

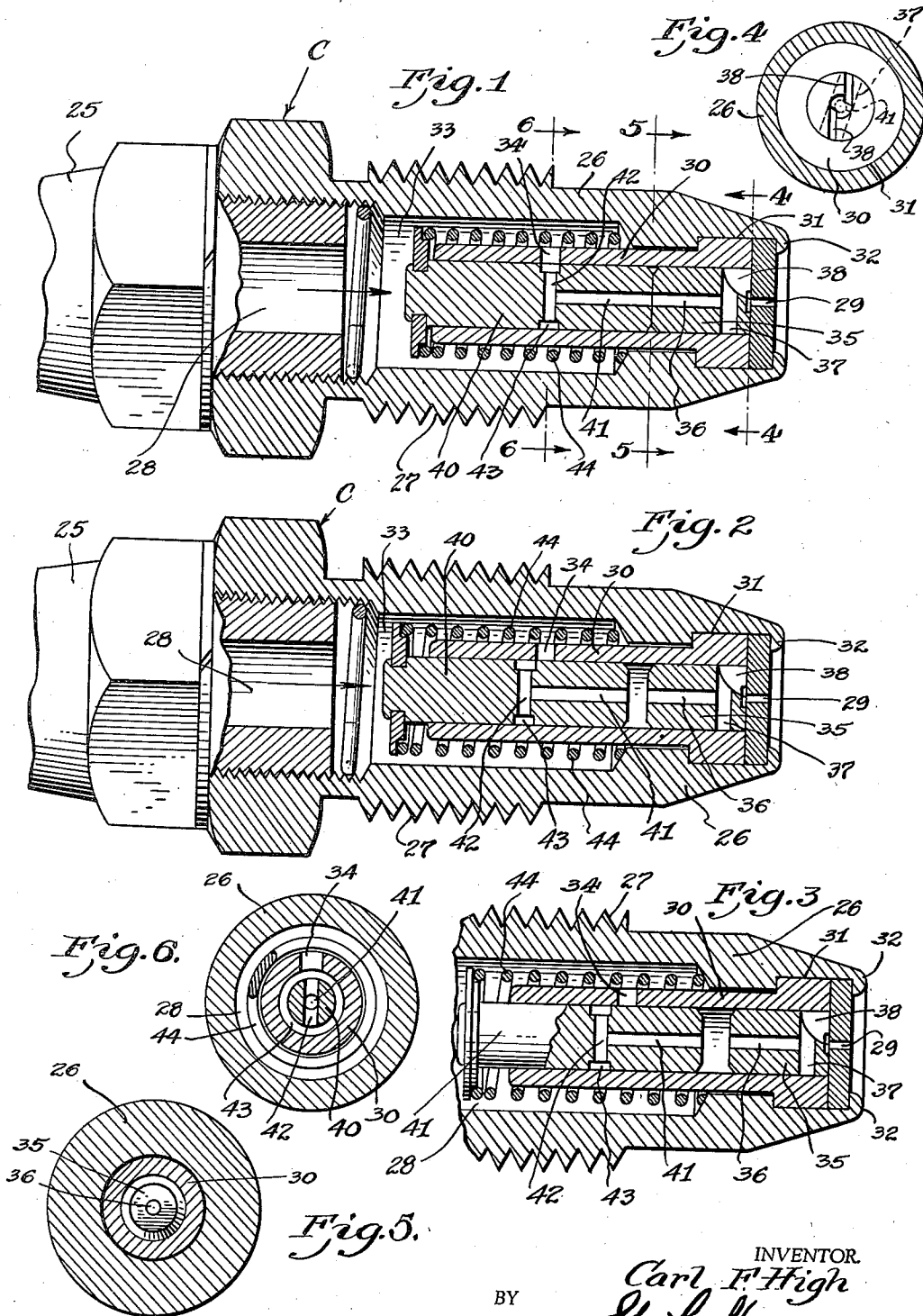
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FUEL INJECTOR AND FUEL JET CONSTRUCTION

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FUEL INJECTOR AND FUEL JET
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My invention relates to a fuel injecting device and more particularly to a system embodying means which intermittently introduces fuel under pressure to an injecting device provided with an improved fuel jet control means.

In the conventional type fuel injecting devices it is difficult to positively control fuel flow to the discharge jet, particularly when the fuel in the system is subjected only to relatively low pressure. It is difficult to accurately control the beginning and ending of fuel discharges with such devices as are now on the market.

An object of my present invention is to overcome the difficulties aforesaid by providing a fuel injector device, associated with a fuel supply system which intermittently supplies fuel under pressure thereto, which incorporates an improved valve means responsive in its operation to fuel pressure and which is freely operable to positively control fuel flow to the engine.

Another object of my present invention is to provide an improved fuel injecting device particularly suitable for association with a low pressure fuel injection system by providing a free floating piston valve operable in response to fuel pressure for controlling flow of fuel to the discharge jet of the device.

A further object of my present invention is to provide a fuel injecting device of economical construction and positive action by constructing same with an internal valve means consisting of a free floating piston valve operable in response to fuel pressure to open the valve and operable in response to spring pressure to yieldingly close the valve and to thereby positively cut off the fuel injection when the fuel pressure in the supply line is relieved.

Still further objects of the invention relate to various features of construction and assembly of the injecting device in conjunction with a fuel supply system having incorporated therewith a fuel injector having a fuel pump which is operable to intermittently supply fuel under pressure thereto.

For a more detail understanding of my invention, reference may be had to the accompanying drawing illustrating in detail an embodiment of my invention in conjunction with a fuel supply system of an internal combustion engine, in which drawing like characters refer to like parts throughout the several views, and in which:

Fig. 1 is a longitudinal detail sectional view through a fuel injecting device illustrating the

valve construction in detail and showing the valve in an open position.

Fig. 2 is a similar detail sectional view showing the valve in the position, when same just closes,

Fig. 3 is a similar fragmentary sectional view illustrating another position of the valve and showing the same urged outwardly of the valve cylinder in a position tending to create a suction pressure on the fuel adjacent the discharge jet to minimize leakage of the fuel through said jet at the end of injection,

Fig. 4 is a transverse sectional view on the line 4-4 of Fig. 1 and showing the details of the fuel jet construction,

Fig. 5 is a transverse sectional view on the line 5-5 of Fig. 1, and

Fig. 6 is a transverse sectional view on the line 6-6 of Fig. 1 showing the valve porting.

My improved fuel jet may be used with a fuel injection system associated with an internal combustion engine.

It will be noted that these fuel injecting devices C may, if desired, be suitably attached directly to a fuel injector, or may be suitably connected to a union 25 when same is remotely associated with a fuel injector. The union 25 preferably is suitably connected to a source of fuel supply that is intermittently subjected to pressure.

The fuel injecting device particularly illustrated in Figs. 1 to 6 inclusive, comprises a casing 26 having external threads 27 by which same may be suitably assembled to an engine, and is provided with a fuel intake 28 and a fuel discharge jet 29. Said casing carries a valve cylinder 30 which is preferably constructed of a separate piece fitted within the counter-bore 31 of the casing 26 and secured in place by peening over the casing end as at 32. The valve cylinder 30 which is thus fixed or permanently secured in the casing is secured inwardly thereof in the large chamber 33 within the casing 26, and is provided with an inlet port 34 which is in open communication with the intake 28.

A fuel jet mixture 35 is tightly fitted into the outer end of the valve cylinder 30 and is preferably constructed with suitable fuel passages communicating with the discharge jet 29. These fuel passages consist of a central passage 36 extending longitudinally of the fixture 35 and communicating with a transverse passage 37 extending substantially normal to passage 36. The radial slots 38 are machined in the outer end of fixture 35 and these slots communicate with the

transverse passage 37 and serve as a passageway for conducting fuel to the discharge jet 29, said slots 38 being preferably constructed to extend substantially tangentially with respect to the discharge jet 29. Thus the fuel introduced to the discharge jet is induced to swirl and results in finely atomizing the fuel as same is discharged through the discharge jet 29.

Valve means are associated with this injecting device for controlling the flow of fuel from the intake 28 to the discharge jet 29. This valve means comprises in general a piston valve 40, which is operable within the valve cylinder 30 and is provided with a central longitudinal passage 41 connecting with passage 36 in the fixture 35. This passage 41 communicates with a transverse passage 42 extending substantially radial of the piston valve, the transverse passage 42 openly connecting with the annular groove 43 on the external cylindrical surface of the piston valve 40.

Normally when the injecting device is associated with a fuel supply line in which no fuel is being introduced under pressure, the piston valve 40 will assume a closed position substantially like that illustrated in Fig. 2, the piston valve being urged outwardly of the piston cylinder by the spring 44 to thus carry the annular groove 43 out of registration with the inlet port 34.

Responsive to fuel pressure in the fuel supply line, the piston valve 40 is caused to move inwardly of the valve cylinder until same abuts the discharge jet fixture 35 which serves as a "stop," that limits the travel of the piston valve inwardly of the valve cylinder. The fuel pressure urges the piston valve into the position shown in Fig. 1 and the fuel is free to flow to the discharge jet 29 because the valve passages 41, 42 and 43 are placed in open communication with the inlet port 34 of the valve cylinder. Thus, during the entire discharge stroke of the fuel pump illustrated in Fig. 8, the column of fuel is moved through the supply line, through the chamber 33, cylinder port 34, valve passages in the valve and fuel jet device 35, and to the discharge jet 29.

Immediately when the fuel pressure is relieved in the fuel supply line, due to the fact that the fuel pump has ended its discharge stroke, the pressure urging the piston valve inwardly of the valve cylinder is relieved, permitting the spring 44 to move the valve away from the "stop" to close the port 34, thus cutting off the flow of fuel to the discharge jet.

It will be observed that the momentum of the valve 41 is such as to cause the same to go beyond the position shown in Fig. 2 to the one shown in Fig. 3 and since the port 34 is closed during this travel of the piston valve, it will be noted that the piston tends to create a suction pressure on the fuel in the system intermediate the valve and discharge jet 29. This suction pressure tends to suck in the fuel in the discharge end of the discharge jet and to thus minimize leakage of fuel through said discharge jet at the end of fuel injection. It will thus be observed that I have provided a positively actuated cut-off means for ending fuel injection.

It will be noted that the piston valve 40 as herein illustrated is of the free floating type. The valve is relatively closely fitted into the valve cylinder but is free to move longitudinally or axially thereof. The piston valve thus has a close sliding fit in the valve cylinder and this fit is sufficient to prevent leakage of any fuel by the

valve when the engine is idle or when there is no pressure being applied to the fuel in the supply line. Immediately, when pressure is introduced to the fuel in the supply line, the free floating piston valve is moved into abutment with the "stop" 35 thus opening the port 34. The injection of fuel takes place only when there is pressure in the fuel supply line. The action of the injecting device described above effects a sharp cut-off of fuel spray through the discharge jet because of the suction pressure on the fuel adjacent this discharge jet, when the valve is closed.

It will be understood that the present construction embodies a minimum number of parts, and is one which can be economically manufactured and serviced, since there are no complicated connections or cam structures in the valve assembly. The present fuel spraying and injecting device is particularly suited for a low pressure fuel injecting system, and especially one which particularly embodies an intermittently acting fuel pump.

Although I have illustrated but one form of my invention and have described in detail but a single application thereof, it will be apparent to those skilled in the art to which my invention pertains, that various modifications and changes may be made therein without departing from the spirit of my invention or from the scope of the appended claims.

I claim:

1. In a fuel injecting device, a casing having a fuel discharge jet and a fuel intake means, a unitary valve assembly secured in said casing comprising a valve cylinder having a fuel inlet port in the cylinder wall communicating at all times with the fuel intake means, a cylindrical piston valve supported for movement axially of said cylinder to control said fuel inlet port, an outlet fixture secured in the end of said valve cylinder adjacent the discharge jet and acting as a piston locating device for limiting the travel of said valve in one direction, means moving said valve into abutment with said outlet fixture in response to fuel pressure produced in the fuel intake means to open the fuel port, and spring means yieldingly engaging said piston valve and yieldingly urging said valve away from said outlet fixture to close said port, said outlet fixture having fuel passages communicating with the discharge jet, said piston valve having a central longitudinal bore communicating with the fuel passages in said outlet fixture and a lateral port registering with said cylinder fuel inlet port when said piston valve is moved inwardly of the cylinder into abutment with said outlet fixture.

2. A fuel spraying and atomizing device including a casing having a fuel intake means and a fuel discharge jet, means connecting said intake means with a source of fuel supply that is intermittently subjected to pressure, and valving means supported within said casing and including a valve cylinder having an inlet communicating at all times with the casing intake means, and a free floating piston valve operable in said valve cylinder in response to fuel pressure, said piston having a longitudinal axial bore extending in axial alignment with the discharge jet and at least one radial fuel inlet passage constructed and arranged to openly connect said piston bore with the valve cylinder inlet when the piston is subjected to pressure to place said fuel discharge jet in open communication with said casing fuel intake means.

3. A fuel injecting device for an engine and comprising a casing provided with a fuel intake means and a fuel discharge jet member, and a unitary valve means supported within said casing and including a fixed valve cylinder having a central cylindrical axial bore and abutting said fuel discharge jet member and having an inlet constructed in open communication with the casing fuel intake means, an outlet fixture in said axial bore and abutting said discharge jet member, and a free floating piston valve operable in said valve cylinder bore in response to fuel pressure in said casing, said valve and outlet fixture having axially aligned longitudinal bores aligned with the discharge jet, said piston valve having at least one radial fuel inlet passage constructed and arranged to openly connect said piston bore with the valve cylinder inlet when the piston is subjected to pressure to place said fuel discharge jet in open communication with said casing fuel intake means.

4. A fuel injecting device for an engine and comprising a casing provided with a fuel intake means and a fuel discharge jet member, and a unitary valve means supported within said casing and including a fixed valve cylinder having a central cylindrical axial bore and abutting said fuel discharge jet member and having an inlet constructed in open communication with the casing fuel intake means, an outlet fixture in said axial bore and abutting said discharge jet member, and a free floating piston valve operable in said valve cylinder bore in response to fuel pressure in said casing, said valve and outlet fixture having axially aligned longitudinal bores aligned with the discharge jet, said piston valve having at least one radial fuel inlet passage constructed and arranged to openly connect said piston bore with the valve cylinder inlet when the piston is

subjected to pressure to place said fuel discharge jet in open communication with said casing fuel intake means, said outlet fixture fixedly secured in said valve cylinder bore and cooperating with said piston valve to limit the travel of said valve when subjected to pressure to locate said valve in order to align the valve fuel inlet passage with the valve cylinder inlet.

5. A fuel injecting device for an engine and comprising a casing provided with a fuel intake means and a fuel discharge jet member, and a unitary valve means supported within said casing and including a fixed valve cylinder having a central cylindrical axial bore and abutting said fuel discharge jet member and having an inlet constructed in open communication with the casing fuel intake means, an outlet fixture in said axial bore and abutting said discharge jet member, and a free floating piston valve operable in said valve cylinder bore in response to fuel pressure in said casing, said valve and outlet fixture having axially aligned longitudinal bores aligned with the discharge jet, said piston valve having at least one radial fuel inlet passage constructed and arranged to openly connect said piston bore with the valve cylinder inlet when the piston is subjected to pressure to place said fuel discharge jet in open communication with said casing fuel intake means, said outlet fixture fixedly secured in said valve cylinder bore and cooperating with said piston valve to limit the travel of said valve when subjected to pressure to locate said valve in order to align the valve fuel inlet passage with the valve cylinder inlet, and spring means operatively connected with said piston valve and operable to retract said piston valve and close off communication between the valve radial fuel inlet passage and said valve cylinder inlet.

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