Aug. 12, 1958 B. G. PARSONS 2,846,986

NOZZLE FOR FUEL INJECTION SYSTEMS

Original Filed Dec. 5, 1950 2 Sheets-Sheet 1

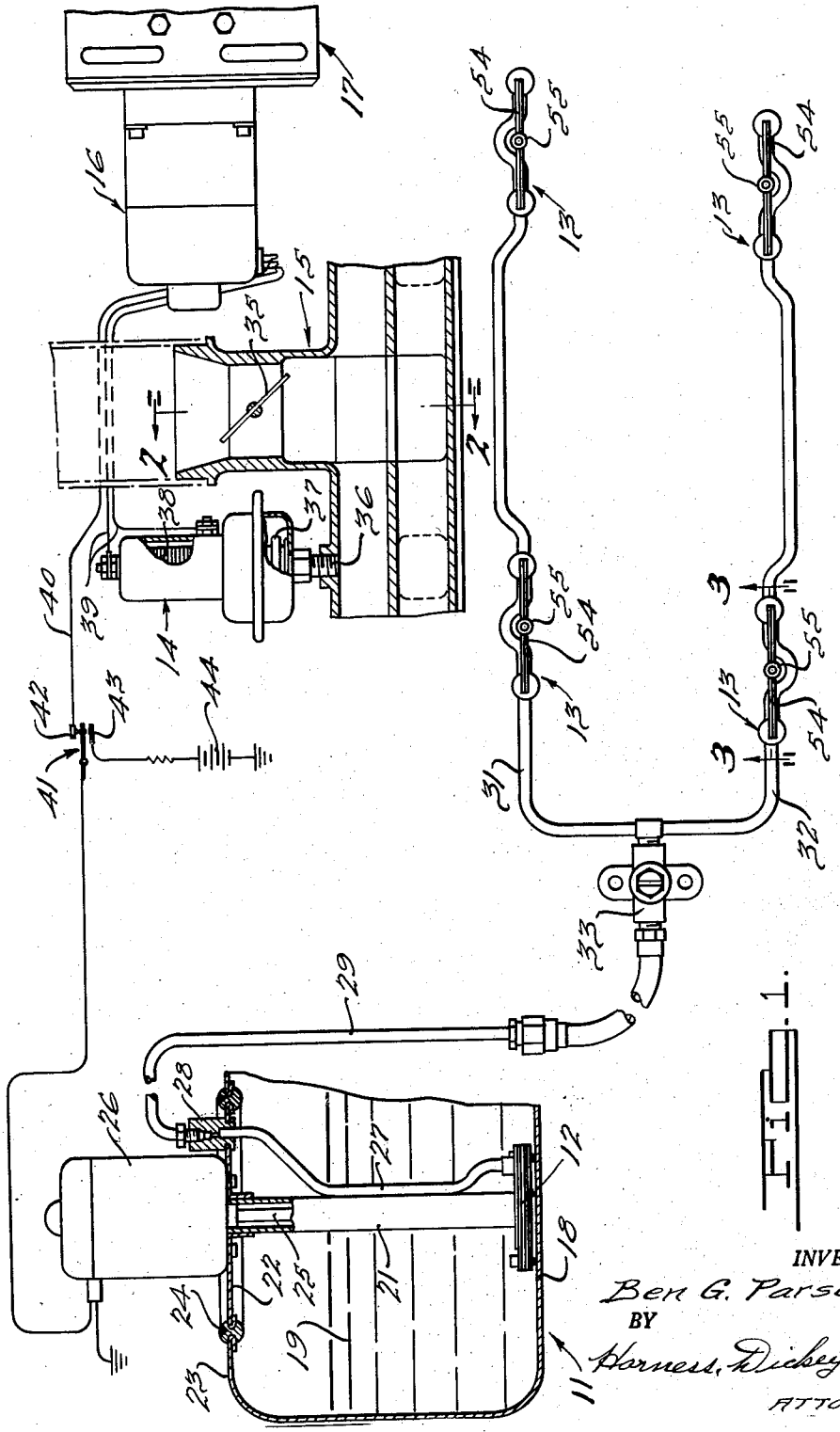


Fig. 1.

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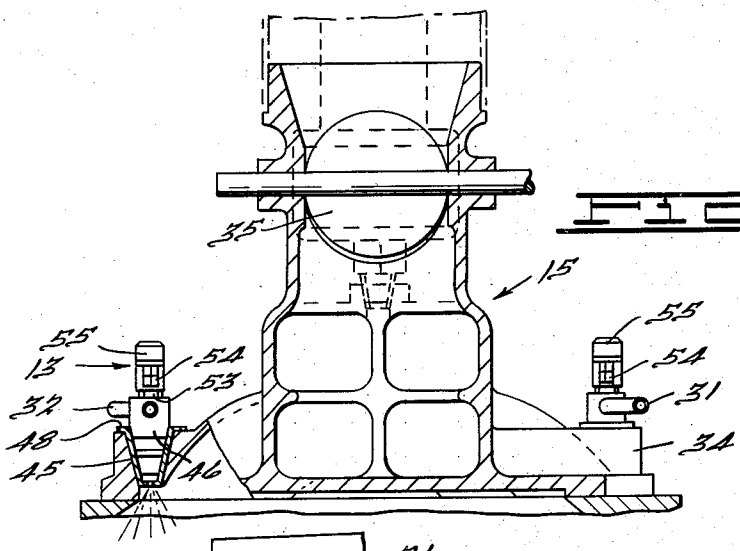


FIG. 2

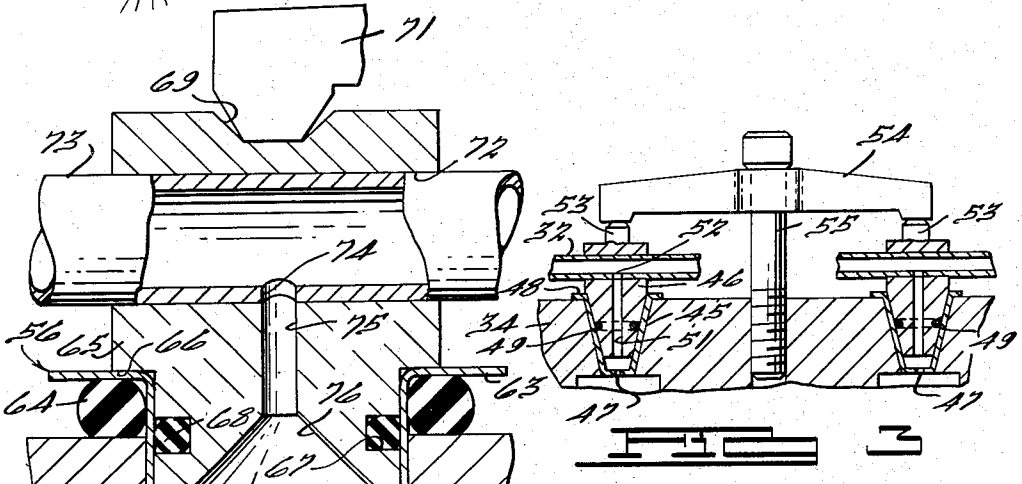


FIG. 3

FIG. 4

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NOZZLE FOR FUEL INJECTION SYSTEMS

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Original application December 5, 1950, Serial No. 199,325, now Patent No. 2,687,123, dated August 24, 1954. Divided and this application December 17, 1956, Serial No. 629,209

5 Claims. (Cl. 123—32)

This invention relates to internal-combustion engines, and more particularly to nozzles for use in fuel injection systems of spark ignition engines, in which liquid fuel and air are supplied to each cylinder through an injection nozzle and an inlet port respectively. This application is a continuation-in-part of my copending application Serial No. 397,371, filed October 21, 1953, now abandoned which is in turn a division of application Serial No. 199,325, filed December 5, 1950, now Patent No. 2,687,123, issued August 24, 1954.

It is an object of the present invention to provide an improved injector nozzle for use with internal-combustion engines, which is extremely easy to assemble and disassemble. More particularly, it is an object to provide such a nozzle which is of a two-piece or three-piece threadless construction and which may be quickly removed from its operative position for cleaning or replacement.

It is another object to provide, in combination with an internal-combustion engine incorporating the improved nozzles, novel clamping means for holding said nozzles in place, which is extremely simple and efficient and will permit securing or removal of the nozzles with a minimum of effort.

Other objects, features and advantages of the present invention will become apparent from the subsequent description, taken in conjunction with the accompanying drawings.

In the drawings:

Figure 1 is a schematic view of the improved fuel injection ssytem described and claimed in said patent, showing the construction and cooperation of the elements including the clamping means for the novel fuel injection nozzles;

Figure 2 is a cross-sectional view taken along the line 2—2 of Figure 1 and showing the positioning of the injector nozzles in the engine head;

Figure 3 is a cross-sectional view taken along the line 3—3 of Figure 1 and showing the construction of the injector nozzles as well as their mounting on the engine head; and

Figure 4 is an elevational view in cross section of a modified form of the improved nozzle which incorporates a particle retention device therein.

The improved nozzle of this invention is especially adapted for use with spark ignition internal-combustion engines having fuel injection systems wherein liquid fuel is supplied directly to the cylinders by positive pressure means and is injected through a nozzle or atomizer, the air being drawn into the cylinders through intake valve adjacent the nozzles. It will be understood, however, that the principles of this invention are equally applicable to other types of internal-combustion engines. The improved nozzle is shown for illustrative purposes as being incorporated in a fuel injection system of the type described and claimed in the aforementioned patent.

The system comprises in general a fuel supply source

11, a pump 12 which forces the fuel through a series of injector nozzles 13, a device 14 which is sensitive to the pressure within intake manifold 15, and a generator 16 which controls the pump speed and is in turn controlled both by the pressure-sensitive device 14 and by the speed of engine 17 to which it has a driving connection. The fuel supply source 11 comprises a fuel tank 18 containing liquid fuel 19. The pump 12 may be of any conventional type, and in the illustrated embodiment is shown as comprising a turbine type of pump mounted within the lower portion of the fuel supply tank 18. The pump is supported by a tubular column member 21 extending upwardly therefrom and suspended in turn from a plate 22. This plate is preferably secured in flush relation with the upper wall 23 of the fuel supply tank by means of a seal strip 24. The pump rotor shaft 25 is concentrically mounted within tubular column 21 and is driven by a motor 26 mounted above plate 22.

The discharge end of pump 12 has a riser 27 leading upwardly therefrom through the tank to a connecting piece 28. Fuel supply line 29 leads from the connecting piece to the distributing lines 31 and 32 through an adjustable idle speed valve control 33. Injector nozzles 13 are mounted at spaced intervals along the distributing lines 31 and 32 and are supported within engine head 34, as best seen in Figures 2 and 4. It will be observed that in the illustrated embodiment there does not appear a distributor element in fuel supply line 29 or in the distributing lines 31 and 32 in order to intermittently supply fuel to the various nozzles. This arrangement is especially adapted for the conventional high speed internal-combustion engine wherein the combustion cycle is so brief as to nullify the usefulness of such a distributor. It will be understood, however, that the principles of this invention would be equally effective in a system containing such a distributor in the line.

Control means are provided in the illustrated fuel injection system for supplying a richer air-fuel mixture to the engine when its power needs are greater—namely, when the throttle 35 is opened and also when the speed of the engine 17 is increased. The operation and advantages of this control means is described in detail in the aforementioned patent. For present purposes, it is sufficient to state that pressure-responsive device 14 is connected directly to the intake manifold 15 by a nipple 36 and has a pressure-responsive element 37 therein such as a bellows or diaphragm which controls a variable rheostat 38 in the generator field circuit so that the resistance in the field circuit increases as the manifold vacuum increases. Lead lines 39 connect the pressure-responsive rheostat to the generator field circuit. The output of the generator is carried by a line 40 having a starting switch 41 therein to the pump motor 26. The starting switch 41 may be of a conventional two-way type having a terminal 42 connected to line 40 and a starting terminal 43 connected directly to a battery 44, so that the pump may be operated for priming purposes upon starting the engine.

The injector nozzles 13 are preferably mounted within openings (not designated) in the engine head adjacent their corresponding cylinders. As best seen in Figures 2 and 3, each nozzle comprises a shell portion 45 inserted within the cylinder head opening and a body portion 46 fitting within the shell portion and connected to the distributing line. The shell portion 45 and it corresponding opening may be tapered if desired and has an orifice 47 designed to disperse and atomize the fuel as it is forced therethrough, the upper edge of the shell being provided with a peripheral flange 48 which rests upon the top of the engine head. The body 46 is held in sealed relation with the shell 45 by means of O-ring 49, and the body is pro-

vided with an axial bore **51** extending therethrough and aligned with an aperture **52** in the distributing line, the latter passing transversely through the upper portion of the body. A boss **53** projects upwardly from the body, and a pair of injector nozzles may be clamped in operative position by a clamping bar **54** drawn downwardly against the bosses by a bolt **55** threaded into the head. It will therefore be seen that the nozzles are exceedingly easy to take apart and clean, since it is only necessary to loosen clamp **54**, lift the nozzle from its seat (the line **32** being of resilient construction), and slip the shell **45** from the body to clean the orifice **47**.

In operation, the fuel supply system will be started by moving switch **41** against starting contact **43** so as to connect pump motor **26** directly to battery **44**. Once the engine is started the switch **41** may be moved to contact **42** and the pump motor **26** supplied with power by generator **16**. The performance of the system under various conditions is discussed in detail in the aforementioned patent and need not be repeated here. Fuel pumped through distributing lines **31** and **32** will pass through the aperture **52** adjacent each nozzle, and through axial bore **51** to orifice **47**, where it will be sprayed under pressure into the corresponding cylinder. When the system is shut down and it is desired to clean or replace the nozzles, appropriate clamps **54** will be loosened and the nozzles lifted from their seats so that shells **45** may be slipped from the body to clean orifices **47**.

Figure 4 shows a modified form of the nozzle which is generally similar to the previous embodiment but in which a particle retention device or filter is incorporated in the construction. The nozzle is generally indicated at **56** and is mounted in an engine block **57** of an internal-combustion engine having a cylinder **58**. The nozzle comprises a shell **59** having a lower tapered portion and an upper cylindrical portion, the lower end of shell **59** having an end wall provided with an orifice **61**. An aperture **62** conforming to the shape of the major portion of shell **59** is provided in engine block **57** adjacent cylinder **58** for the reception of the nozzle. The upper end of shell **59** is provided with an outwardly extending flange **63** which engages the upper surface of engine block **57** through the intermediary of an annular sealing member **64**.

A nozzle body **65** is mounted within the upper cylindrical portion of shell **59**, the body having a lower cylindrical portion and an intermediate shoulder **66** for engagement with flange **63** of shell **59**. An annular groove **67** is provided in body **65** for the reception of a sealing member **68**, this sealing member engaging the inner surface of shell **59**. The upper end of body **65** is provided with a recess **69** for engagement by a clamping bar **71**, shown partially in Figure 4, which holds nozzle **56** in place. Bar **71** may have a shape similar to that of bar **54** in the previous embodiment for engagement with a pair of nozzles. The upper portion of body **65** is further provided with a radial bore **72** which receives a distributing line **73** therethrough. The distributing line is provided with a radial aperture **74** aligned with an axial passageway **75** in body **65**, the lower end of this passageway terminating in a flared opening **76**.

In the illustrated embodiment, a particle retention device or filter **77** is disposed within the tapered portion of shell **59**. This device may be constructed of any suitable material such as compressed woven wire and is capable of retaining foreign particles and other matter which might be injurious to or hamper efficiency of the nozzle. The outer surface of filter **77** is tapered to conform with the inner surface of shell **59**, and the height of the filter is such that it may rest within shell **59** immediately below body **65** and without interfering with the other portions of the nozzle. The upper surface of filter **77** may be hollowed, as shown at **78** in Figure 4, to more effectively transmit the pressurized feel received from tapered lower opening **76** of body **65**.

The operation of the modified form of nozzle shown in Figure 4 will be apparent from the foregoing description. When it is desired to replace or clean the nozzle parts, release of clamping bar **71** will permit lifting of body **65** from shell **59**, conduit **73** being of resilient construction as in the previous embodiment. Shell **59** may then be easily slipped out of aperture **62** in engine block **57**, for replacement or cleaning of the shell or of filter **77**.

While it will be apparent that the preferred embodiments of the invention disclosed are well calculated to fulfill the objects above stated, it will be appreciated that the invention is susceptible to modification, variation and change without departing from the proper scope or fair meaning of the subjoined claims.

What is claimed is:

1. The combination with an internal-combustion engine of a pair of nozzles for injecting fuel into adjacent cylinders thereof; each of said nozzles comprising a shell having an annular side wall adapted to fit within a recess in said engine, a fuel injection orifice at the lower end of said shell, a body portion fitting snugly within said shell, the lower end of said body portion being spaced above said orifice, a radial bore extending through the upper end of said body portion and adapted to receive a fuel distributing line therethrough, an axial passageway leading from said radial bore to the lower end of said body portion, and means for holding said pair of nozzles in place, said holding means comprising a clamping bar having opposite ends engageable with the upper ends of said body portions, and means engageable with an intermediate portion of said bar for drawing the bar toward said engine.

2. The combination with an internal-combustion engine of a pair of nozzles for injecting fuel into adjacent cylinders thereof; each of said nozzles comprising a shell having an annular side wall adapted to fit within a recess in said engine, a fuel injection orifice at the lower end of said shell, a body portion fitting snugly within said shell, a radial bore extending through the upper end of said body portion and adapted to receive a fuel distributing line therethrough, an axial passageway leading from said radial bore to the lower end of said body portion, means for holding said pair of nozzles in place, said holding means comprising a clamping bar having opposite ends engageable with the upper ends of said body portions, and means engageable with said bar for drawing the bar toward said engine.

3. A nozzle for injecting liquid fuel into an engine cylinder, comprising a unitary shell having a tapered annular side wall adapted to be mounted adjacent said cylinder, and end wall at the narrow end of said side wall having a fuel injection orifice therein adapted to lead to said cylinder, a radially extending flange at the outer end of said side wall adapted to rest against a portion of the engine, a tapered body portion fitting snugly within and in releasably sealed relation with said shell, the narrow end of said body portion being spaced above said orifice, a radial bore extending through the wide end of said body portion and adapted to receive a fuel distributing line therethrough, and an axial passageway leading from said radial bore to the narrow end of said body portion.

4. A nozzle for injecting liquid fuel into an engine cylinder comprising a thin-walled shell having a tapered annular side wall adapted to be mounted adjacent said cylinder, a thin end wall at the narrow end of said side wall having a fuel injection orifice therein adapted to lead to said cylinder, a radially extending flange at the outer end of said side wall adapted to rest against a portion of the engine, a body portion having a relatively narrow lower end and a relatively wide upper end fitting snugly within and in sealed relation with said shell, the lower end of said body portion being spaced above said shell end wall, said body portion being normally withdrawable from said shell by relative axial movement, means for clamping said body portion within said shell

to prevent relative movement between said parts, a bore in the wide end of said body portion and adapted to receive a fuel distributing line therein, and a passageway leading from said bore to the narrow end of said body portion.

5. A nozzle for injecting liquid fuel into an engine cylinder, said nozzle comprising a shell having a side wall of annular shape adapted to be mounted adjacent said cylinder, the lower portion of said side wall tapering upwardly and outwardly, the upper portion of said side wall being cylindrical, a fuel injection orifice at the lower end of said shell and adapted to lead to said cylinder, an outwardly extending flange at the upper end of said shell, a body having a cylindrical portion fitting snugly within and in releasably sealed relation with the cylindrical portion of said shell, a shoulder on said body above said last-mentioned body portion engageable with the flange of said shell, a filter of tapered shape disposed within the tapered portion of said shell between the lower end of said body and said fuel injection orifice, a radial bore extending through the upper end of said body and adapted to receive a fuel distributing line therethrough, and an axial passageway leading from said radial bore to the lower end of said body, the lower end of said axial passageway terminating in a downwardly and outwardly flared opening.

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