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F. ROCHEFORT

FUEL INJECTION DEVICE FOR INTERNAL COMBUSTION ENGINES

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Fig.1.

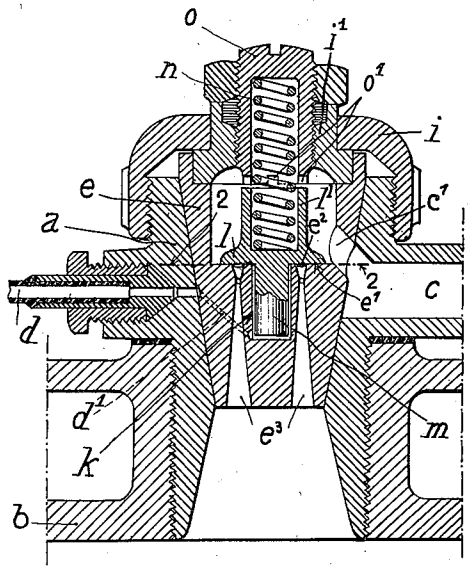
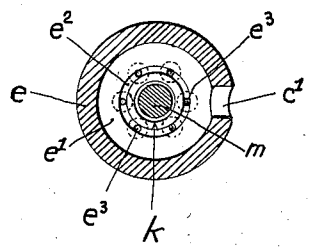


Fig.2.



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FUEL-INJECTION DEVICE FOR INTERNAL-COMBUSTION ENGINES.

Application filed December 20, 1924, Serial No. 757,170, and in France December 28, 1923.

My present invention relates to fuel injection devices for internal combustion engines, of the type in which the pressure of the liquid itself is utilized for lifting from its seat the fuel injection valve or the like, which forms likewise the valve for the compressed air or gas serving for the diffusion of the liquid fuel, by the pressure of the liquid fuel acting upon a piston connected to the said valve.

My invention more particularly relates to fuel injection devices of the type described and shown in my application for United States Letters Patent, filed April 30, 1923, Serial No. 635,788, in which the liquid fuel is admitted by a passage of very small sectional area, between the cylindrical external surface of this piston and the cylindrical bore in which the said piston is displaceable, so as to obtain a constant sectional area of passage for the liquid fuel, with a view to ensure its mechanical lamination before its mixture with the diffusion air or gas under pressure, whatever be the quantity of liquid fuel admitted,—the said lamination of the liquid fuel being thus maintained whatever be the lift of the piston.

According to my present invention, this passage of constant sectional area for the liquid fuel consists of an accurately gauged annular clearance space of small and constant cross sectional area provided between the cylindrical external surface of the piston and its cylindrical lodgment in the valve-casing.

The accompanying drawing represents by way of example one form of construction in accordance with my invention.

Fig. 1 is a vertical axial section through the injection device, and

Fig. 2 a horizontal section on line 2—2 of Fig. 1.

As shown, a is the body of the injector, adapted to be secured by a screwthread to the cylinder head b of the engine. The body a receives on one side the end c of the compressed air supply pipe, and, on the other side, the end d of the pipe supplying liquid fuel under pressure. The body a comprises a conical recess, in which is located a valve casing e, held in place by a ring nut i, screwed upon the body a and bearing upon a member i^2, in turn bearing upon the valve casing e.

In the valve casing e is arranged a valve body consisting of a flat-seated valve l, fast with a cylindrical member or piston m, located in a cylindrical bore k provided in the valve casing e. The external diameter of this piston m and the internal diameter of the bore k are such as to provide an accurately gauged annular clearance between the external cylindrical surface of the piston m and its cylindrical lodgment k in the casing e.

The stem l^1 of the valve body l is bored to receive the spring n, which bears at one end upon the bottom of the hollow stem of the valve and, at the other end, upon a tubular plug o, screwed in the member i^1 and which serves at the same time as a stop for the valve-stem l^1 for the purpose of limiting the lift of the valve l. Notches o^1, provided in the lower end of the tubular plug o, allow the compressed air, admitted through c and an opening c^1 in the valve casing e, always to exert its pressure upon the whole surface of the valve l, so as to ensure, together with the spring n, rapid closing of this valve.

Liquid fuel is supplied from d through the port d^1 beneath the piston m. Under the pressure of the fuel delivered by the injection pump (not shown), the piston m is lifted, raising with it the valve l which is raised from its flat seating e^1; the liquid fuel is discharged through the very small but accurately calibrated clearance provided between the cylindrical piston m and bore k, and passes, in the form of a thin film, between the flat valve l and its seat e^1; the compressed air, at the same time admitted through c c^1, and the space between the valve l and its seat e^1, in the form of a thin film, meets with the said fuel and mixes therewith in an annular chamber, consisting of a circular groove e^2 recessed in the seat e^1 of the valve, between the inlets of air and fuel controlled by the said valve. The mixture thus formed passes through convergent-divergent nozzle e^3, arranged symmetrically to the axis of the valve and opening into the annular mixing chamber e^2; these nozzles e^3 discharge into the engine cylinder, so as to increase the speed of the mixture and to distribute this fuel mixture upon a greater area in the engine cylinder.

By the above described arrangement, there is obtained a thorough atomization of the liquid fuel and diffusion air or gas and a thorough mixture of the same.

What I claim is:

1. A fuel injection device for internal com-

bustion engines, comprising a body, separate inlet passages in said body for fuel and gas supplied under pressure, a single valve member arranged to control passage through the body of both fuel and gas under pressure by its displacement relatively to the body, a piston connected to said valve member, a cylindrical bore in the body for receiving the piston, the piston having an external diameter slightly less than the internal diameter of the bore in the body so as to provide an accurately gauged annular clearance space of small and constant cross sectional area between the cylindrical external surface of the piston and the cylindrical bore in the body member, means establishing communication between said fuel inlet and said bore whereby said piston together with the valve member is moved relatively to said body through pressure exerted on said piston by the fuel to thus allow passage of fuel and gas under pressure through the body, and means for moving the valve member with the associated piston in the opposite direction for cutting off the flow of fuel and gas under pressure.

2. A fuel injection device for internal combustion engines, comprising a body, separate inlet passages in said body for fuel and gas supplied under pressure, a valve seat, a single valve member closing on the seat and arranged to control passage through the body of both fuel and gas under pressure by its displacement relatively to the body, a piston connected to said valve member, a cylindrical bore in the body for receiving the piston, the piston having an external diameter slightly less than the internal diameter of the bore in the body so as to provide an accurately gauged annular clearance space of small and constant cross sectional area between the cylindrical external surface of the piston and the cylindrical bore in the body member, said body being formed with an annular mixing chamber for the liquid fuel and gas under pressure positioned in the valve seat communicating with the engine cylinder, means establishing communication between said fuel inlet and said bore whereby said piston together with the valve member is moved relatively to said body through pressure exerted on said piston by the fuel to thus allow passage of fuel and gas under pressure through the body, and means for moving the valve member with the associated piston in the opposite direction for cutting off the flow of fuel and gas under pressure.

3. A fuel injection device for internal combustion engines, comprising a body, separate inlet passages in said body for the fuel and gas supplied under pressure, a valve member arranged to control passage through the body of both fuel and gas under pressure by its displacement relatively to the body, a piston connected to said valve member, a cylindrical bore in the body for receiving the piston, the piston having an external diameter slightly less than the internal diameter of the bore in the body member so as to provide an accurately gauged annular clearance space between the cylindrical external surface of the piston and the cylindrical bore in the body, the valve member having a flat portion for controlling both the flow of the gas under pressure and of the liquid fuel passing through the accurately gauged annular clearance space, means establishing communication between said fuel inlet and said bore whereby said piston together with the valve member is moved relatively to said body through pressure exerted on said piston by the fuel to thus allow passage of fuel and gas under pressure through the body, and means for moving the valve member with the associated piston in the opposite direction for cutting off the flow of fuel and gas under pressure.

4. A fuel injection device for internal combustion engines, comprising a body, separate inlet passages in said body for the fuel and gas supplied under pressure, a valve seat, a valve member closing on the seat and arranged to control passage of both fuel and gas under pressure through the body by its displacement relatively to the body, a piston connected to said valve member, a cylindrical bore in the body for receiving the piston, the piston having an external diameter slightly less than the internal diameter of the bore in the body so as to provide an accurately gauged annular clearance space between the cylindrical external surface of the piston and the cylindrical bore in the body, means establishing communication between said fuel inlet and said bore whereby said piston together with the valve member is moved relatively to said body through pressure exerted on said piston by the fuel to thus allow passage of fuel and gas under pressure through the body, and means for moving the valve member with the associated piston in the opposite direction for cutting off the flow of fuel and gas under pressure, and convergent-divergent body outlet nozzles arranged symmetrically of the axis of the valve member, opening into the valve seat, and arranged to discharge directly into an engine cylinder.

In testimony whereof I have signed my name to this specification.

FRANÇOIS ROCHEFORT.