June 17, 1969 F. MESSERSCHMIDT 3,450,351

FUEL INJECTION NOZZLE FOR INTERNAL COMBUSTION ENGINES

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FIG. 1

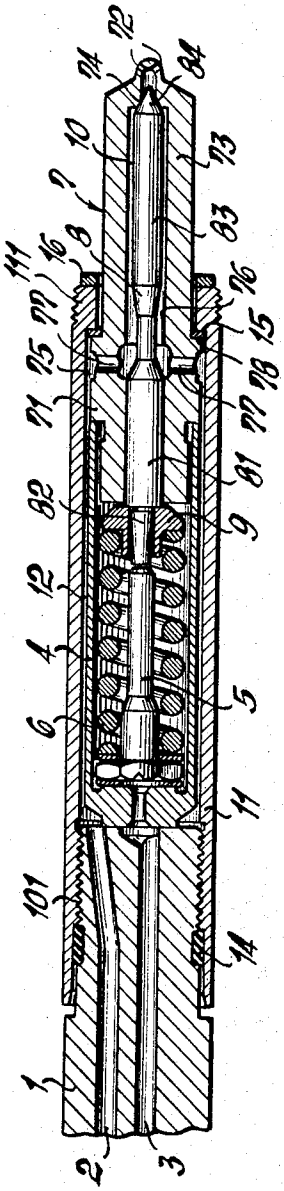
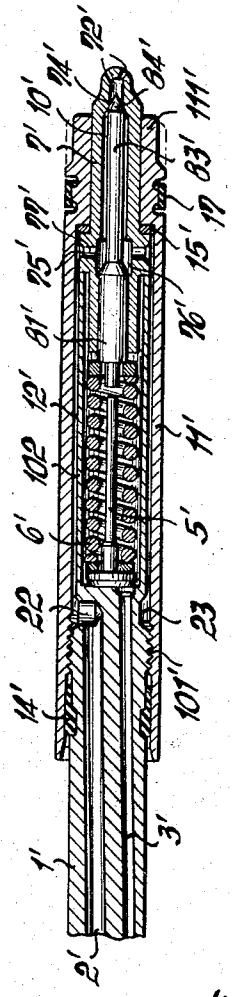


FIG. 2



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FUEL INJECTION NOZZLE FOR INTERNAL COMBUSTION ENGINES

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2 Claims

ABSTRACT OF THE DISCLOSURE

A fuel injection nozzle for an internal combustion engine in which a screw cap at least partly surrounds and releasably connects nozzle means to a nozzle holder and forms an annular gap providing communicating between a fuel feed passage in the nozzle holder and a fuel injection passage in the front portion of the nozzle means.

The present invention relates to a fuel injection nozzle for internal combustion engines in which a nozzle body is releasably and exchangeably connected to a nozzle holder by means of a screw cap.

The nozzle holder of a fuel injection nozzle of this type is usually rod-shaped and formed with a fuel feed channel therethrough and the nozzle body carried thereby is formed with an axial bore. Passage means have therefore to be provided between the fuel feed channel in the nozzle holder and the axial bore in the nozzle body so that fuel fed into the fuel feed channel may be injected through the axial bore of the nozzle body.

In known fuel injection nozzles of this type in which the nozzle body is releasably held by means of a screw cap on the nozzle holder it was heretofore not possible to reduce the outer diameter of the fuel injection nozzle to a dimension less than 20 mm., since in the known constructions of this type the fuel was fed into the bore of the nozzle body in which the nozzle needle is guided through a separate bore in the nozzle body. Due to this arrangement it was not possible to reduce the outer diameter of the injection nozzle below the dimension mentioned above without reducing the diameter of the nozzle needle and the pressure spring cooperating therewith below a suitable minimum value.

It is an object of the present invention to provide for a fuel injection nozzle of the aforementioned type in which a nozzle body is releasably connected to nozzle holder by means of a screw cap and in which the outer diameter of the whole fuel injection nozzle can be held smaller than in constructions of this type known in the art.

It is a further object of the present invention to provide for a fuel injection nozzle of the aforementioned type which is constructed of relatively few and simple parts so that the whole nozzle may be manufactured at reasonable cost and will stand up trouble-free under extended use.

With these objects in view, the fuel injection nozzle according to the present invention mainly comprises nozzle holder means formed with a fuel feed channel therethrough, nozzle means having a front portion formed with a fuel injection passage, a screw cap having a rear portion surrounding part of the nozzle holder means and formed with an inner screw thread threadingly connected to the latter, and a front portion surrounding part of said nozzle means and engaging the latter so as to hold the nozzle means releasably on the nozzle holder means, in which the screw cap has an inner surface forming with the outer surface of at least one of said means enclosed thereby an annular gap providing communication between the fuel channel and the fuel injection passage.

In one embodiment according to the present invention, the aforementioned annular gap is formed between the inner surface of the screw cap and the outer surface of a nozzle body and a jacket surrounding a spring pressing the nozzle needle in the axial bore through the nozzle body against the front end of the latter. In another embodiment according to the present invention, the front portion of the nozzle holder is formed with an axial blind bore in which the aforementioned spring and part of the nozzle body is located, and in this arrangement the aforementioned annular gap is formed between the inner surface of the screw cap and the outer surface of the front portion of the nozzle holder.

In both constructions it is possible to design the nozzle needle and the spring cooperating therewith with suitable dimensions while at the same time providing an outer diameter for the whole nozzle arrangement which is smaller than has been obtainable in similar constructions known in the art.

A proper seal between the nozzle holder and the screw cap, necessary due to the annular gap provided through which the injected fuel passes, is preferably formed by an annular radial seal from elastically yieldable material between the inner surface of the screw cap and the outer surface of the nozzle holder, and this annular seal is preferably arranged rearwardly of the threaded portion of the screw cap. The seal between the screw cap and the nozzle body is preferably formed by an additional annular seal, preferably of metal, and arranged between an inner shoulder on a front portion of the screw cap and an outer shoulder on the nozzle body so that this additional annular seal may be axially compressed by tightening the screw cap on the nozzle holder.

The novel features which are considered as characteristic for the invention are set forth in particular in the appended claims. The invention itself, however, both as to its construction and its method of operation, together with additional objects and advantages thereof, will be best understood from the following description of specific embodiments when read in connection with the accompanying drawings, in which:

FIG. 1 is an axial cross section of a first embodiment of a fuel injection nozzle according to the present invention; and

FIG. 2 is an axial cross section of a second embodiment.

Referring now to the drawings, and more specifically to FIG. 1 of the same, it will be seen that the fuel injection nozzle according to the present invention mainly comprises a rod-shaped nozzle holder **1** which is formed with a fuel feed channel **2** therethrough and an additional leak oil discharge channel **3**. Abutting against the front end of the nozzle holder **1** is the rear end of a jacket **4** in which a stop bolt **5** for a nozzle needle **8** and a spring **6** abutting with one end against the rear end of the stop bolt are located. A rear portion **71** of a nozzle body **7** in which the rear portion **81** of the nozzle needle **8** is slidably guided projects into the front portion of the jacket **4**. The nozzle needle **8** has an end portion **82** of reduced diameter projecting rearwardly beyond the rear end of the nozzle body **7** and a washer **9** is mounted on the portion **82** of the nozzle needle against which the front end of the spring **6** abuts. The nozzle body **7** is formed in a front portion thereof with a central bore **76** therethrough and the outer surface of the portion **83** of the nozzle needle is radially inwardly spaced from the surface of the bore **76** to form therewith an annular passage **10** which reaches up to the conical end **84** of the nozzle needle which cooperates with a seat surface **74** in the nozzle body **7**.

The nozzle means, which in the embodiment shown in FIG. 1 comprise the jacket **4**, the nozzle body **7** and the elements **5**, **6** and **8** located therein are releasably con-

nected to the nozzle holder **1** by means of a screw cap **11** which is provided in the region of its rear end with an internal screw thread **101** threadingly connected with a corresponding screw thread on the front end of the nozzle holder **1**. The screw cap **11** surrounds the jacket **4** and part of the nozzle holder **7** and the inner surface of the screw cap surrounding the jacket **4** and the portion **71** of the nozzle body **7** forms with the outer surfaces of the jacket **4** and the portion **71** of the nozzle body an annular gap **12** through which fuel fed under high pressure into the fuel feed channel **2** of the nozzle holder **1** may pass to an annular groove **75** formed in the outer peripheral surface of the nozzle body **7** and from there through radial bores **77** into the central bore **76** of the nozzle body **7** to pass along the annular passage **10** to the front end of the nozzle body. When under the pressure of the fuel the conical end **84** of the nozzle needle **8** is, against the pressure of the spring **6**, rearwardly displaced away from the seat **74**, the fuel is injected through the openings **72** at the front of the nozzle body.

A seal between the screw cap **11** and the nozzle holder **1** is provided by means of an annular seal **14** of elastically yieldable material arranged in an annular groove formed in the nozzle holder **1** rearwardly of, or in direction of the fuel flow upstream of the threaded portion **101** of the screw cap. The seal between the screw cap **11** and the nozzle body **7** is formed by a metallic annular sealing disk **15** arranged in direction of flow of the fuel downstream of the radial bores **77** and between an outer annular shoulder **78** of the nozzle body **7** and an inwardly extended shoulder on the front end **111** of the screw cap **11**. An annular seal **16** may also be provided on the front face of the screw cap **11** by means of which the injection nozzle may be sealed against the cylinder head of an internal combustion engine.

The embodiment illustrated in FIG. 2 is very similar to the embodiment shown in FIG. 1 and corresponding parts are designated in FIG. 2 with the same reference numeral as in FIG. 1 and a prime is added to the reference numerals in FIG. 2. The fuel injection nozzle illustrated in FIG. 2 can be constructed with an even smaller diameter than the embodiment shown in FIG. 1. This result is obtained in that the jacket **4** shown in FIG. 1 is omitted from the construction illustrated in FIG. 2 and the front end portion **102** of the nozzle holder **1'** is in this case formed with an axial blind bore extending from the front end of the nozzle holder **1'** into the latter, in which the spring **6'** and the rear portion of the nozzle body **7'** is located. The arrangement shown in FIG. 2 differs also from that shown in FIG. 1 in that the annular sealing ring **16** on the end face of the screw cap **11'** is omitted and sealing of the screw cap **11'** against the cylinder head is provided by an annular sealing ring **17** located in a corresponding groove formed in the peripheral surface of the front portion **111'** of the screw cap **11'**. The annular gap **12'** is in this modification located between the inner surface of the screw cap **11'** and the outer surface of the front portion **102** of the nozzle holder **1'**. The fuel is fed under high pressure through the fuel feed channel **2'** in the nozzle holder **1'** and through a radial bore **22** in an annular groove **23** formed at the outer surface of the nozzle holder **1'**, from where the fuel passes through the annular gap **12'** to the annular groove **75'** in the nozzle body **7'** and further through the radial bores **77'** into the central bore **76'** of the nozzle body **7'** which forms with the front portion **83'** of the nozzle needle an annular channel **10'** which extends up to the conical end **84'** of the needle and the seat surface **74'** of the nozzle body coordinated therewith. After retracting of the nozzle needles **81'**, **83'** against the force of the spring **6'** from the seat surface **74'**, the fuel will be ejected through the openings **72'** in the front end of the nozzle body.

As described in connection with the embodiment shown in FIG. 2, the screw cap **11'** is sealed against the nozzle

holder **1'** and the nozzle body **7'** by a radial annular seal **14'** and an axial annular seal **15'**, respectively.

It will be understood that each of the elements described above, or two or more together, may also find a useful application in other types of fuel injection nozzles for internal combustion engines differing from the types described above.

While the invention has been illustrated and described as embodied in a fuel injection nozzle for an internal combustion engine in which nozzle means are releasably connected to a nozzle holder by means of a screw cap, it is not intended to be limited to the details shown, since various modifications and structural changes may be made without departing in any way from the spirit of the present invention.

Without further analysis, the foregoing will so fully reveal the gist of the present invention that others can by applying current knowledge readily adapt it for various applications without omitting features that, from the standpoint of prior art, fairly constitute essential characteristics of the generic or specific aspects of this invention, and therefore, such adaptations should and are intended to be comprehended within the meaning and range of equivalence of the following claims.

What is claimed as new and desired to be secured by Letters Patent is:

1. A fuel injection nozzle for an internal combustion engine comprising, in combination, nozzle holder means formed with a fuel feed channel therethrough; nozzle means having a front portion formed with a fuel injection passage, said nozzle means including a jacket, a nozzle body having a rear portion projecting into a front portion of said jacket and a portion projecting beyond the front end of said jacket, said nozzle body being formed with an axial bore therethrough forming part of said fuel injection passage, a nozzle needle in said bore, and spring means located in said jacket and engaging said nozzle needle at a rear portion thereof for pressing said needle toward a front end of said bore; and a screw cap having a rear portion surrounding part of said nozzle holder means, part of said rear portion being provided with an inner screw thread threadingly connected to said nozzle holder means, and a front portion surrounding part of said nozzle means and engaging the latter so as to hold said nozzle means releasably on said nozzle holder means, said screw cap having an inner surface radially outwardly spaced from an outer surface of said jacket and a portion of said nozzle body projecting beyond the jacket and forming between said inner surface and said outer surface an annular gap providing communication between said fuel feed channel and said fuel injection passage.

2. A fuel injection nozzle as defined in claim **1**, wherein said nozzle body is formed with at least one radial bore providing communication between said annular gap and said central bore.

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U.S. Cl. X.R.

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