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FUEL INJECTION DEVICE FOR DIESEL ENGINES

Filed March 5, 1945

2 Sheets-Sheet 1

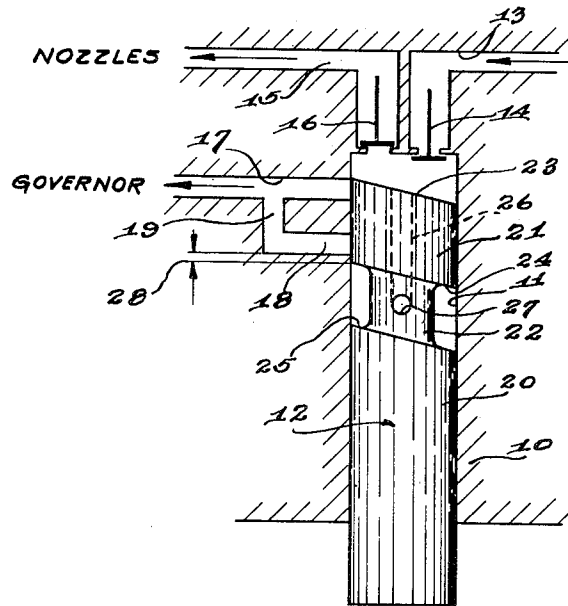


Fig. 2

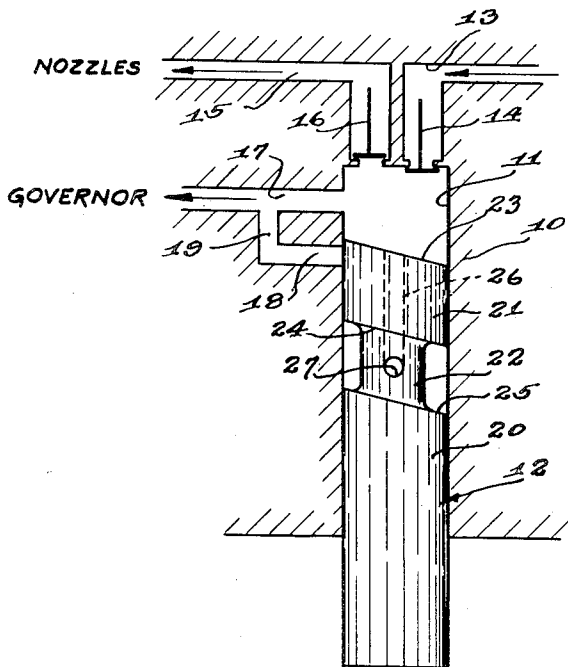


Fig. 1

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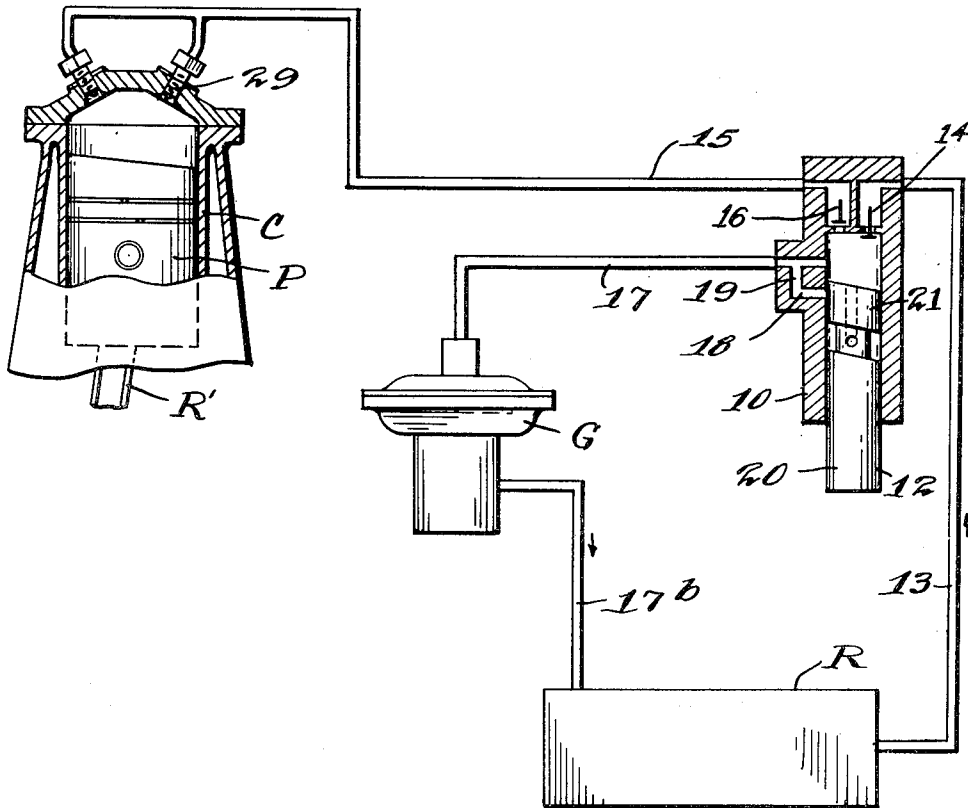


Fig 3

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FUEL INJECTION DEVICE FOR DIESEL ENGINES

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3 Claims. (Cl. 123-140)

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This invention relates to Diesel engines but more particularly to fuel injection systems for such engines.

High compression internal combustion engines which are adapted to employ either oil or gas or a mixture of the two fuels are equipped with a governor controlling the rate of fuel supply in accordance with the demands of service and the availability of the kind of fuel. In case gas, such as producer gas, is used as fuel, oil serves as an igniter, as is readily understood. It is desirable, therefore, that a substantially constant minimum quantity of oil be injected for pilot ignition without control of the governor but any quantity greater than the minimum up to the full capacity of the injector pump be under the control of the governor.

An object is to produce a simple and efficient fuel injection system of the above type which employs a single injection pump operating in cooperation with a suitable governor mechanism.

Other objects and advantages will hereinafter appear, and for purposes of illustration but not of limitation, the invention is shown on the accompanying drawings in which

Figure 1 is a diagrammatic sectional view showing a fuel injection pump for a high compression internal combustion engine, fuel lines leading to the governor for the engine, a fuel line to the injection nozzles for the engine, and a fuel line from the fuel reservoir;

Figure 2 is a view similar to Figure 1 and showing the plunger in its upward movement and at the point where fuel is being injected into the line leading to the fuel injection nozzles; and

Figure 3 is a schematic view showing the fuel injection pump in relation to other elements of the engine feed system.

The illustrated embodiment of the invention comprises a suitable housing or casing 10 which is provided with a pump cylinder 11 in which is reciprocable a piston-type plunger or pumping element 12. Leading into the upper end of the cylinder is a passage 13 extending from a fuel oil reservoir R and controlled by a poppet type valve 14 which unseats upon downward movement of the plunger to admit oil to the cylinder 11. Also leading from the upper end of the cylinder 11 is a passage 15 which leads to the fuel injection nozzles 29 in a high compression internal combustion engine. The passage 15 is controlled by a poppet type valve 16 which opens inwardly into the passage 15 upon upward movement of the plunger 12 and after a predetermined pressure within the pump cylinder has been

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created. Ordinarily springs are associated with the valves 14 and 16 to hold them normally seated as will be readily understood by those skilled in this art.

Near the upper end of the cylinder 11 extends a lateral passage 17 which leads to the governor G. It will be understood that the governor may be of the well-known type to control the amount of gas, such as producer gas, and oil delivered to the engine cylinders in accordance with the demands of service, as well as the available supply of gas. Governors of this type are well-known to those skilled in this art and detail description and illustration thereof is not considered necessary here. A suitable governor which is well-known in this industry and is not infrequently employed in connection with engines of this type is known as Type U. G. 8 Governor and manufactured by Woodward Governor Company of Rockford, Illinois.

Spaced a short distance below the passage 17 is a passage 18 which is parallel to the passage 17 and communicates therewith at its outer end through a branch 19. It will be understood that reciprocatory motion is imparted to the plunger 12 in any suitable manner and as shown, it comprises a cylindrical body portion 20 and a head portion 21 which are integrally connected by a reduced neck portion 22. As shown, the top surface 23 of the head and the under or bottom surface 24 of the head are inclined or angularly disposed but in parallel relationship. Likewise the upper surface 25 of the body portion 20 is similarly inclined and parallel to the surfaces 23 and 24.

Drilled through the head 21 is a passage 26 which terminates in a lateral passage 27 opening from the neck portion 22 and into the space between the surfaces 24 and 25. This enables oil from above the plunger head 21 to pass into the space around the neck portion 22 as will hereinafter appear.

It will be understood that the distance between the heads 23 and 24 is slightly greater than the distance between the ports leading to the passages 17 and 18 so that these passages may be covered and still a slight additional movement of the plunger may take place before the surface 24 of the head 21 uncovers the port leading to the passage 18 during the upward movement of the plunger. This additional movement is indicated by the reference numeral 28.

In operation it will be understood that when the plunger 12 moves downwardly, the valve 14 is unseated and oil from the reservoir R flowing

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through the passage 13 enters the cylinder 11 above the plunger head. When the plunger moves upwardly, oil thus drawn into the cylinder is forced therefrom through the passages 18, 19 and 17 assuming that the governor calls for oil, the oil passing through the governor G being returned to the reservoir R through the communicating passage 17b. However, since the plunger head 21 closes off the passages 17 and 18, the additional movement of the plunger indicated by the reference number 28 enables oil disposed above the plunger head to be forced past the valve 16 and into the passage 15 to the injection nozzles 29 of the engine represented in Figure 3 by a cylinder C having a piston P, and its piston rod R' reciprocal therein, it being understood that such force created is sufficient to unseat the valve 16 against the force of the spring (not shown) which is associated therewith.

Thus it will be understood that this additional movement 28 affords a minimum and substantially fixed quantity of oil to the engine as, for example, for pilot ignition in the case of an oil-gas engine. It will be manifest that such minimum quantity is not controlled by the governor but in the event that the governor does not call for oil so that the pump 12 can not force oil from the cylinder through the passages 18, 19 and 17, then all of the oil within the cylinder will be forced to the nozzles 29 through the passage 15. Furthermore, if the governor calls for a reduced amount of oil, then the additional oil over and above that called for by the governor will be delivered to the nozzles through the passage 15 as will be readily understood. Thus although the minimum quantity of oil delivered to the nozzles is not controlled by the governor, the governor does control any quantity greater than that minimum up to the maximum capacity of the pump.

By angularly disposing the surfaces 23 and 24 of the plunger head 21, the plunger 12 may be rotatively adjusted for effecting operational changes. Such rotative adjustment may be effected manually or automatically by suitable connection to the governor mechanism. It will be manifest that the time at which injection starts will be changed, that is, the time at which oil is forced from the cylinder 11 into the passage 15. By maintaining the surfaces or faces 23 and 24 in parallel relationship, the amount of oil recurrently delivered to the nozzle passage 15 remains constant through the portion of the plunger travel indicated by the reference number 28 and the rotative adjustment of the plunger results only in changing the time of oil injection to the passage 15.

It will be understood that in the event that the faces or surfaces 23 and 24 are not arranged in parallel relationship, then the rotative adjustment of the plunger 12 will affect both the quantity of oil delivered to the nozzles as well as the timing of such delivery. For example, if the surface 23 were disposed at right angles to the axis of the cylinder 11, the timing of the fuel injection to the passage 15 is fixed by the point in the plunger travel at which the passage 17 is covered and does not change when the plunger is rotatively adjusted, although the quantity is changed depending upon the angularity of the face or surface 24.

From the above description it will be apparent that the minimum quantity of oil delivered to the nozzles 29 through the passage 15 remains constant and is not affected by the operation of

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the governor G. However, the timing of the injection of oil to the nozzle passage may be varied by rotatively adjusting the plunger 12 in connection with the structure such as illustrated. Any quantity of oil above such minimum is controlled by the operation of the governor depending upon whether the governor calls for a greater or lesser quantity of oil. By making the upper surface of the plunger straight across instead of angularly disposed, as shown, the timing of the injection of oil to the nozzle passage 15 is controlled by the point in the plunger travel at which the passage 17 is covered assuming that the passages leading to the governor are substantially unrestricted, and would not change when the plunger is rotatively adjusted. However, in such event, the quantity of oil delivered to the nozzle passage 15 is dependent upon the angularity of the face 24 or the degree of rotative adjustment given the plunger 12.

It is to be understood that numerous changes in details of construction, arrangement and operation may be effected without departing from the spirit of the invention especially as defined in the appended claims.

What I claim is:

1. In a Diesel engine having a fuel controlling governor and oil injection nozzles, means providing a pump cylinder, oil supply passage leading to the head end of said pump cylinder, a passage also in the head end of said cylinder end leading to the oil injection nozzles, valves controlling said passages respectively, a passage leading from a side of said cylinder to the governor, a branch passage communicating with said governor passage and spaced inwardly therefrom and leading from the side of said cylinder, a reciprocatory pump plunger within said cylinder having a body, a reduced neck and a head portion, the length of said head being uniform throughout and being slightly greater than the distance between said governor passages, and a passage extending from the outer end of said plunger head, centrally therethrough and opening into said neck portion, whereby in the reciprocation of the plunger the minimum quantity of oil delivered to the nozzles is maintained constant.

2. A fuel injection system as claimed in claim 1, in which the plunger is rotatable, and the inner and outer faces or surfaces of the plunger head extend circumferentially thereof, are inclined and disposed in parallel relation, thereby to vary the timing of the injection of pilot oil to the nozzles during plunger movement of the head during the period when both governor passages are covered.

3. In a Diesel engine having a fuel controlling governor, means providing a pump cylinder, passage means extending laterally of the outer end portion of the cylinder and adapted to communicate with the governor, valve controlled passages adjacent and head end of the cylinder and arranged outwardly of said passage means and adapted to communicate respectively with the fuel oil supply and the engine injection nozzles, a rotatively adjustable plunger reciprocable in the cylinder, a head on the plunger movable to cover said passage means, opposite faces of said head being parallel and inclined relative to the axis of the plunger, the length of said head throughout being such that the same is movable during the period that the said passage means is covered, and a passage extending centrally through the plunger for enabling liquid at the

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outer end of said head to flow to the inner side thereof after the inner end of said head has uncovered said passage means, whereby in the reciprocation of the pump plunger the minimum quantity of oil delivered to the nozzles is maintained constant but the timing of oil injection is varied in response to rotative adjustment of the plunger.

EDWARD RATHBUN.

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