July 13, 1948. J. F. HOFFER 2,445,269

COMBINED INJECTOR NOZZLE AND FILTER

Original Filed March 1, 1939

Fig. 1.

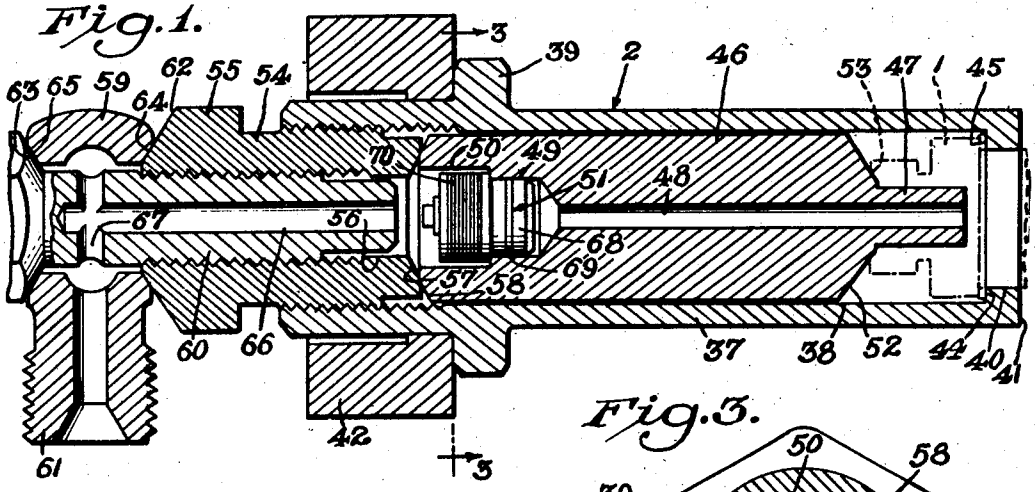


Fig. 3.

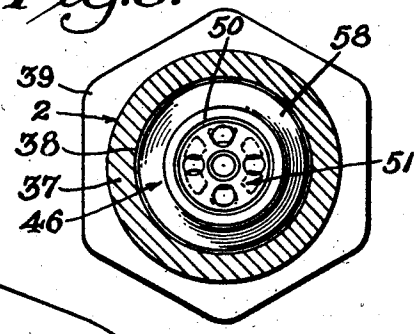


Fig. 2.

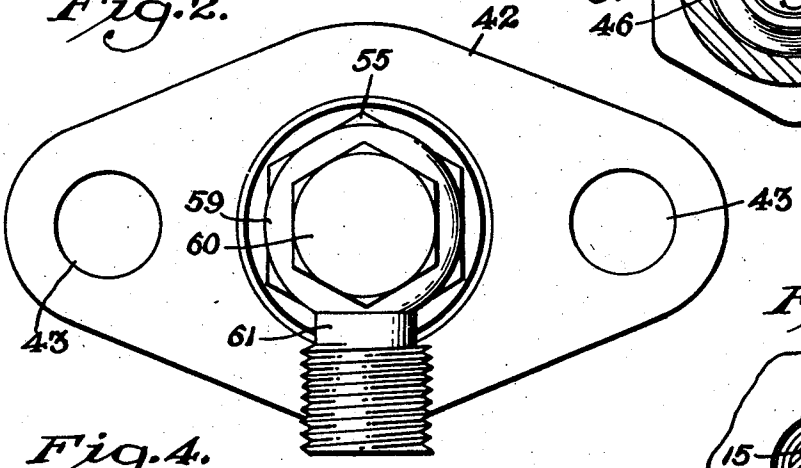


Fig. 5.

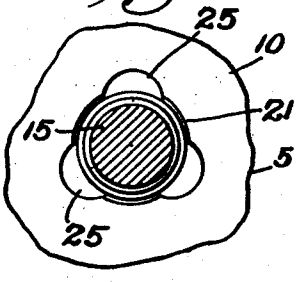
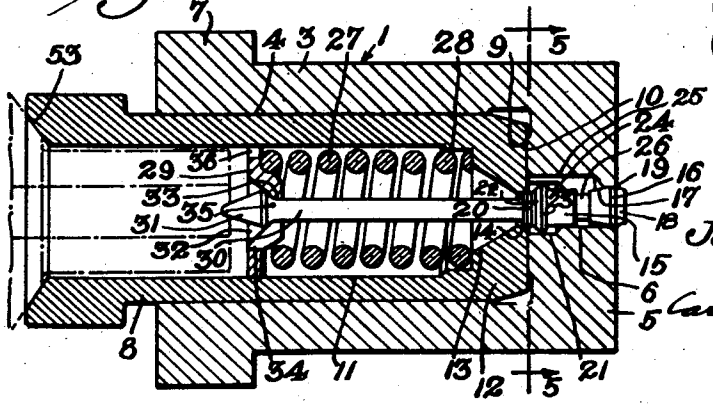


Fig. 4.



Inventor
James F. Hoffer
BY
Carlson, Pitzen, Hubbard & Wolfe
Attorneys.

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COMBINED INJECTOR NOZZLE AND FILTER

James F. Hoffer, Detroit, Mich., assignor to Ex-Cell-O Corporation, Detroit, Mich., a corporation of Michigan

Original application March 1, 1939, Serial No. 259,088. Divided and this application May 6, 1944, Serial No. 534,440

4 Claims. (Cl. 210—164)

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The present invention relates to improvements in nozzles adapted particularly for delivering timed metered injections of liquid fuel in connection with the operation of internal combustion engines.

One of the objects of the invention is to provide a new and improved fuel injection nozzle having a safety oil filter located in proximity to the nozzle tip.

Another object is to provide a novel fuel injection nozzle having a holder which encloses a safety oil filter in the path of the fuel flow to the nozzle tip and in which the filter is secured in position without the use of threads or gasket connections directly with the tip.

Further objects and advantages will become apparent as the description proceeds.

In the accompanying drawings,

Figure 1 is a longitudinal fragmentary sectional view of one form of a nozzle embodying features of the present invention.

Fig. 2 is a left-end view of the nozzle.

Fig. 3 is a transverse sectional view of the nozzle taken along line 3—3 of Fig. 1.

Fig. 4 is an axial sectional view on an enlarged scale of the discharge tip of the nozzle.

Fig. 5 is an enlarged transverse sectional view taken along line 5—5 of Fig. 4.

While the invention is susceptible of various modifications and alternative constructions, I have shown in the drawings and will herein describe in detail the preferred embodiment, but it is to be understood that I do not thereby intend to limit the invention to the specific form disclosed, but intend to cover all modifications and alternative constructions falling within the spirit and scope of the invention as expressed in the appended claims.

Referring more particularly to the drawings, one form of fuel injection nozzle embodying features of the present invention (Fig. 1) comprises a replaceable nozzle unit or tip 1 removably mounted in a holder 2. It will be understood that the nozzle tip 1 is adapted to be clamped or secured by means of the holder 2 to the engine (not shown) at the desired point of injection.

The nozzle tip 1 may be of any suitable character and in the present instance of the type disclosed in my copending application Serial No. 259,088, filed March 1, 1939 (Patent No. 2,351,965), of which the present application is a division.

In the form shown, the tip 1 has a body 3 in the form of a tubular shell which defines an internal bore 4, and which is closed at the discharge end with an end wall 5 having a small discharge bore 6 coaxial with the bore 4. An external peripheral mounting flange 7 is formed on the base end of the body 3.

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Closely fitted within the bore 4 is a valve seat member 8 having an inner end surface 9 in pressure tight engagement with the inner surface 10 of the end wall 5 about the bore 6. The valve seat member 8 is tubular in form to provide an axial passage or bore 11, and projects from the open end of the tip body 3 for fluid tight connection to the source of fuel supply. The inner end of the seat member 8 has an end wall 12 formed with a central opening or bore 13 terminating in an annular valve seat 14.

A pintle 15 extends slidably through the discharge bore 6 and coacts therewith to define a discharge orifice means having suitable fuel discharge characteristics for proper atomization and penetration. The pintle 15 consists of a cylindrical stem which is formed adjacent its outer end portion with a spray control form consisting of a narrow cylindrical area 16 of full pintle diameter, a control cone 17 tapering inwardly from the area 16, and an outer cone 18 tapering outwardly from the area 16. The pintle 15 coacts with the bore 6 to define a single annular discharge orifice 19 and is movable outwardly in the opening movement of the nozzle to obtain a progressively increasing orifice area.

Formed on the inner end of the pintle 15 is an annular valve face 20 adapted for engagement with the stationary seat 14. Also formed on the pintle 15 adjacent the face 20 and movable in a counterbore or chamber 21 in the inner end of the bore 6 is a peripheral rib 22. The rib 22 defines a conical abutment shoulder 23 adapted for engagement with a fixed conical stop shoulder 24 at the end of the counterbore 21 to limit the opening movement of the pintle 15.

A free path of fuel flow from the valve 14, 20 to the orifice 19 is afforded by a plurality of spaced longitudinal passages 25. Formed in the pintle 15 at the inner end of the control cone 17 is an annular groove 26 which serves to effect equalization of the pressure and velocity of the fuel issuing from the passages 25.

A coil compression spring 27 is mounted within the seat member 8 and at one end impinges against the inner surface of the wall 12, and is centered by the end of the bore 11 which is reduced in diameter as indicated at 28. At the other end, the spring 27 impinges against a hanger 29 slidably disposed in the bore 11 and suitably anchored to the pintle 15. In the preferred form,

the pintle 15 is provided with an elongated shank 30 having an enlarged head 31 at its free inner end. The hanger consists of a circular disk having an axially offset portion which serves to center the adjacent end of the spring 27, and which defines an outwardly opening socket 32 having a central opening 33 to receive the shank 30. The opening 33 is larger than the shank 30 to provide clearance permitting limited angular adjustment of the hanger 29 to the end plane of the spring 27. A clearance hole 34 of sufficient size to receive the head 31 intersects one side of the opening 33 to permit assembly of the hanger 29 and the shank 30. When the parts are assembled as shown, the socket 32 is in pilot engagement with an abutment shoulder 35 on the base of the head 31. A plurality of peripherally spaced notches 36 are formed in the hanger disk 29 and supplement the opening 33 to provide an adequate area for unrestricted fuel flow past the hanger.

The holder 2 is adapted to support the nozzle tip 1 in operative position to inject fuel into a combustion chamber (not shown), and to connect the tip to a fuel supply line leading from a suitable fuel source. In the form shown, the holder 2 comprises an outer body or housing 37 which preferably consists of an elongated generally tubular shell having a longitudinal bore 38 and an external peripheral hexagonal mounting flange 39. One end of the body 37 is formed with an inner peripheral flange 40 for holding the nozzle tip 1 and has an end surface 41 adapted to be clamped through a gasket (not shown) against a mating surface (not shown) in the engine cylinder head (not shown) to provide a gas-tight seal. A clamp plate 42 closely encircles the outer end of the body 37 and engages the outer end of the mounting flange 39. The plate 42 is formed at opposite sides of the body 37 with suitable holes 43 through which bolts (not shown) may be inserted to clamp the holder 2 in position.

The mounting flange 7 of the nozzle tip 1 is positioned against the inner surface 44 of the flange 40, a suitable gasket 45 being interposed therebetween, and the tip projects through the flange 40 to extend into the combustion chamber of the engine. Removably inserted into the holder body 37 is a cylindrical filter holder 46 having an axial stem 47 on one end extending into the inner end of the bore 11 of the valve seat member 8, and having an axial bore or passage 48 opening therethrough. The inlet end of the bore 48 is formed with two counterbores 49 and 50 in which a fuel filter 51 is removably mounted. The filter holder 46 is formed on one end at the base of the stem 47 with a conical abutment 52 adapted for fluid-tight engagement with an annular mating surface 53 on the inner end of the valve seat 8 coaxial with the bore 11. A nut 54, with an outer hexagonal head 55 and an axial bore 56 opening therethrough, is threaded into the outer end of the bore 38 of the holder body 37, and is formed on the inner end with a coaxial conical abutment surface 57 in fluid-tight engagement with a mating surface 58 on the filter holder 46. It will be seen that when the nut 54 is tightened, it will clamp the nozzle tip 1 and the filter holder 46 securely in position within the holder 2 while maintaining communication between the alined bores 11, 48 and 56.

High pressure tubing from a fuel injection pump or other fuel source may be suitably connected to the outer end of the nut 54. In the present instance, a hollow fitting 59 is removably

clamped with a pressure-tight seal against the outer end of the nut 54 by a bolt 60 threaded into the outer end of the bore 56. The fitting 59 loosely encircles the shank of the bolt 60, and has a laterally extending threaded nipple 61 adapted to be connected to the tubing. The outer end of the nut 54 and the head of the bolt 60 are formed with opposed coaxial conical abutment surfaces 62 and 63 adapted for pressure-tight engagement with mating surfaces 64 and 65 in opposite sides of the fitting 59. It will be seen that when the bolt 60 is tightened, the fitting 59 will be clamped securely in position. The bolt 60 is formed with an axial bore 66 which opens to the counterbore 50, and which is connected through a plurality of intersecting radial ports 67 in the shank of the bolt to the interior of the fitting 59.

The filter 51 may be of any suitable character, and preferably is of the disk type. In the form shown, the filter 51 comprises a cylindrical body 68 with a seal ring 69 fitted tightly within the counterbore 49. A plurality of filtering disks 70 are clamped in coaxial relation to the body 68 within and in peripherally spaced relation to the counterbore 50.

In operation, fuel supplied from the source passes through the fitting 59, the ports 67, the bore 66, the filter 51, and the bore 48 to the nozzle tip 1. The holder 2 permits the filter 51 to be installed without removing the nozzle tip 1 from the engine. Being mounted directly in the nozzle holder 2, the filter 51 is located close to the tip 1, and requires no threaded connections.

I claim as my invention:

1. A fuel injection nozzle comprising, in combination, a holder having an external cylindrical casing formed in one end with an internal peripheral flange, a nozzle tip removably mounted in said one end of said casing and having an external peripheral flange engaging said first mentioned flange and having an axial inlet bore, a cylindrical filter holder removably inserted in said casing and having an axial stem inserted in said bore, said holder being formed with an axial passage opening therethrough and communicating at the discharge end with said bore and formed with an enlarged stepped counterbore in the inlet end of said passage, a nut threaded into the other end of said casing and serving to clamp said casing, nozzle tip and filter holder rigidly in assembled relation and formed with an inlet passage opening to said counterbore and adapted to be connected to a source of fuel, and a filter removably inserted in said counterbore.

2. A fuel injection nozzle for internal combustion engines comprising, in combination, a holder having an external elongated casing formed in one end with an internal flange, a nozzle tip removably mounted in and projecting from said one end of said casing and having an external peripheral flange engaging said first mentioned flange and an inlet bore, a cylindrical filter holder removably inserted in said casing and formed with an axial passage opening therethrough and communicating with said bore and with an enlarged counterbore in the inlet end of said passage, said inlet end of said passage being adapted to receive fuel from a fuel source, a nut threaded to said casing and serving to clamp said casing, nozzle tip and filter holder rigidly in assembled relation, and a filter removably inserted in said counterbore.

3. A fuel injection nozzle for internal combustion engines comprising, in combination, a

holder having an external elongated casing, a nozzle tip slidably mounted in and projecting from one end of said casing and having a fuel inlet, a filter holder slidably inserted in said casing in separable end to end fluid-tight engagement with said tip and formed with a longitudinal passage opening therethrough and enlarged at one end and communicating with said inlet, means threaded into the other end of said casing into end to end fluid-tight engagement with said filter holder serving to clamp said casing, nozzle tip and filter holder rigidly in assembled relation, and a filter removably inserted in said enlarged end of said passage.

4. A fuel injection nozzle for internal combustion engines comprising, in combination, a holder having an external elongated casing, a nozzle tip slidably mounted in and projecting from one end of said casing and having a fuel inlet, a filter holder slidably inserted in said casing in separable end to end engagement with

said tip and formed with a longitudinal passage opening therethrough and communicating with said inlet, means serving to clamp said casing, nozzle tip and filter holder rigidly in assembled relation, and a filter removably inserted in said passage and comprising a plurality of superimposed filtering disks in the path of fuel flow.

JAMES F. HOFFER.

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