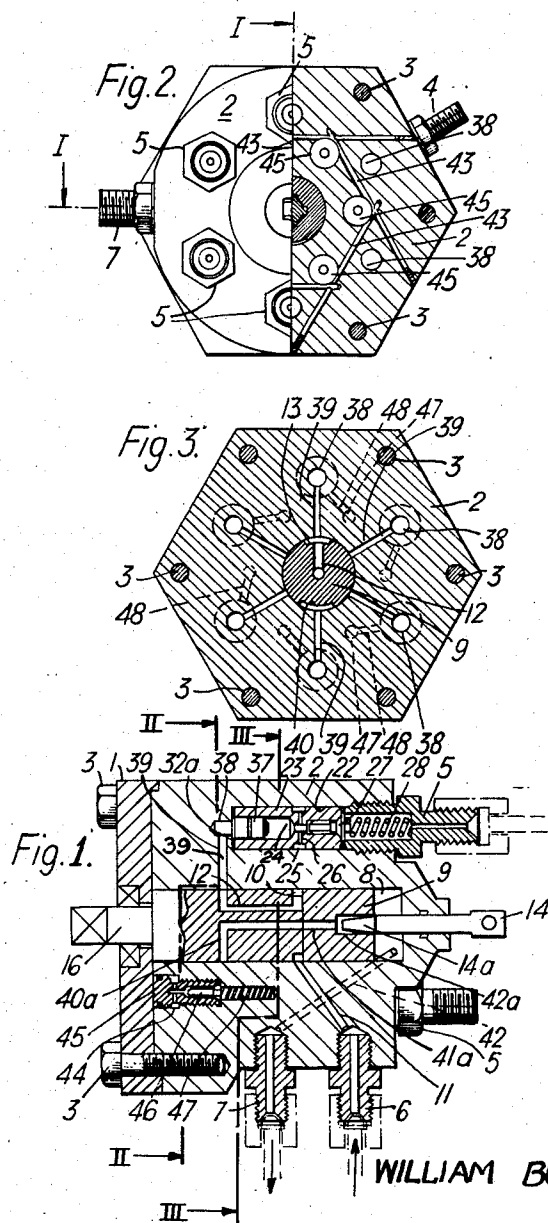


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DEVICES FOR INJECTING FUEL OR OTHER MEDIA
INTO INTERNAL COMBUSTION ENGINES
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DEVICES FOR INJECTING FUEL OR OTHER MEDIA INTO INTERNAL COMBUSTION ENGINES

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1 Claim. (Cl. 103—52)

This invention relates to devices for injecting fuels (either of the lubricating kind or not) or other media such as anti-detonates into internal combustion engines.

Devices for this purpose have been proposed in which at least one delivery conduit and at least one pressure liquid chamber are separated by a movable partition, and provision is made for charging the delivery conduit with a constant quantity of fuel or other liquid (hereinafter referred to as fuel) at each return stroke of the partition and for usefully discharging the fuel on the forward strokes of the partition in proportions that can be manually varied.

An object of the present invention is to provide new and improved means for metering the fuel deliveries in a manually variable manner which enables the number of the moving parts of the device to be considerably reduced.

In accordance with the invention the device includes a distributor rotatable in the body of the device for controlling the periodic supply and discharge of pressure liquid to and from the or each pressure liquid chamber, a return flow passageway in the distributor for the pressure liquid, and a manually operable valve controlling the outlet from the passageway thereby to vary each return stroke of the movable partition which is preferably a movable piston and thus variably meters the quantity of fuel admitted on such stroke to the fuel delivery conduit.

By way of example one form of injection device in accordance with the invention is shown diagrammatically on the accompanying drawings.

Fig. 1 represents this form as a composite, longitudinal section on I—I of Fig. 2.

Fig. 2 represents a half end view and a half section in the plane II—II of Fig. 1.

Fig. 3 represents a cross section in the plane III—III of Fig. 1.

The same references are used throughout to denote the same or similar parts.

The body of the injection device comprises the two parts 1 and 2 detachably held together by stud bolts 3. Body part 2 is provided with a fuel inlet nipple 4 (shown only in Fig. 1); with fuel outlet nipples 5, one for each engine cylinder, there being six in the present example which is intended for a six cylinder, internal combustion engine; and with an inlet nipple 6 for a high pressure pumping liquid, and a return or outlet nipple 7 for this liquid.

Rotatably mounted in an axial bore 8 of the body part 2 there is a distributor 9 for the pumping liquid, this distributor having an annulus 10 in constant communication with the inlet nipple 6 via a duct 11 in the body part 2. An axial duct or passageway 41a in the distributor has an enlarged portion 42a at one end of the distributor. Annulus 10 communicates with a duct 12 in the distributor. A manually operable control rod 14 projects through a small bore in one end of the body

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part 2 into the bore 8, its inner end being formed as a restriction 14a that co-acts with said larger portion 42a leading to passageway 41a to control the rate of return flow of liquid via a duct 42 and the return nipple 7. The other end of the distributor 9 has a shaft 16 rotatably mounted in the body part 1.

Extending through the body part 2 in line with each fuel outlet nipple is a bore 22. In each such bore 22 there is a liner or barrel 23 affording a fuel delivery conduit 24 open to an annulus 25 via radial ducts or passageways 26, and housing a non-return valve 27 which is biased to its closed position by a spring 28 and which, when open, places the conduit 24 in communication with the pertaining fuel outlet nipple. Each valve 27 has a fluted stem.

A freely floating piston or partition 37 within each liner or barrel 23 separates the fuel delivery duct 24 from a pressure liquid chamber 38 at the rear of the floating piston. When the distributor 9 is rotated, the pressure liquid chambers 38 are placed, in turn in communication with the duct 12 of the distributor by means of radial ducts 39 (Figs. 1 and 3). These radial ducts 39 also communicate in turn with a radial duct or passageway 40a in the distributor leading via the axial duct 41a and enlarged portions 42a and duct 42 back to the outlet or return nipple 7.

The beforementioned fuel inlet nipple 4 (Fig. 2) communicates with a fuel gallery 43 formed in the body part 2, this fuel gallery in turn communicating with the inlet chambers 44 (Fig. 1) of six fuel inlet valves each comprising a valve housing 45 screw-threaded into a corresponding bore in the housing part 2, and a fluted-stemmed valve member 46 biased to its seat in the valve housing by a spring 47. The bore containing this spring constitutes the outlet bore of the corresponding fuel inlet valve; it communicates by a branch 48 (shown only in Fig. 3) with the annulus 25 of the pertaining fuel conduit 24.

The inlet nipple 6 communicates, via a conduit, with an accumulator (not shown) supplied with liquid at high pressure by a suitable pump (such as the well known "Deri" pump); and the outlet or return nipple 7 communicates via a conduit with a sump or reservoir (not shown) from which liquid is supplied to the pump. Between the pump and the reservoir there is an over-pressure, spring-load relief valve to ensure substantially constant pressure of the liquid in the accumulator.

In practice the described device is suitably mounted on the engine and the shaft 16 is arranged to be driven from the engine at half the speed of the engine crankshaft in the case of a four-stroke cycle engine. Fuel is supplied to the fuel inlet nipple 4 by a low-pressure pump (not shown) driven by the engine, as is the pump for the supply of high-pressure pumping liquid.

It will be evident that fuel from the gallery 43 will flow past the non-return valves 46 and via the bores 47 and ducts 48, 25, 26 to those of the fuel delivery conduits 24 in which the rear of the floating pistons 37 are not for the time being subjected to high pressure pumping fluid, the fuel forcing back the floating pistons 37 in those conduits 24 against their abutments 32a. High pressure liquid from the aforesaid accumulator will flow, via the nipple 6 and duct 11 and annulus 10 to the duct 12 in the distributor 9. As this duct is brought to register with each radial duct 39 the high pressure liquid exerts pressure in the pertaining pressure fluid chamber 38 on the rear of the corresponding floating piston 37, whereby this piston is urged to the right in Fig. 1 forcing the fuel content of the conduit 24 past the non-return valve 27 to the pertaining fuel outlet nipple and thence to the fuel injector of the corresponding engine cylinder. The liquid pressure in the pressure chamber 38 is relieved when, on con-

tinued rotation of the distributor 9, said radial duct 39 is placed in communication with the radial duct 40a leading via axial duct 41a to the interior 8 of the body part 1 and by way of the duct 42 to the outlet or return nipple 7.

The effective fuel capacity of the conduits 24 (together with their supply ducts back to their respective inlet valves) is determined by the rearmost position assumed by the floating pistons 37. The maximum limit of backward movement of the floating pistons 37 is determined by fixed abutments 32a constituted by the end walls of the barrels 23 containing the pistons. However, axial movement of the control rod 14 has the effect of throttling the passage portion 42a for the return flow of the pumping liquid past the valve-like restriction 14a to a variable extent, thereby correspondingly varying the extent of backward movement of the pistons 37 and consequently the amount of fuel admitted to the fuel conduits 24.

It will be seen that with the described arrangement for metering the quantity of fuel the number of moving parts per fuel outlet is reduced to the minimum.

Clearances of the working parts is not critical since leakage past them does not affect the fuel metering.

Only small driving torque is necessary and this is constant.

The device can be made quite small in size and is capable of operation at speeds high enough for two stroke cycle as well as four stroke cycle internal combustion engines.

I claim:

A device for injecting fuel into an internal combustion engine, comprising a body having at least one delivery conduit, at least one pressure liquid chamber, a movable partition separating the delivery conduit and the pressure liquid chamber from one another, passageways in the body including a non-return valve for supplying fuel under low pressure to the delivery conduit, a non-return valve controlling the outlet from the delivery conduit, a distributor rotatable in the body for controlling the periodic supply and discharge of a pumping liquid at high pressure to and from the pressure liquid chamber, a return flow passageway in the distributor for the pressure liquid, and a manually operable valve controlling the outlet from said passageway thereby to limit each return stroke of the movable partition and variably meter the quantity of fuel admitted on such stroke to the delivery conduit prior to the expulsion of said fuel by the next forward stroke of said partition under the action of the high pressure pumping liquid admitted to the high pressure liquid chamber.

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