Nov. 11, 1958 H. R. SENNSTROM ET AL 2,860,010

FUEL INJECTION NOZZLE

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Fig. 2.

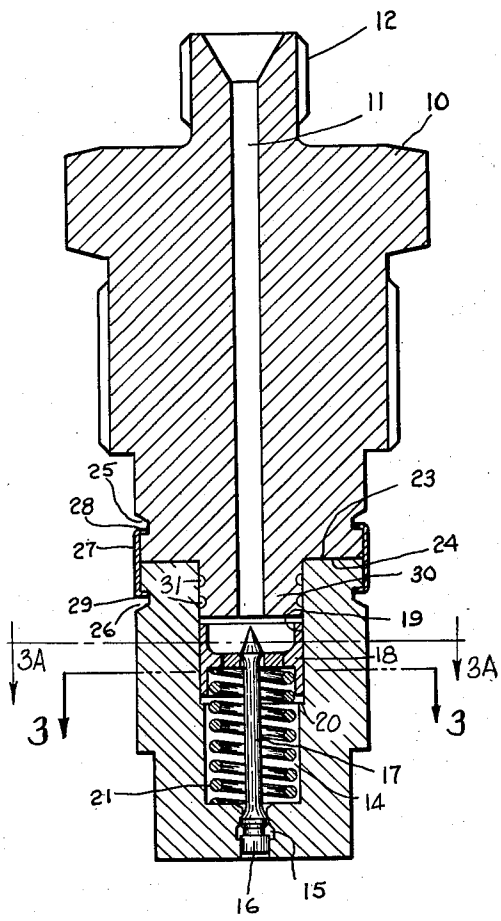
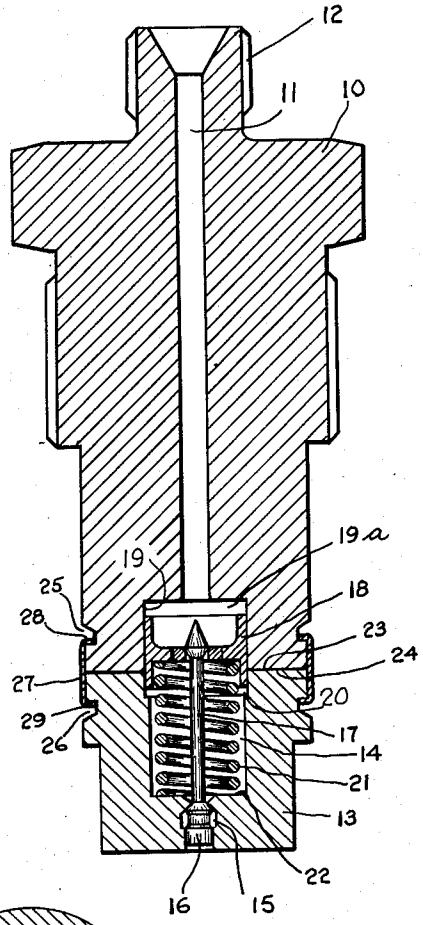


Fig. 1.



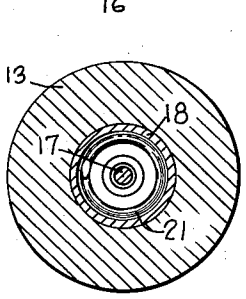


Fig. 3.

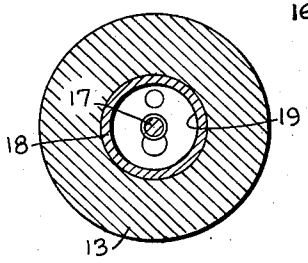


Fig 3A

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Fig. 6.

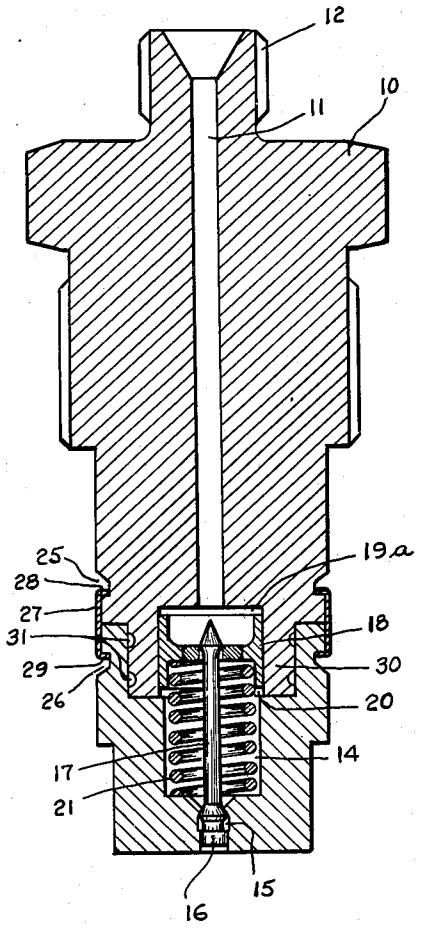
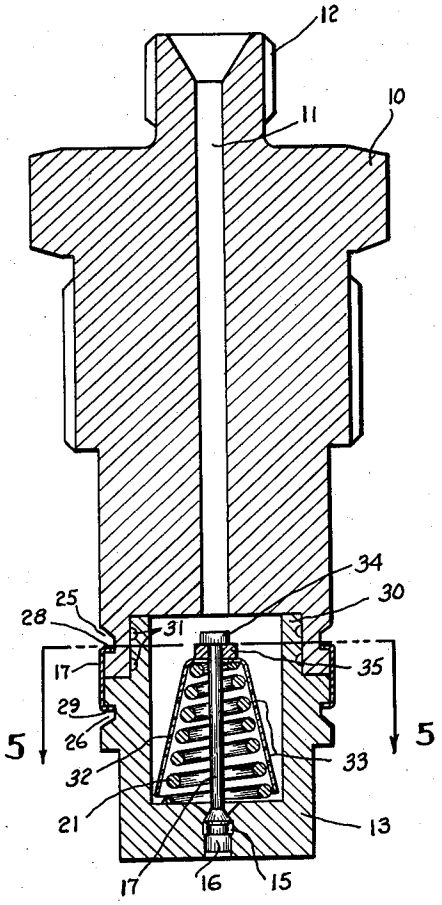


Fig. 4.



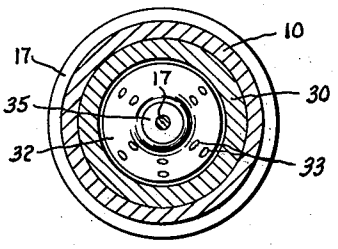


Fig. 5.

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FUEL INJECTION NOZZLE

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Application September 26, 1955, Serial No. 536,542

7 Claims. (Cl. 299—107.6)

This invention relates to fuel injection nozzles and has particular reference to a new and improved nozzle body and nozzle assembly which is simple and more economical in construction and yet efficient in operation.

An object of the invention is to provide a new and improved device of the type set forth wherein the nozzle and nozzle body are assembled as a complete unit by providing a simple and more economical construction which can be installed and serviced as a complete unit.

Another object is to provide a device of the type set forth wherein the nozzle and holder are joined together as a unit and wherein a new and improved securing arrangement is provided.

Other objects and advantages of the invention will be apparent from the following description taken in connection with the accompanying drawings. It will be understood that changes may be made in the details of construction and arrangement of parts shown and described as the preferred form has been given by way of illustration only.

Referring to the drawings:

Fig. 1 is a longitudinal sectional view of a device embodying the invention;

Fig. 2 is a view generally similar to Fig. 1 but showing another form of the invention;

Fig. 3 is a sectional view taken on line 3—3 of Fig. 2, looking in the direction of the arrows;

Fig. 3A is a sectional view taken on line 3A—3A of Fig. 2 looking in the direction of the arrows.

Fig. 4 is a view generally similar to Figs. 1 and 2 but showing another form of the invention;

Fig. 5 is a sectional view taken on line 5—5 of Fig. 4, looking in the direction of the arrows; and

Fig. 6 is a view generally similar to Figs. 1, 2 and 4 but showing a slightly different form of the invention.

Referring more particularly to the drawings wherein similar reference characters designate corresponding parts throughout, the form of the invention shown comprises the nozzle body **10** having the fuel passage or duct **11** and the coupling **12** for connection to the fuel line.

The nozzle portion **13** is adapted to be secured in aligned relation with the body **10** and is provided with the spring chamber **14** and the discharge passage or duct **15** leading outwardly therefrom for the discharge of fuel into the combustion chamber.

The passage of fuel through the discharge passage **15** is controlled by the nozzle valve **16** having the extension **17** extending into the spring chamber **14** and operatively connected to valve retainer **18** which is mounted for sliding movement in slideway **19** and the extent of sliding movement or adjustment of retainer **18** is limited by internal peripheral shoulder **20**.

Valve retainer **18** also serves as a spring seat for one end of spring **21** and the opposite end of said spring engages the end face **22** of spring chamber **14** surrounding discharge passage **15** whereby spring **21** will control

the opening pressure of the nozzle valve **16** which is opened by fuel pressure.

The adjacent end faces **23** and **24** of body portion **10** and nozzle portion **13** respectively are relatively flat ground surfaces adapted to provide the leak proof connection between the portions.

The body portion **10** is provided with the peripheral groove **25** adjacent to but spaced from said end faces **23** and the nozzle portion **13** is provided with the peripheral groove **26** adjacent to but spaced from the end face **24** and the clip **27** is provided with its ends **28** and **29** in grooves **25** and **26** respectively to retain the body portion **10** and nozzle portion **13** aligned assembly.

The clip **27** may be formed from a link shaped piece of material having its ends **28** and **29** rolled into the grooves **25** and **26** whereby a tight leak proof connection is formed between the parts.

The construction shown in Fig. 2 is generally similar to that of Fig. 1 but a slightly modified form of the body portion **10** and nozzle portion **13** is provided. In this construction the adjacent end of body portion **10** is provided with the projection **30** which is preferably annular, and which extends into portion **19** in the adjacent end of nozzle portion **13** by a pressed fit and the engaging faces **23** and **24** are preferably ground surfaces, as previously described, for forming a leak proof connection.

If desired, the projection **30** may be provided with the peripheral grooves **31** having resiliency.

In Figs. 4 and 5 the arrangement shown is generally similar to that of Figs. 1 and 2 but the valve connection between the body portions **10** and **13** is the reverse of that shown in Fig. 2, namely, the integral extension **30** is provided on the nozzle portion **13** instead of on the body portion **10** and the peripheral grooves **31** for resiliency are also provided on the nozzle portion rather than on the body portion. Also, the slidable valve retainer **18** is eliminated and the spring **21** is a conical spring with its cross section decreasing progressively away from discharge passage **15** and the spring is covered by the spring cap **32** having the openings **33** therethrough and the end of valve extension **17** passes through spring **21** and the end of cap **32** and is provided with the enlarged end **34**. The washer **35** may be provided between the end of cap **32** and enlarged end **34**.

In the construction shown in Fig. 6, the valve retainer **18** is positioned within the bore **19***a* which is formed in the end of the body portion **10** and the diameter of spring chamber **14** is smaller than the diameter of chamber **19***a* whereby the shoulder or stop **20** is formed by the difference in diameter of the chamber, that is, the adjacent end of the spring chamber **14**, having a smaller diameter, provides a stop for valve retainer **18**. In this form of the invention, the means for securing the adjacent ends of the body portion **10** and the nozzle portion **13** is similar to that shown in Fig. 2 except that the projection end **30** of the body portion contains the retainer chamber **19***a*, as previously described.

It is pointed out that except for the form of the invention shown in Fig. 1, that each of the forms shown can employ the fastening or securing clip **27**, or not, as desired, but that with such clip or joining means employed, when the device is removed from the engine, it insures that both the body portion and the nozzle portion will be removed as a unit in those cases where the nozzle portion might stick for any reason in the engine head.

From the foregoing it will be seen that new and improved means have been provided for obtaining all of the objects and advantages of the invention.

We claim:

1. In a device of the character described, a body por-

tion having a fuel passage therethrough and a separate nozzle portion having an open ended spring chamber and an integral end wall with a fuel discharge passage therethrough communicating with said spring chamber, said spring chamber communicating with said fuel passage in said body portion, a valve having a valve portion in said discharge passage and an extension portion extending into said spring chamber, a spring in said spring chamber operatively connected to said valve extension portion for controlling the operation thereof, the adjacent ends of said body portion and said nozzle portion having engaging faces and each of said portions having an external peripheral shoulder adjacent said engaging faces and clip means operatively connected to each of said shoulders for securing said body portion and said nozzle portion in assembled aligned relation.

2. In a device of the character described, a body portion having a fuel passage therethrough, a separate nozzle portion in aligned relation with said body portion and having an open ended spring chamber and an integral end wall with a fuel discharge passage therethrough in communication with said spring chamber and said fuel passage in said body portion, a valve having a valve portion in said discharge passage and an extension portion extending into said spring chamber, a spring in said chamber operatively connected to said valve extension portion, the adjacent ends of said body portion and said nozzle portion having engaging faces and means connecting the adjacent ends of said body portion and said nozzle portion, said means comprising a reduced extension and peripheral flange and shoulder on one of said portions and a shoulder on the other of said portions press fitted over said reduced extension and engaging said shoulder on said first portion and an external peripheral shoulder in said body and nozzle portions adjacent the connections of said body portion and said nozzle portion and means engaging said shoulders to retain said portions in assembled relation.

3. In a device of the character described, a body portion having a fuel passage therethrough, a separate nozzle portion in aligned relation with said body portion and having an open ended spring chamber and a wall having a fuel discharge passage extending therethrough and communicating with said fuel passage in said body portion, a valve member having a valve portion in said discharge passage and an extension portion extending into said spring chamber, a spring in said chamber operatively connected to said valve and extension portion and means connecting the adjacent ends of said body portion and said nozzle portion, said means comprising a reduced extension and peripheral flange and shoulder on one of said portions and a shoulder on the other of said portions fitting over said reduced extension and engaging said shoulder on said first portion, and a press fit between said shoulder and said reduced extension and external groove means in the periphery of said body portion and said nozzle portion adjacent the connections of said body portion and said nozzle portion and means engaging said groove means to retain said portions in assembled relation.

4. In a device of the character described, a body portion having a fuel passage therethrough, a separate nozzle portion in aligned relation with said body portion and having an open ended spring chamber and a wall having a fuel discharge passage extending therethrough and communicating with said fuel passage in said body portion, a valve in said discharge passage and extending into said spring chamber, a spring in said chamber operatively connected to said valve and means connecting the adjacent ends of said body portion and said nozzle portion, said means comprising a reduced extension and peripheral flange and shoulder on one of said portions and a shoulder on the other of said portions fitting over said reduced extension and engaging said shoulder on said first portion, and a press fit between said shoulder and said reduced extension and a plurality of spaced, external peripheral grooves between said adjoining faces.

5. In a device of the character described, a body portion having a fuel passage therethrough, a separate nozzle portion in aligned relation with said body portion and having an open ended spring chamber and a wall having a fuel discharge passage extending therethrough, a valve member having a valve portion in said discharge passage and an extension in said spring chamber, a spring in said spring chamber operatively connected to said valve extension, said body portion and nozzle portion each having flat engaging end face portions and external means for retaining said portions in aligned relation, said external means comprising groove means in said body portion adjacent said engaging end face portions and said nozzle portion adjacent said engaging end face portions and clip means engaging said groove means.

6. In a device of the character described, a body portion having a fuel passage therethrough, a separate nozzle portion in aligned relation with said body portion and having an open ended spring chamber and a wall with a fuel discharge passage extending therethrough, a valve member having a valve portion in said discharge passage and having an extension portion, a spring in said spring chamber operatively connected to said valve extension, said body portion and nozzle portion having comating adjoining ends in pressed relation to frictionally retain said portions in assembled relation, said nozzle and body portions both having external holding means adjacent their adjoining ends, and clamping means engaging said holding means on said body portion and nozzle portion for additional retaining of said portions in assembled relation.

7. In a device of the character described, a body portion having a fuel passage therethrough, a separate nozzle portion in aligned relation with said body portion and having a spring chamber and a fuel discharge passage communicating therewith, a valve in said discharge passage and a spring in said spring chamber operatively connected to said valve, said body portion and nozzle portion having comating adjoining ends in pressed relation to retain said portions in assembled relation and external groove means on said body portion and nozzle portion adjacent said comating ends and means engaging said groove means.

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