from beyond the upper end of the bore in the nozzle portion 2 to just above the seating face at the lower end of the needle, which grooves serve for the passage of fuel. Within the body portion 1 is formed an enlarged circular recess 6 with which communicates a fuel inlet port 7 connected by a pipe 8 to a fuel pump. The upper end of the recess 6 is screw-threaded, and within the recess is housed a transversely corrugated metal tubular member 9, the lower end of which is hermetically secured to a flanged disc 10 from which depends a stem 11 connected through a substantially loose coupling to the upper end of the needle 5. The upper end of the corrugated tubular member 9 is hermetically secured within a circular recess in the lower end of a screwed plug 12, adapted to engage the internally threaded upper portion of the recess 6. The plug 12 is formed with an upper extension, through a bore 13 in which a depending rod 14 passes. The upper end of the rod 14 is screw-threaded as shown at 20 and engages a correspondingly threaded portion of the upper part of the bore 13, and an externally protruding portion of this threaded part 20 is engaged by a nut 15 to lock the rod 14 in position. The exterior surface of the upper part of the plug 12 is screw-threaded to accommodate a nut 16 on which is hermetically secured a suitably formed sheet metal cap 17. The lower part of the nut 16 is chamfered at its inner circumference and a copper washer 19 is interposed between this chamfered portion and the exterior portion of the joint between the plug 12 and the upper portion of the body 1.

In operation, the corrugated tubular member 9 retains the needle 5 resiliently against its seating 4, the depending rod 14 being adjusted by rotation thereof to limit to a predetermined amount, the upward movement of the flanged disc 10 caused when fuel under pressure is forced through the port 7. In the raised position of the disc 10, the needle 5 is lifted from its seating and permits the fuel under pressure to be forced through the atomizing nozzle 3 into the combustion chamber. When the fuel pressure decreases, the needle 5 is returned to its seating 4 due to the biassing force exerted by the corrugated tubular members, and the atomizing nozzle 3 is closed.

In the arrangement shown in Fig. 2, the corrugated tubular member 9 is hermetically closed at its upper end by means of a disc 21 and the rod 14 which in this case is not adjustable from the exterior of the device, is secured at its lower end in the flanged disc 10. The upper end of the tubular member 9 is accommodated in a screwed plug member 12, the lower end of a flange on which, bears on a copper ring 19 to make a fluid-tight joint with the upper end face of the injector body 1. The depending stem 11 is formed at its lower end with a screwed spigot 22 which loosely engages a threaded hole in the upper end of the needle 5. As shown in Fig. 2, a split pin 23 passing laterally through the spigot 22 and the needle 5 prevents the spigot from unscrewing from the needle.

In an alternative arrangement, the needle 5 may be formed integrally with the stem 11 which depends from the flanged disc member 10.

It will be evident that the construction, arrangement and operation of the injector device hereinbefore described by way of example, may be modified without departing from the scope of the invention.

I claim:

1. A fuel injector for internal combustion engines comprising a body portion, having a fuel inlet and a fuel outlet, a needle valve controlling said outlet, a closed transversely corrugated flexible tubular member disposed in a recess in said body portion substantially in axial alignment with the needle, said tubular member being connected at one end to the needle valve, and at the other end in a fluid-tight manner to a screwed plug engaging a threaded upper portion of the recess, a screwed rod engaging a threaded hole in said plug and extending through the centre of the tubular member to near its lower end, a lock nut for said screwed rod and a cap member adapted to close the upper end of said plug and to make a fluid-tight joint between said plug and the body portion.

2. A fuel injector for internal combustion engines comprising a body portion, having a fuel inlet and a fuel outlet, a needle valve controlling said outlet and a closed, transversely corrugated flexible tubular member disposed in a recess in said body portion substantially in axial alignment with the needle said tubular member being flexibly connected at one end to the needle valve and at the other to a plug adapted to be secured in a fluid-tight manner in the said recess, and a rod disposed axially within said tubular member so as to restrict the contraction of said tubular member.

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