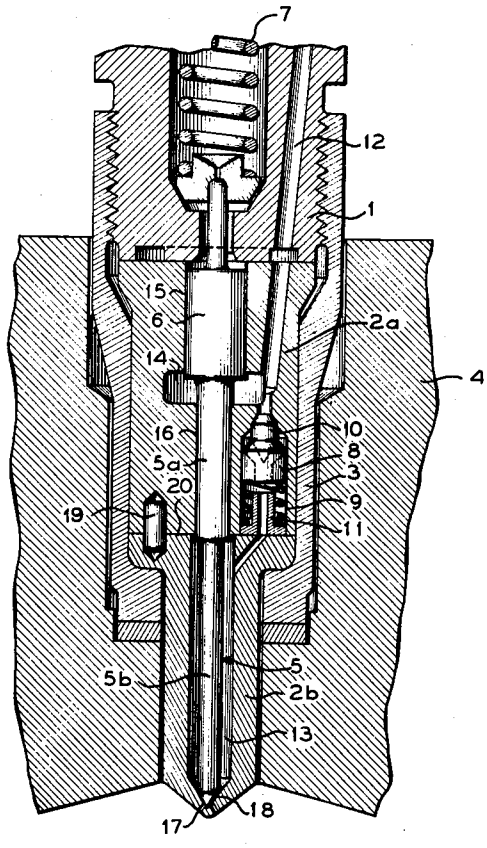
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FUEL INJECTION VALVE

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FUEL INJECTION VALVE

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The present invention relates to fuel injection valves comprising a valve housing assembly and a valve member movable therein with at least one large and one small plunger type portion sealed and guided in the housing assembly and an auxiliary valve at the side of said member. One object of the invention is to produce a fuel injection valve of this type having a reduced diameter so that the fuel injection valve may be disposed in a narrow space in an engine. A further object of the invention is to produce a fuel injection valve of this type in which the portion directly exposed to the combustion heat may be exchanged. A further feature consists in the provision in a fuel injection valve of this type of a separate nozzle tip forming a part of the housing assembly into which the small plunger type portion extends to form the shut-off means for the passage to the nozzle. The separate nozzle tip which extends into the combustion chamber of the engine when the fuel injection valve is fitted thereon is provided with one or more openings for injection of fuel into the combustion chamber controlled by the shut-off means formed by the valve member. Said tip may be carried out so as not to form a guide or seal for the plunger type portions of the valve member which are instead guided and sealed in the remaining part of the valve housing assembly. It is thus possible to carry out said tip from special material and to interchange it without interchanging the valve member or the remaining part of the valve housing assembly which are usually lapped together.

On the accompanying drawing one embodiment of a fuel injection valve according to the invention is illustrated in section by way of example.

The fuel injection valve according to the figure comprises a valve housing assembly formed by three separate parts 1, 2*a* and 2*b* held together by a nut 3 and assembled as a unit into a wall 4 of a combustion chamber, for instance in the cylinder head of a diesel engine. A valve member 5 is movable in the valve housing assembly in conventional manner under the action of the fuel pressure, said valve member comprising a thin portion 5*a*, 5*b* and a plunger type larger portion 6 which is guided and sealed in an enlarged bore 15 in the valve housing assembly. The thin portion 5*a*, 5*b* consists of a thin plunger type portion 5*a* guided and sealed in a smaller bore 16 in the part 2*a* of the valve housing assembly and a still thinner stem 5*b* extending freely into the tip 2*b* of the valve housing assembly and forming the means which definitely shuts off a fuel passage 12, 13 to the nozzle openings 17 in

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the valve housing assembly and which for this purpose cooperate with a valve seat 18 formed close to the nozzle openings 17 in the tip 2*b*. The valve member 5*a*, 5*b*, 6 is actuated in conventional manner by a pressure spring 7 acting to close the valve member against the fuel pressure in the passage through the valve housing assembly and a chamber 14 surrounding the junction between the small and the large plunger portions 5*a* and 6. An auxiliary valve 8 is provided in the part 2*a* of the valve housing assembly in a portion of the fuel passage 12 forming a bore 9 at the side of the small plunger type portion 5*a* of the valve member 5*a*, 5*b*, 6. The auxiliary valve 8 is a check valve which, as illustrated, may be provided with a pressure reducing portion 10, and which may cooperate with a stopper 11 for limiting the valve motion. A pin 19 is provided in the part 2*a* and extends into a suitable bore in the part 2*b* of the valve housing assembly so that said parts can only be assembled in correct position relative to each other with the face 20 of the part 2*b* abutting the end of part 2*a*.

The fuel injection valve above described and illustrated in the drawing should only be considered as an example and the details of the invention may be modified in several different ways within the scope of the claims.

What I claim is:

1. A fuel injection valve comprising a valve housing a portion of which forms a fuel injection nozzle, a fuel injection opening in said nozzle, a fuel supply passage in said housing leading to said opening, at least one bore with large diameter and one bore with small diameter located in a unitary portion of said housing, a unitary main valve member movable in the housing and having a plunger type guiding portion with large diameter forming a fluid tight seal in said large bore, a plunger type guiding portion with small diameter forming a fluid tight seal in said small bore and a stem extending from said small diameter portion for controlling said opening, and an auxiliary valve in the housing disposed in said passage at one side of said plunger type guiding portion with small diameter.

2. A fuel injection valve as defined in claim 1, in which said auxiliary valve is a non-return valve opening towards the nozzle opening and in which a chamber is provided in the housing at the junction of the large and small diameter bores, which chamber communicates directly with the fuel supply passage on the side of the auxiliary valve remote from the injection opening.

3. A fuel injection valve as defined in claim 1, in which the portion forming the nozzle comprises a part separate from the unitary portion of the valve housing in which said bores are located and said auxiliary valve is disposed in said unitary portion.

4. A fuel injection valve comprising a valve housing, a portion of which forms a fuel injection nozzle, a fuel injection opening in said nozzle portion, a fuel passage leading through said valve housing to said opening, a main valve member in the valve housing movable from closed to open position under the action of fuel pressure in said passage and provided with at least one plunger type portion with large diameter and one plunger type portion with smaller diameter and a stem forming shut off means for controlling the passage to the nozzle opening, one bore with large diameter and one bore with smaller diameter in the housing, in which bores said plunger type portions form fluid tight seals, and a non-return auxiliary valve in the passage disposed in the housing at one side of said small bore closely adjacent to said bore and utilizing the space in a portion of the housing laterally of the small bore and enabling said portion and the portion of the housing laterally of the large bore to be carried out with minimum diameter.

5. A fuel injection valve comprising a valve housing, a first portion of said housing provided with one bore with large diameter and one bore with smaller diameter, a second portion of the housing separate from said first portion and forming a fuel injection nozzle, a fuel injection opening in said nozzle portion, a fuel passage leading through said valve housing to said opening, a main valve member in the valve housing movable from closed to open position under the action of fuel pressure in said passage and provided with at least one plunger type portion with large diameter forming a fluid tight seal in said large bore and one plunger type portion with smaller diameter forming a fluid tight seal in said small bore and a stem forming shut off means for controlling the passage to the nozzle opening, and a non-return auxiliary valve in the passage assembled into the first portion of the housing from an end face abutting the second portion and disposed at one side of the small bore in said portion closely adjacent to said bore to utilize the space in the housing laterally of the small bore.

6. A fuel injection valve comprising a valve housing, a first portion of said housing provided with one bore with large diameter extending from one end of said portion into the housing and with one bore with smaller diameter extending from the opposite end of said portion into the housing coaxially with said large bore, a second portion of the housing formed as a piece separate from said first portion and having a face abutting the end of said first portion into which said small bore extends and forming a fuel injection nozzle, a fuel injection opening in said nozzle portion, a fuel passage leading through said valve housing

to said opening, a main valve member in the valve housing movable from closed to open position under the action of fuel pressure in said passage and provided with at least one plunger type portion with large diameter forming a fluid tight seal in said large bore and one plunger type portion with smaller diameter forming a fluid tight seal in said small bore and a stem forming shut off means for controlling the passage to the nozzle opening, and an auxiliary valve in the passage assembled into the first portion of the housing from the end face abutting the second portion and disposed at one side of the small bore in said first portion closely adjacent to said bore to utilize the space in the housing laterally of the small bore.

7. A fuel injection valve comprising a valve housing, a first portion of said housing provided with one bore with large diameter extending from one end of said first portion into the housing and with one bore with smaller diameter extending from the opposite end of said first portion into the housing coaxially with said large bore and a chamber in said first portion uniting said large and small bores, a second portion of the housing formed as a piece separate from said first portion and having a face abutting the end of said first portion into which said small bore extends and forming a fuel injection nozzle, a fuel injection opening in said nozzle portion, a fuel passage leading through said valve housing to said opening and communicating at one point with said chamber, a main valve member in the valve housing movable from closed to open position under the action of fuel pressure in said passage and provided with at least one plunger type portion with large diameter forming a fluid tight seal in said large bore and one plunger type portion with smaller diameter forming a fluid tight seal in said small bore and a stem forming shut off means for controlling the passage to the nozzle opening, and an auxiliary valve in the passage between said point communicating with the chamber and the nozzle opening and assembled into the first portion of the housing from the end face abutting the second portion and disposed at one side of the small bore in said first portion closely adjacent to said bore to utilize the space in the housing laterally of the small bore.

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