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INJECTION DEVICE

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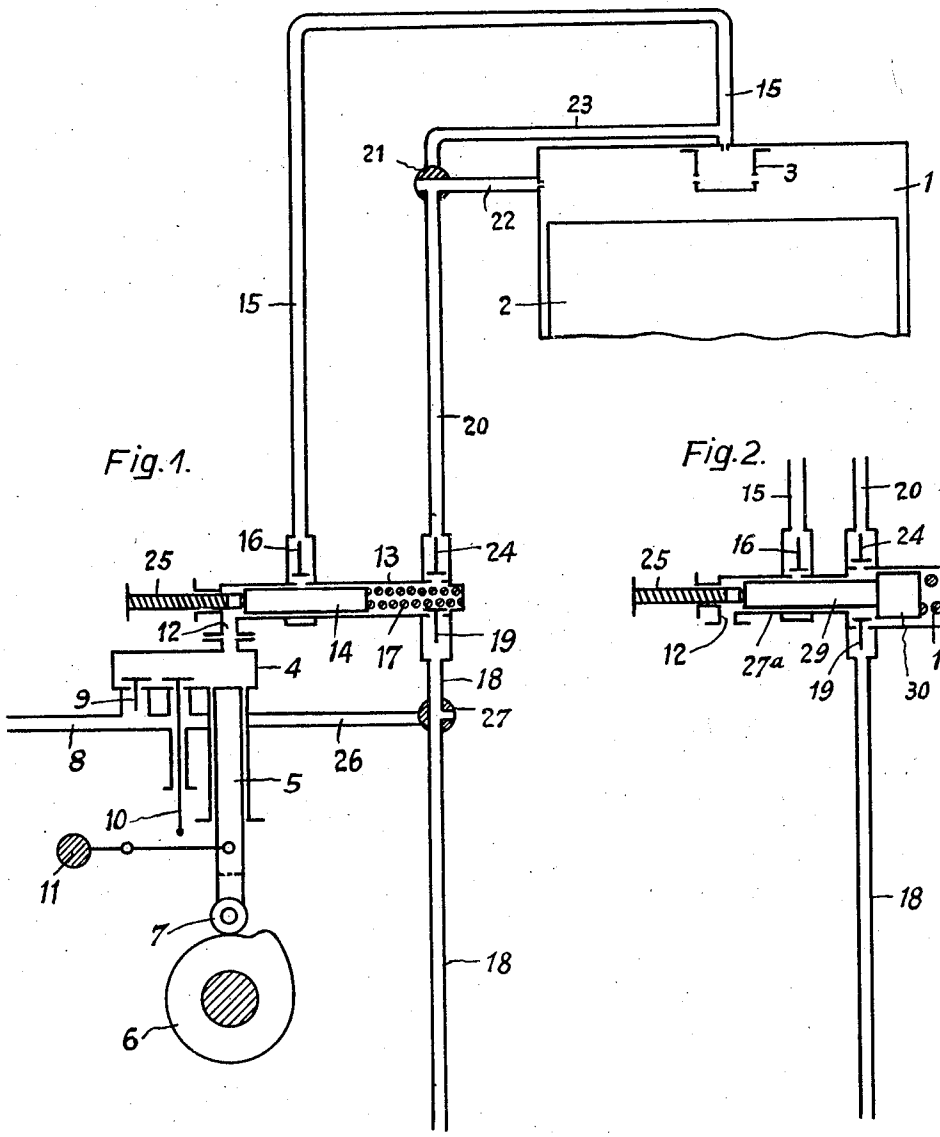

Fig. 1.

Fig. 2.

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INJECTION DEVICE

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3 Claims. (Cl. 103—9)

This invention relates to an injecting device for internal combustion engines for delivering two different fuels in successive pipings independently from one another to the point of injection.

Injecting devices for internal combustion engines for delivering two fuels, e. g. for burning tar oils or alcohols that are not readily spontaneously inflammable by means of easily inflammable gas oils are known already. It is further known to employ a separate pump for injecting each fuel, each pump having either a special mechanical drive, or the ignition oil pump is hydraulically driven by the driving oil pump to save the mechanical driving means. The invention has to do with the latter kind of drive. In the known devices, the piston of the ignition oil pump is either plain or of the differential type and moves in a cylinder communicating with the working space of the driving oil pump between the suction and pressure valves. In order to make the ignition oil pump deliver before the driving oil pump, the pressure valve of the latter is loaded so that it will open only when the piston of the ignition oil pump, at the end of its pressure stroke, is prevented from further motion by a stop and the driving oil pressure increases still more under the influence of further motion of the driving oil piston. It happens, however, in connection with such pumps that, if the ignition nozzle is slightly clogged, the pressure of the driving oil required for moving the ignition piston will be higher than the pressure at which the pressure valve of the driving oil pump will open, so that the ignition oil pump fails to operate while the driving oil pump continues to work. The tar oil which does not burn for lack of ignition oil will then soil the engine cylinder and the piston will grind.

The known devices further fail to solve the problems connected with the use of thick oils which often coke the nozzles and which make it necessary to wash the nozzles with good oils or alcohols at the completion of injection to purify the exhaust, which is done by air in Diesel engines having a compressor.

The invention eliminates the drawbacks of the known devices by providing a main pump for the driving medium, in the delivery piping of which a housing constructed as pump cylinder is interposed. In the housing is found a piston controlled by the liquid pressure of the main pump and releasing delivery of the driving oil towards the point of injection only after having carried out part of its motion, whereas on the other side of the piston a supply and discharge piping for additional fuel are provided.

According to the construction of this intermediate piston, injection of the additional fuel may be effected before the driving oil is injected to favor ignition or after the injection of the driving oil to wash out the injection nozzle. To fulfill the latter purpose the intermediate piston is preferably of the differential or multiple stage type.

One form of the invention is illustrated on the accompanying drawing, in which Figure 1 is a diagrammatic view of the device for injecting the additional fuel prior to the driving oil; and Fig. 2, a view of a device in which the additional fuel is injected after the driving oil has been injected.

Referring to the drawing, in the working cylinder 1 operates the piston or plunger 2. 3 is the combustion space or hot bulb. Supply of driving oil is effected by a main pump consisting mainly of a housing 4 and the piston 5 working therein. Drive of the piston 5 is effected by a cam disc 6 and the guide roll 7 moving thereon. The fuel flows through the piping 8 opening into the housing 4 to the main pump. At the inlet point a valve 9 is provided, and the housing 4 contains also a regulating valve 10 which is controlled by the shaft 11 actuater by the regulator in order to adapt the fuel supply to the main pump to the motor load. From the housing 4 a delivery piping 12 leads to the auxiliary pump housing 13 in which the intermediate piston 14 operates in a closely sliding manner. At a certain distance from the inlet point 12 the auxiliary housing 13 is connected with another portion of the delivery piping 15, a regulating valve 16 being provided at the point of junction. The piping 15 leads directly to the point of the injection in the hot bulb 3. By a compression spring 17 the piston 14 is constantly pressed into end position, in which it prevents the flow of fuel to the piping 15. Into the other end of the cylinder 13 opens a delivery piping 18 for additional or auxiliary fuel, a regulating valve 19 being interposed at the point of junction. 20 is the piping for liquid fuel, which at 21 branches out into the pipings 22 and 23. According to the position of the member 21, injection of the auxiliary fuel may be effected through the piping 22 opening directly into the cylinder or the fuel is delivered through the piping 23 to the main piping 15 and injected there before the driving oil through the hot bulb 3. At the point of junction of the piping 20 and the housing 13 a regulating valve 24 is disposed. 25 is a screw spindle which can be turned more or less into the cylinder for varying the stroke of the piston 14. There is also a connecting piping

26 which connects the main supply piping 8 with the piping 18. At the point of junction a control valve 27 is arranged by the actuation of which the pipings 18 or 8 may be alternately connected with the auxiliary pump.

The device described functions as follows:

Owing to the turning of the cam disc 6, the piston 5 is moved up and down in its housing 4, fuel drawn out of the piping 8 and pressed into the cylinder 13 before the piston 14 which is thus displaced against the action of the spring 17. After the piston 14 has carried out part of its stroke, the discharge piping 15 is exposed, so that the valve 16 opens and delivery of the driving oil through the piping 15 to the point of injection can take place. When the piston 5 begins its suction stroke, the piston 14 will be pressed back by the spring 17 and the auxiliary fuel in the cylinder 13 drawn in from the piping 18 while the valve 19 is open. At a new pressure stroke of the piston 5, the piston 14 will be pressed forward and the auxiliary fuel drawn into the cylinder 13 guided through the pipings 20 or 22, 23 to the point of injection. Only after the piston 14 has released again the junction point of the piping 15 can injection of the driving oil be effected after the auxiliary fuel has been injected.

In the construction shown in Fig. 2 the auxiliary fuel is injected only after the driving oil. For this purpose, the cylinder 13 has a narrow portion 27*a* and a wider portion 28. Correspondingly, the piston 14 is formed by a part 29 of smaller diameter and a part 30 of larger diameter. The delivery piping 15 and the piping 12 open into cylinder portion 27*a* in the same way as into the cylinder 13 shown in Fig. 1, but the pipings 18 and 20 are connected to one end of the wider cylinder part 28.

This device functions so that at the pressure stroke of the piston 5 of the main pump the piston 29, 30 is pressed forward, the auxiliary fuel being drawn out of the piping 18 by the piston portion 30. When the piston portion 29 has released the point of junction for the main piping 15, delivery of the driving oil takes place, partly under the pressure of the main pump. After delivery, the piston 29, 30 returns to initial position by means of the spring 17 while the piston portion 30 passes the auxiliary fuel contained in the cylinder 28 through the piping 20 to the injection point where it serves for washing the injection nozzle.

The two pumps may be used alternately by controlling the supply and discharge pipings through the regulators 27 and 21. Furthermore, the device may be used also as starting pump for precombustion chamber engines, in which the fuel, in the beginning or continually, is fed to an ignition nozzle in the cylinder space. The gradual injection of the fuel or a corresponding combustion insures steady running of the engine, especially during starting. Vigorous turbulent motion of the fuel insures high power effect during starting. The device can be advantageously used where fuel has to be successively injected through several nozzles into the combustion spaces of an engine. Furthermore, the device according to the invention combines greatest simplicity in design with cheapness and clear operation, and can be attached to existing engines, no matter whether closed or open nozzles are concerned. The device can further be of the double-acting type.

I claim:—

1. Injection device for internal combustion engines, comprising a main pump for the driving medium, a delivery piping connecting the pump with the point of injection, a housing constructed as pump cylinder and interposed in said delivery piping, a piston controlled by the liquid pressure of the main pump and arranged in said housing, said piston releasing only after part of its motion with its front side said delivery piping for driving oil towards the point of injection, a supply piping for auxiliary fuel opening on the rear side of said piston into said housing, a discharge piping for auxiliary fuel opening into said housing on the same side and leading towards the point of injection, a compression spring for bringing said piston into end position in which it shuts off the delivery piping for the driving medium, and regulating valves disposed at the points where said pipings open into said housing.

2. Injection device for internal combustion engines, comprising a main pump for the driving medium, a delivery piping connecting the pump with the point of injection, a multiple housing interposed in said delivery piping, a piston controlled by the liquid pressure of the main pump in one part of said housing, said piston releasing only after part of its motion with its front side delivery piping for driving oil towards the point of injection, an additional piston on the second part of said housing, said piston being rigidly connected with said first piston, a supply piping for auxiliary fuel opening at the front side of said second piston into said second part of the housing, a discharge piping for auxiliary fuel opening at the same side into the same house portion and leading towards the point of injection, a compression spring, said spring bringing the said two rigidly connected pistons into end position in which the delivery piping for the driving of connection between said delivery piping and the two housing portions.

3. Injection device for internal combustion engines according to claim 2, in which the two pistons in the housing interposed in the driving medium delivery piping form a multi-stage piston.

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