Feb. 16, 1937. T. RUPPRECHT 2,071,237

FUEL INJECTOR FOR DIESEL ENGINES

Filed Aug. 16, 1934

Fig. 1.

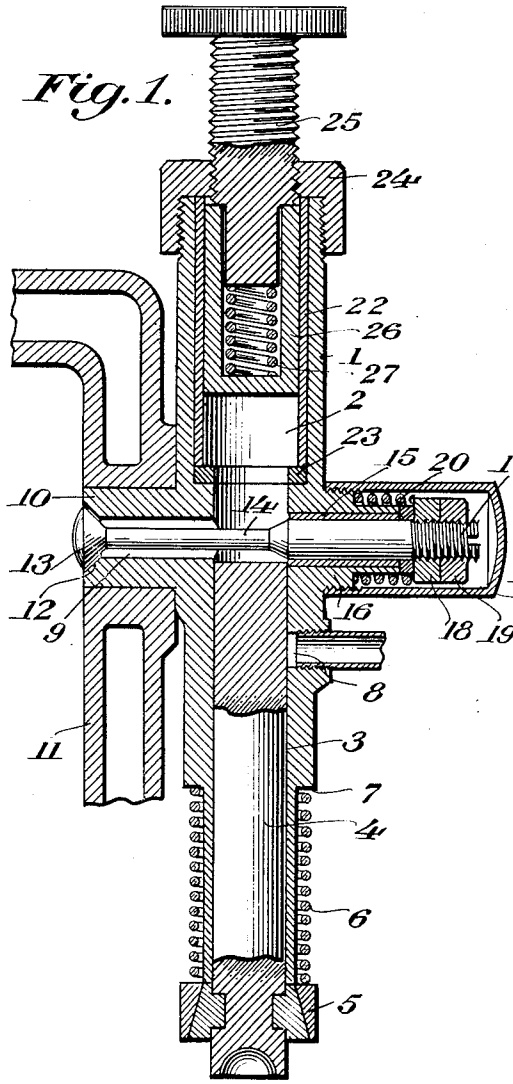
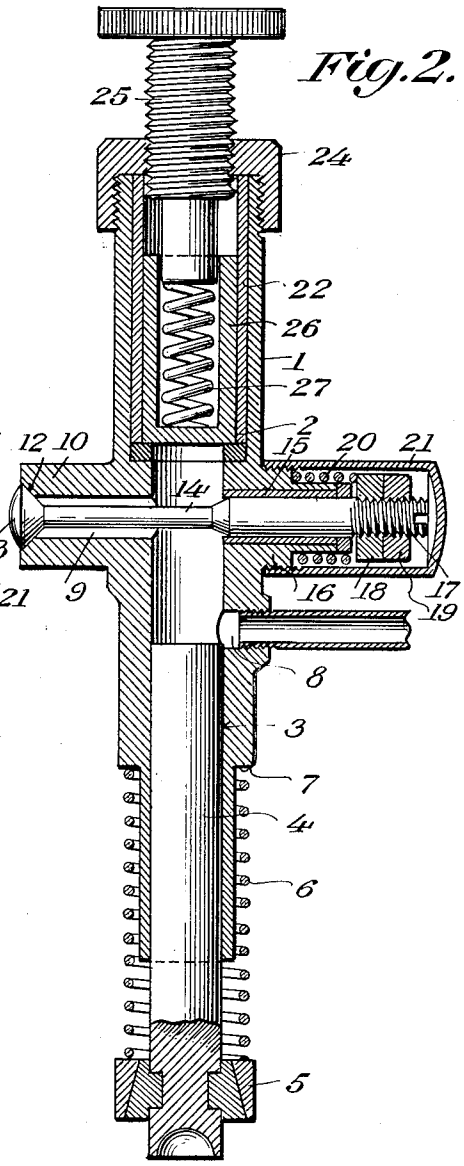


Fig. 2.



Tom Rupprecht
INVENTOR

BY Victor J. Evans & Co.
ATTORNEYS

WITNESS:

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FUEL INJECTOR FOR DIESEL ENGINES

Tom Rupprecht, Indianapolis, Ind.

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3 Claims. (Cl. 299—107.2)

This invention relates to a volume control for hydraulic devices and has for the primary object the provision of a device of the above stated character which may be easily and quickly adjusted to vary the output from the device and provides a device which has been found especially adaptable as a fuel injector to an engine designed for the consumption of heavy grade fuel and commonly known as a Diesel engine.

With these and other objects in view this invention consists in certain novel features of construction, combination and arrangement of parts to be hereinafter more fully described and claimed.

For a complete understanding of my invention, reference is to be had to the following description and accompanying drawing, in which

Figure 1 is a fragmentary vertical sectional view showing my invention adapted to the cylinder of an engine to act as a fuel injector.

Figure 2 is a similar view showing the device with the parts positioned for the interruption of fuel therefrom.

Referring in detail to the drawing, the numeral 1 indicates a housing, the upper portion of which forms a fuel control chamber 2 and the lower portion forms a pump cylinder 3 for the reception of an actuating plunger 4 adapted to be reciprocated at timed intervals by the operation of the engine to which the device is applied. The plunger 4 carries at its lower end a removable spring seat 5 engaged by one end of a coiled spring 6 while the opposite end of the spring bears against a shoulder 7 on the housing 1 so that the spring may normally act to urge the plunger in a direction to uncover a fuel port 8. The movement of the plunger in an opposite direction to close the fuel port is accomplished by the actuating mechanism (not shown) of the engine. Between the fuel chamber and the cylinder of the housing 1 is an outlet passage 9 formed in a nipple 10 forming an integral part of the housing and adapted to be suitably connected to an engine cylinder 11, as shown in Figure 1. The outlet passage 9 terminates in a valve seat 12 engaged by a valve 13 having a stem 14 which extends through the housing 1 into a sleeve 15 mounted in a boss 16 integral with the housing 1. The portion of the stem 14 which operates in the sleeve 15 and projects beyond the latter is screw threaded, as shown at 17, to receive thereon an adjusting nut 18 and a lock nut 19 therefor. A portion of the boss 16 is reduced and forms a seat for one end of a coil spring 20 bearing against the nut 18 and acting to engage the valve 13 with the seat 12. A removable cap 21 encloses the nuts 18 and 19 and spring 20 and is threaded to the boss 16.

The fuel chamber 2 has a lining 22 engaging at one end with a seat 23 and its opposite end engaging with a closure collar 24 threaded to the housing 1 and provided with a screw threaded opening to receive an externally threaded adjusting medium 25. The inner end of the medium 25 is reduced and received in a sleeve-like piston 26 having slidable contact with the lining 22. The piston is free to move relative to the reduced end of the adjusting medium 25 and has interposed between itself and the adjusting medium a coil spring 27 acting normally to return the piston 26 to the seat 23 each time the plunger 4 returns to the outward end of its stroke. Fuel or liquid is delivered to the intake port 8 under pressure and when said port is uncovered by the plunger 4 the fuel enters the chamber 2. The plunger on closing the port 8 acts on the fuel in the chamber 2, causing the piston 26 to move against the action of the spring 27 until said piston abuts the adjusting medium 25 so that further movement of the plunger in the same direction forces a predetermined amount of fuel from the chamber 2 to the cylinder of the engine by overcoming the action of the spring 20 and unseating the valve 13. The tension of the spring 27 is twice as strong as the line pressure at port 8. Thus it will be seen that by adjusting the medium 25 inwardly and outwardly of the casing 1, the amount of fuel entering the cylinder of the engine may be varied for the purpose of controlling the speed of operation of the engine. The inward movement of the plunger 4 by the mechanism of the engine covers the port 8 and forces piston 26 outward until it strikes stop medium 25 and thereby forcing fuel into the engine through the remainder of the stroke of said piston 4. It is to be understood that the reciprocation of the plunger 4 is in accordance with the timing of the engine so that the fuel will be injected in the engine at the proper time for ignition.

This invention when employed upon an engine provides a fuel injector unit having the following features:

(1) An adjustable poppet valve type spray nozzle and check valve combined.

(2) A simple and more accurate means of controlling the speed of the engine by controlling the volume of fuel injected at each stroke of the plunger.

(3) Due to the special design of the speed control mechanism, the fuel injection timing is automatically advanced as the speed of the engine is increased.

In operation, when the plunger **4** moves inwardly past the intake port **8** the fuel is trapped and compressed in the chamber **2** and forces the piston **26** outwardly until it engages the adjusting medium **25**. However, when the piston **26** strikes the stop provided by the adjusting medium, the plunger **4** has not reached the end of its innermost stroke, the volume of the fuel displaced by the remainder of the stroke of the plunger is forced out through the passage **9** by unseating the valve **13** to the combustion chamber of the engine. Therefore, it can be seen that the volume of fuel forced to the cylinder at each stroke of the plunger is in direct proportion to the adjusting medium **25** thereby controlling the speed of the engine. The adjusting medium **25** not only controls the volume of fuel which is forced into the engine at each stroke of the plunger **4** but also starts the fuel injection period at an early degree of the crank shaft travel of the engine, thus automatically advancing the timing of the fuel injection period as the speed of the engine is increased.

The valve **13** and the seat **12** therefor acts as a nozzle for aiding in breaking up or atomizing the fuel to the engine and the valve is held against its seat by the pressure in the engine cylinder during the compression and expansion periods and is also held against the seat by the spring **20** throughout the exhaust and intake periods of the engine. It is essential that the strength of the spring **20** is one and one-half times as strong as the pressure of fuel in the intake port **8**. The distance the valve **13** may move away from its seat can be accurately adjusted so that the valve can only be forced open a few thousandths of an inch, that is, until the adjusting nut **18** strikes the boss **16** which acts as a stop for the movement of the valve. This adjustment is set where the fuel is best atomized to give the most complete combustion. The adjustment of the valve **13** is made by screwing the nut **18** on the stem of said valve and the nut is locked after adjustment by bringing the nut **19** in engagement therewith. The nut **18** also acts as a seat or retainer for the spring **20**. The plunger **4** is best actuated by a cam or eccentric driven by the engine and the spring **6** acts to retain the plunger in engagement with the cam or eccentric at all times.

The medium **25** may be adjusted so that the piston **26** may travel far enough to increase the volume of the chamber so that said chamber may accommodate all of the fuel forced in by the plunger **4** so that said fuel will not unseat the valve **13** and thereby provide means for stopping the operation of the engine.

Having described the invention, I claim:

1. A fuel injector for internal combustion engines comprising a housing formed with both a pump cylinder and a control chamber radiating therefrom and with a lateral nipple formed with an axial passage having a valve seat at its outer end, the pump cylinder and control chamber being in communication with said passage, a piston in the pump cylinder, the latter having a fuel supply port communicating with the interior of the cylinder but closed by the piston during part of its stroke, a piston in the control chamber spring pressed toward the pump piston, and a valve yieldingly retained on the seat in the nipple to close the passage through the latter, the casing being formed with a boss opposite the nipple and the valve having a stem of which a portion is slidably mounted in the boss to constitute a guide for the valve, a nut secured to the stem exterior to the boss, a spring surrounding the boss and compressed between a shoulder on the latter and the nut, and a cap removably secured to the boss and enclosing the spring and nut.

2. A fuel injector for internal combustion engines comprising a housing formed with both a pump cylinder and a control chamber radiating therefrom and with a lateral nipple formed with an axial passage having a valve seat at its outer end, the pump cylinder and control chamber being in communication with said passage, a piston in the pump cylinder, the latter having a fuel supply port communicating with the interior of the cylinder but closed by the piston during part of its stroke, a piston in the control chamber and spring pressed toward the pump piston to yield on the fluid pressure produced by the inward stroke of the piston, an adjustable stop to limit the movement of the control chamber piston against the pressure of its spring, and a spring actuated valve engaging the seat in said nipple to close the passage but responsive to fluid pressure within the passage.

3. A fuel injector for internal combustion engines comprising a housing formed with both a pump cylinder and a control chamber radiating therefrom and with a lateral nipple formed with an axial passage having a valve seat at its outer end, the pump cylinder and control chamber being in communication with said passage, a piston in the pump cylinder, the latter having a fuel supply port communicating with the interior of the cylinder but closed by the piston during part of its stroke, a piston in the control chamber and spring pressed toward the pump piston to yield on the fluid pressure produced by the inward stroke of the piston, an adjustable stop to limit the movement of the control chamber piston against the pressure of its spring, and a spring actuated valve engaging the seat in said nipple to close the passage but responsive to fluid pressure within the passage, the control chamber piston being of sleeve like form and the control chamber having a collar threadingly engaged with its outer end, the adjustable stop consisting of a screw thread adjusting medium threadingly engaged with the collar and formed with a pilot entering the outer end of the piston, the spring in the latter consisting of a coil compression spring compressed between the end of the pilot and the lower end of the piston.

TOM RUPPRECHT.