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INJECTOR NOZZLE

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2 Sheets-Sheet 2

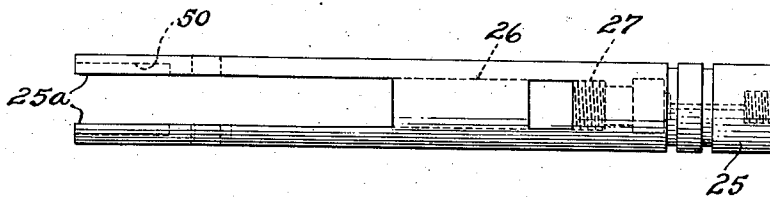
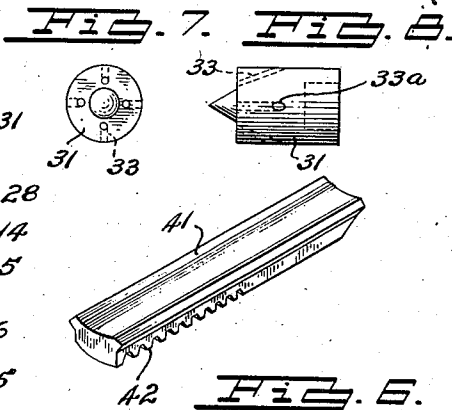
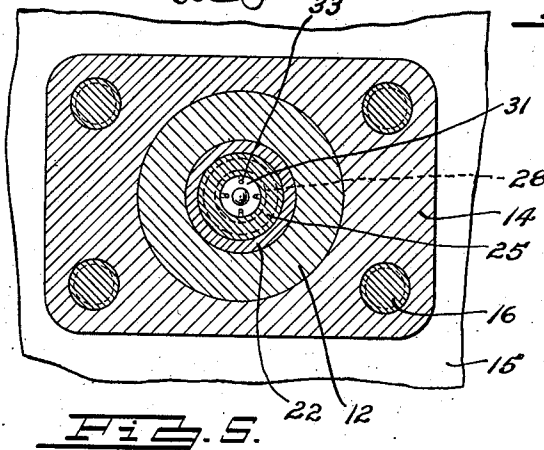
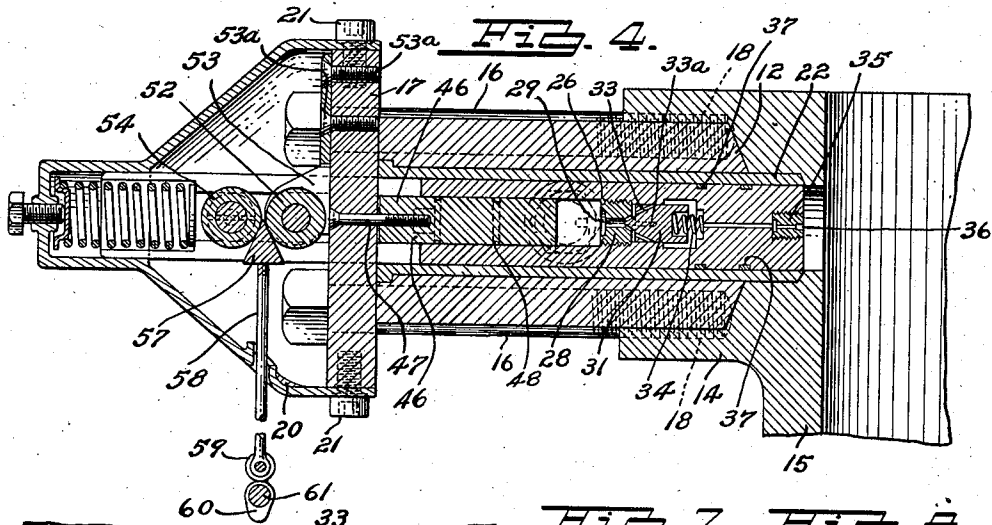


Fig. 9.

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UNITED STATES PATENT OFFICE

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INJECTOR NOZZLE

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2 Claims. (Cl. 299-107.2)

This invention relates to fuel injectors for internal combustion engines and has particular reference to an improved unitary injector and nozzle for use with Diesel engines.

An object of the invention is the provision of a fuel injector for use with a Diesel engine which is so constructed as to utilize the high pressure developed within the combustion chamber of the engine as assistance to force the fuel from the injector into the engine.

Another object of the invention is the provision of a fuel injector and nozzle in which the working stresses are materially reduced.

Another object of the invention is the provision of a device of the character referred to which is simple in construction, economical to manufacture and easy to install.

Another object of the invention is the provision of an injector nozzle the parts of which are so arranged as to be readily accessible for cleaning and replacement.

Another object of the invention is the provision of a device which will greatly improve the results obtained from the use of fuel pumps and nozzles as now used in connection with Diesel engines.

Another object of the invention is the provision of a device for the injection of fuel into an internal combustion engine which has a quick and positive shut-off action thereby eliminating any possibility of the dribbling of fuel.

Further objects and advantages of the invention will appear as the description proceeds, reference being made from time to time to the accompanying drawings constituting part of the disclosure, in which drawings:

Fig. 1 is a longitudinal section taken through a device embodying the invention (line 1-1 of Fig. 2) and illustrates the manner in which it may be secured to the block of a Diesel engine.

Fig. 2 is an end view of the device illustrated in Fig. 1.

Fig. 3 is a vertical section taken on the line 3-3 of Fig. 1.

Fig. 4 is a vertical section taken on the line 4-4 of Fig. 2.

Fig. 5 is a section taken on the line 5-5 of Fig. 1.

Fig. 6 is an enlarged detail of the fuel by-pass gate.

Fig. 7 is an end view of the delivery valve.

Fig. 8 is a side view of the delivery valve.

Fig. 9 is an enlarged detail of the plunger barrel.

Referring now more particularly to the draw-

ings, it will be seen that the device embodying my invention consists of a cylindrical body member 12 which may be made of gray iron machined to tightly fit into a recess 13 bored in a boss 14 formed on the side of the cylinder block of a Diesel engine, a fragmentary portion of which is indicated by the reference character 15. The body 12 is preferably secured in position by means of bolts 16, which extend through the end plate 17 into internally threaded recesses 18 formed in the boss 14. The end plate 17 is arranged to serve as a closure element for one end of the body 12 and is adapted to support the end cover 19, which is preferably made of pressed metal formed with re-enforcing elements 20, and secured to the end plate 17 by means of fillister head screws 21.

Press-fitted into the internal bore of the body member 12 is a sleeve 22, which is formed with a collar 23 at one end, adapted to engage a shoulder 24 formed in the body 12. The collar 23 serves to prevent displacement of the sleeve 22 in one direction, and the end plate 17 prevents the sleeve from being displaced in the opposite direction. A plunger 25 is mounted for reciprocation in the sleeve 22. This plunger (Fig. 9) is provided with an internal bore 26, in which is mounted the working parts hereinafter described. As illustrated in Fig. 9, the plunger is slotted as at 25a so that it may be extended through suitable openings 25b (Fig. 2) formed in the end plate 17. The internal bore 26 is threaded as at 27 and is arranged to receive a threaded plug 28, which in turn is provided with an internal passageway 29. Between the plug 28 and the end of the bore 26 is a restricted area 30 in which is slidably mounted a delivery valve 31, which is provided with angularly positioned passageways 33, which are arranged to communicate with the passageway 29 in the plug 28. A compression spring 34 is arranged to normally maintain the valve 31 in the closed position shown in Fig. 1. The compression of this spring must be sufficient to allow a predetermined pressure to be built up in chamber 38. The greater the pressure in chamber 38, the better the fuel will be atomized during delivery. A burner plate 35 is threaded mounted in an internally threaded recess formed in the end of the plunger 25 and has a small axial passageway 36 arranged to communicate with a similar but larger in diameter axial passageway formed in the plunger 25. The plunger 25 is provided with compression rings 37 which are arranged to seal compression and stop compression loss from the combustion chamber of the

engine. A compression chamber 38 is formed in the plunger 25 and in a portion of the body 12, and communicates at one end with a passageway 39 which extends through the plunger 25, the sleeve 22 and the body 12, and which in turn is connected to a fuel transfer pump (not shown) which moves the fuel from the main fuel tank. The other end of the compression chamber 38 communicates with the passageway 40, which also passes through the body 12 of the injector, and in turn is connected to the fuel tank or fuel line below the transfer pump and adapted to permit the return of by-passed fuel to the main tank or reservoir as hereinafter described.

In order to control the amount of fuel to be by-passed from the compression chamber 38, I provide a by-pass gate 41 which is arranged to reciprocate in a slot 42 formed in one side of the sleeve 22. The by-pass gate 41 is provided on its under side with a rack 43 adapted to engage a pinion 44 mounted on a shaft 45, the latter being preferably connected to manually operable means for rotating the same in order that the by-pass gate 41 may be moved forward or backward. The by-pass gate 41 (Fig. 6) is provided on either side with a tongue arranged to slidably engage the corresponding grooves formed in the side walls of the slot 42. A core 46 is mounted in the internal bore 26 of the plunger 25 and is secured against displacement by means of the machine screw 47, which extends through an aperture in the end plate 17, and engages an internally threaded bore formed in the end of the core. A fiber washer 46a is positioned between the end of the core 46 and the end plate 17. The core 46 is provided with oil grooves 48 which are adapted to trap any fuel oil that may escape from the compression chamber 38. The oil thus trapped in the grooves 48 serves to lubricate the bearing surfaces between the plunger 25 and the core 46. A compression spring 49 is mounted in a counterbore 50 formed in the end of the plunger 25, and is adjustable by means of the adjusting screw 51 which threadedly engages an opening in the end of the end cover 19. A roller 52 is mounted for rotation on an axle supported at either end in a roller holder 53, which is secured by bolts 53a to the end plate 17. A second roller 54 is mounted for rotation on a suitable axis 55, secured by bolts 56 to the opposite sides of the plunger 25. Interposed between the rollers 52 and 54 (Fig. 4) is a wedge-shaped member 57 which is mounted at the end of a push rod 58 at the opposite end of which is mounted a roller 59 adapted to be actuated by a suitably timed cam 60, the latter being driven by a cam shaft 61 motivated by the engine to which the device is attached. The wedge-shaped element 57, when moved by the push rod 58, causes the roller 54 to separate from the roller 52 and at the same time causes the plunger 25 to be moved against the compression spring 49. It will be understood that the cam actuated wedge is timed to operate and cause the plunger 25 to start to move away from the combustion chamber of the engine as the compression reaches its maximum in the cylinder of the engine. With this arrangement the movement of the plunger is then assisted by the compression of the motor itself. This is an advantageous feature of my invention and enables this device to be operated with much less stress and strain than encountered in devices of this kind heretofore known. It will be understood that the compression of the spring 49 will be adjusted by means of the screw

51 so that its compression will just overcome the maximum pressure in the cylinder so as to hold the plunger in closed position.

An operating cycle of my device is as follows:

Fuel is pumped to the device by means of the usual transfer pump (not shown) where it enters the passageway 39 and through which it travels to the compression chamber 38. The compression chamber 38 is formed between the stationary core 46 and the plug 28 which is mounted in the reciprocable plunger 25. As the plunger 25 is moved to the left under the influence of the properly timed cam operated wedge 57 and the increased compression in the cylinder of the engine, the fuel in the compression chamber 38 can only escape in two directions, either around the by-pass gate 41 into the passageway 40 and hence return to the fuel tank or supply line, or through the axial passageway 29 formed in the plug 28 and through the angular passageways 33 formed in the valve 31 and into the space between the valve 31 and the plunger 25 and hence through the axial passageway in the plunger 25 and the burner plate 35 and into the combustion chamber of the engine. By moving the by-pass gate forward and backward the by-pass clearance in the chamber 38 is either increased or diminished. As the by-pass clearance is decreased in the chamber 38, there is an increased amount of fuel injected through the valve 31 into the engine and as the by-pass clearance is increased there is a decreased amount of fuel forced through the valve 31 into the engine.

As the plunger is moved to the left (Fig. 1) the first part of the stroke is ineffective to discharge oil past the valve 31 for in this position the by-pass gate 41 is open and the fuel will be by-passed through the passageway 40. As the plunger continues to move to the left, the by-pass clearance will be reduced and finally closed thereby building up pressure in the chamber 38. While the by-pass 41 is open, the outlet ports 33a of the angular passageways 33 in the valve 31 are still covered by the walls of the restricted area 30. As the plunger 25 continues to move to the left, closing the by-pass 41, the unrestricted area of the internal bore of the plunger 25 communicates with the outlet ports 33a of the valve 31 thus permitting the fuel to pass around the end of the valve 31 and hence into the axial passageway formed through the plunger 25. When the plunger has reached the limit of its travel to the left, it will be returned to the position shown in Fig. 1 by means of the spring 49. As the plunger returns to the position shown in Fig. 1, it is evident that the valve stops delivering fuel before the valve is fully seated because the outlet ports 33a will be covered before the valve 31 is seated.

Although I have herein disclosed the preferred embodiment of my invention, it will be understood that certain modifications may be made all of which are intended to be within the scope of the appended claims.

Having described my invention, what I claim and desire to secure by Letters Patent is:

1. In a device of the character described, the combination of a body member adapted to be secured to an internal combustion engine and having a bore adapted to communicate with the combustion chamber of said engine, a sleeve in said bore, a plunger mounted for reciprocation in said sleeve, spring means arranged to move said plunger towards said engine, means timed with said engine to move said plunger away from

said engine, a longitudinal bore in said plunger, a stationary core in said last named bore, there being a compression chamber between one end of said last named bore and said core, a fuel inlet communicating with said compression chamber, outlets communicating with said chamber, one of said outlets comprising a by-pass controlled by a gate slidable in a recess formed in said sleeve, said other outlets being arranged to discharge fuel from said compression chamber into said combustion chamber upon the movement of the plunger in the direction away from said combustion chamber.

2. An injector nozzle comprising the combination of a body member having a plunger reciprocable therein, an axial bore in said plunger, a restricted area in said bore, a stationary core in said bore, fuel intake and fuel exhaust ports

communicating with said bore, a valve slidably mounted in said restricted area in said bore, a valve-seat member threadedly secured in said bore, there being a fuel exhaust port in said valve-seat member, spring means for holding said valve on said seat to close said last named fuel exhaust port, said spring means being arranged to be overcome, so that said valve may be unseated, by fuel pressure built up in said bore, upon movement of the plunger carrying said valve-seat member towards said stationary core, an end plate for said body member, an end cover member supported by said end plate, adjustable spring means carried by said end cover member for moving said plunger away from said end cover member and timed means for moving said plunger toward said end cover member.

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