June 26, 1945. H. F. HAINES 2,379,399

FUEL INJECTOR

Original Filed July 5, 1941

Fig. 1.

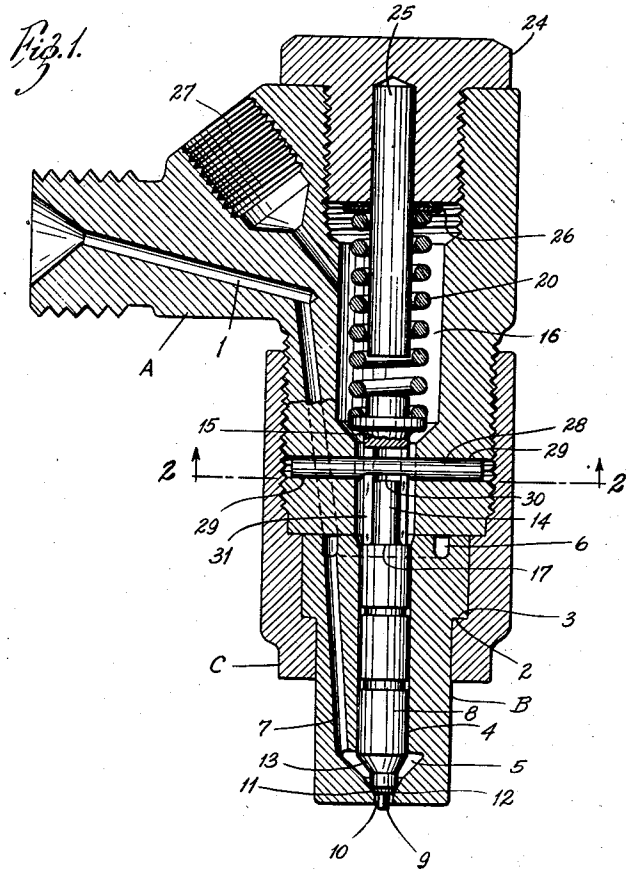
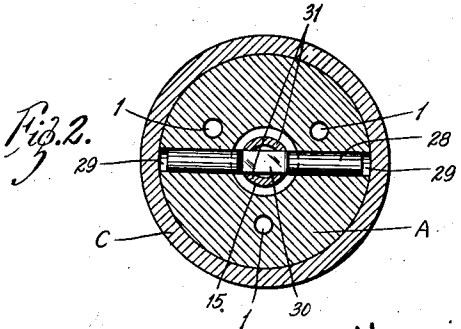


Fig. 2.



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FUEL INJECTOR

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Original application July 5, 1941, Serial No. 401,233. Divided and this application April 27, 1944, Serial No. 532,997

5 Claims. (Cl. 299—107.6)

The subject matter hereof is divided out of my copending application Serial No. 401,233, filed July 5, 1941, for patent for Fuel injector and which became Patent No. 2,358,494.

This invention relates to fuel injectors for compression ignition engines, and more particularly to fuel injectors of the type having a spring-loaded valve that is opened hydraulically by the fuel pressure. The invention has for its principal object to improve the means for limiting the opening movement or lift of the valve and the means for transmitting the end thrust between the valve and valve spring. Other objects are simplicity, cheapness and durability of construction and compactness of design. The invention consists in the fuel injector and in the construction, combinations and arrangements of parts hereinafter described and claimed.

In the accompanying drawing, which forms part of this specification and wherein like symbols refer to like parts wherever they occur,

Fig. 1 is a central longitudinal section through a fuel injector embodying my invention; and

Fig. 2 is a transverse section on the line 2—2 in Fig. 1.

In the accompanying drawing, my invention is shown embodied in a fuel injector for an internal combustion engine of the Diesel type. The injector comprises a nozzle holder A having a fuel inlet or supply passageway 1 that leads inwardly through one side of said holder and thence downwardly through the lower end thereof. The cylindrical nozzle or jet element B of the injector is rigidly secured to the lower end of the holder A by means of a sleeve nut C that is threaded on said end and has an internal annular shoulder 2 adapted to bear against the external annular shoulder 3 on said nozzle and thus rigidly clamp the same in endwise abutting relation to the holder. The nozzle B has an axial bore 4 extending therethrough that is enlarged adjacent to its lower end to form a chamber 5; and communication is established between the fuel inlet or supply passageway 1 and said chamber through an annular groove 6 in the upper end of said nozzle and one or more passageways 7 leading from said groove to said chamber.

Reciprocable in the bore 4 of the nozzle B is a cylindrical plunger 8 which terminates at its lower end in a pin 9 that cooperates with the lower end of said bore to form an annular discharge orifice 10. The plunger 8 is provided just above the pin 9 with an annular valve portion or element 11 adapted to cooperate with an annular valve seat 12 in the chamber 5 and thus prevent flow of fuel through the annular discharge orifice 10. The plunger also has a conical portion 13 located in the chamber 5, whereby the plunger is adapted to be forced upwardly in the nozzle to lift the valve 11 off its seat by the hydraulic pressure of the fuel on said conical portion.

The plunger 8 has its upper end reduced to form a stem portion 14 upon which is supported an end thrust member or thimble 15 located in the lower end portion of a bore 16 that extends through the holder A from top to bottom thereof in axial alinement with the axial bore of the nozzle B. The lower end of the thimble 15 seats on the annular shoulder 17 formed by the reduced upper end or stem portion 14 of the plunger 8; and the upper end of the stem receiving bore of said thimble is spaced above the upper end of said stem. The plunger 8 is snugly guided in the axial bore 4 of the nozzle B and an annular clearing space is provided between the thimble 15 and the bore 16 of the nozzle holder A. The bore 16 of the holder A is enlarged above the thimble 15 to receive a coil compression valve closing spring 20. The thrust member or thimble 15 has its upper end reduced to form an annular shoulder or seat 23 for the lower end of the valve closing spring. The upper end of the spring receiving bore 16 is closed by a threaded plug 24, which forms a seat for the upper end of the valve spring 20; and this plug has an axially extending pin 25 depending therefrom which extends downwardly through the spring 20 and serves as a guide therefor. Shims 26 are disposed between the upper end of the spring 20 and the lower end of the plug 24, whereby the pressure of said spring may be regulated or adjusted. The holder A has a passageway 27 therein leading from the spring receiving bore 16, the purpose of this passageway being to return to the fuel service or supply tank (not shown) for the injector any fuel that may leak past the plunger 8 into said bore.

The upper end of the stem 14 of the plunger 8 abuts against a hardened steel pin 28 that extends across a diameter of the thrust thimble receiving portion of the spring receiving bore 16 of the nozzle holder A with its ends tightly fitted in diametrically opposed holes 29 provided therefor in said holder. The stop pin 28 is slabbed off on its underside to provide a flat abutment surface 30 for the upper end of the stem 14 of the plunger 8. The distance between the upper end of the stem 14 of the plunger 8 and the flat stop

surface 30 on the underside of the stop pin 28 represents the lift or opening movement of the valve. The spring thrust thimble 15 is bifurcated, as at 31, to straddle the stop pin 28 and to permit axial movement of said thimble relative thereto.

By the arrangement described, the valve element 11 of the plunger 8 is held in closed position by the pressure of the lower end of the spring-pressed thimble 15 on the annular shoulder 17 formed on said plunger by the stem 14 thereof. The nozzle is opened by the pressure of the fuel on the conical portion 13 of the plunger, which pressure forces the plunger upwardly against the pressure of the spring 20, thereby lifting the valve element 11 of said plunger off its seat and permitting the fuel to escape through the annular discharge orifice 10. The lift or opening movement of the valve element 11 of the plunger terminates when the upper end of the stem 14 thereof abuts against the flat abutment surface 30 on the underside of the stop pin 28.

What I claim is:

1. A fuel injector comprising a body having a bore with a fuel discharge orifice at the outer end thereof, a plunger reciprocable in said bore and having a valve element cooperating with said discharge orifice, means in said bore cooperating with said plunger for yieldably holding the valve element thereof in position to close said discharge orifice, and a stop pin secured in said body and extending across said bore inwardly of the inner end of said plunger for positively limiting the inward movement of said plunger and the lift of the valve element thereof.

2. A fuel injector comprising a body having a bore therein terminating at its outer end in a fuel discharge orifice, a plunger reciprocable in said bore and having a valve element cooperating with said orifice, a thimble supported on the inner end of said plunger, a spring in said body for holding said thimble in endwise abutting relation to said plunger and the valve element of said plunger in position to close said discharge orifice, and a stop pin extending across said bore inwardly of the inner end of said plunger for positively limiting the inward movement of said plunger and the lift of the valve element of the latter, said thimble being slotted longitudinally to accommodate said stop pin and to permit said thimble to move axially with said plunger relative to said stop pin.

3. A fuel injector comprising a body having a bore therein terminating at its outer end in a fuel discharge orifice, a plunger reciprocable in said bore and having a valve element cooperating with the discharge orifice thereof, the inner end of said plunger having a stem portion of reduced diameter forming an inwardly facing annular shoulder on said plunger, a thimble mounted on said stem portion, a spring in said bore for holding said thimble in endwise abutting relation to said annular shoulder and the valve element of said plunger in position to close said discharge orifice, said thimble having diametrically opposed openings therein, and a stop pin secured in said bore and extending from side to side thereof through the openings in said thimble and across the inner end of said stem portion for limiting the inward movement of said plunger and the lift of the valve element of the latter.

4. A fuel injector comprising a holder having a bore opening through one end thereof, a nozzle secured to said end of said holder and having a bore therethrough in register with the holder bore, the nozzle bore terminating at its outer end in a discharge orifice and having a valve seat therein inwardly of the latter, communicating fuel supply passageways in said holder and nozzle opening into said nozzle bore inwardly of the valve seat therein, a plunger reciprocable in said nozzle bore and having a valve element cooperating with the valve seat therein, a thimble axially slidable in the nozzle opposing end of the body bore, the inner end of said plunger extending into said thimble, a spring in said holder bore for holding said thimble in endwise abutting relation to said plunger and the valve element of said plunger on said valve seat, and a stop pin extending across a diameter of the thimble receiving portion of said body bore inwardly of the inner end of said plunger for positively limiting the inward movement of said plunger and the lift of the valve element of the latter, said thimble being slotted longitudinally to accommodate said stop pin and to permit said thimble to move axially with said plunger relative to said stop pin.

5. A fuel injector comprising a holder having a bore opening through one end thereof, a nozzle secured to said end of said holder and having a bore therethrough in register with the holder bore, the nozzle bore terminating at its outer end in a discharge orifice and having a valve seat therein inwardly of the latter, communicating fuel supply passageways in said holder and nozzle opening into said nozzle bore inwardly of the valve seat therein, a plunger reciprocable in said nozzle bore and having a valve element cooperating with the valve seat therein, a thimble axially slidable in the nozzle opposing end of the body bore and having an axial recess in its nozzle opposing end, the inner end of said plunger having a stem portion of reduced diameter extending into the axial recess of said thimble and forming an inwardly facing annular shoulder on said plunger, a spring in said holder bore for holding the nozzle opposing end of said thimble in endwise abutting relation to the annular shoulder on said plunger and the valve element of said plunger on said valve seat, said thimble having diametrically opposed longitudinal notches therein extending from the annular shoulder engaging end thereof to the inner of the axial recess therein, and a stop pin extending crosswise of said nozzle bore and through the notches in said thimble inwardly of the inner end of the stem portion of said plunger for limiting the inward movement of said plunger and the lift of the valve element of the latter.

HARRY F. HAINES.