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2,640,419

LIQUID FUEL INJECTION PUMP FOR INTERNAL-COMBUSTION ENGINES

Filed May 15, 1951

2 Sheets-Sheet 1

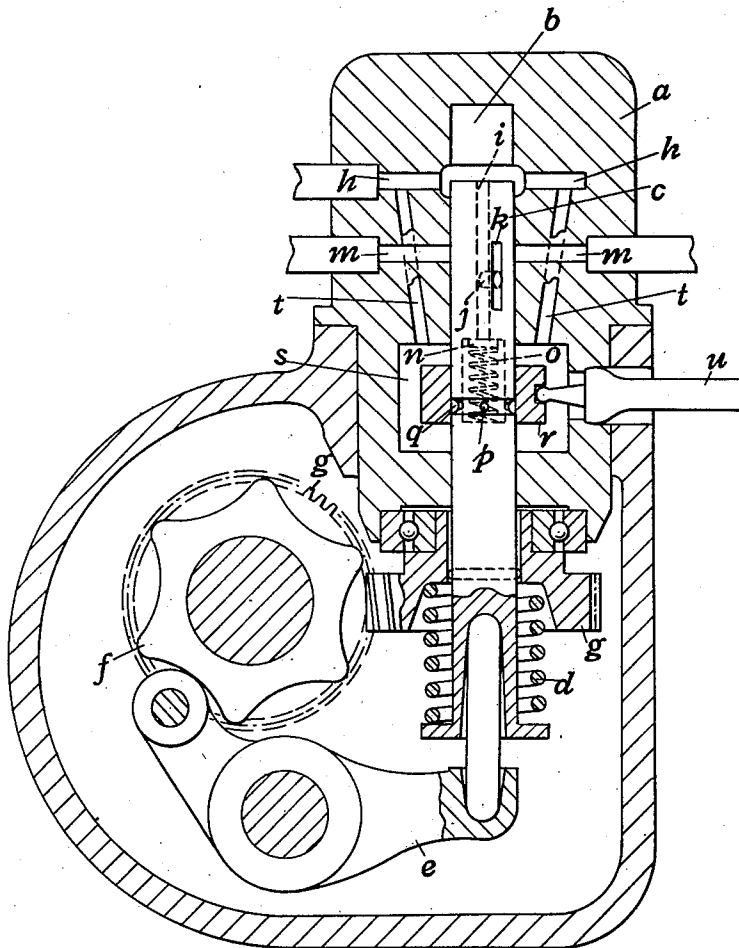


Fig.1

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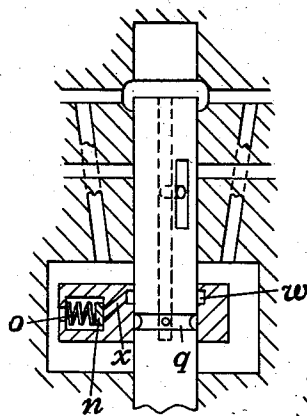


Fig. 2

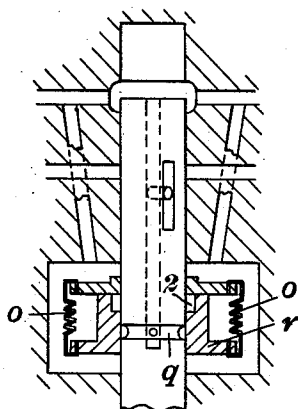


Fig. 3

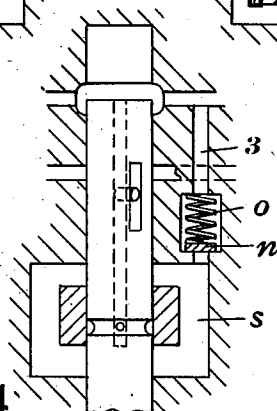


Fig. 4

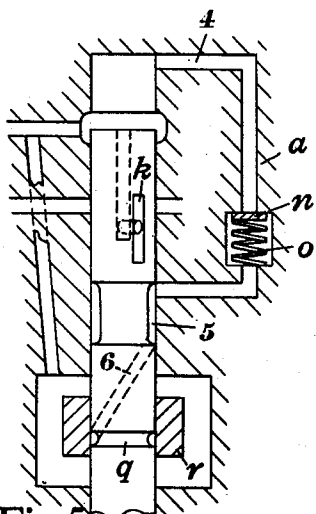


Fig. 5

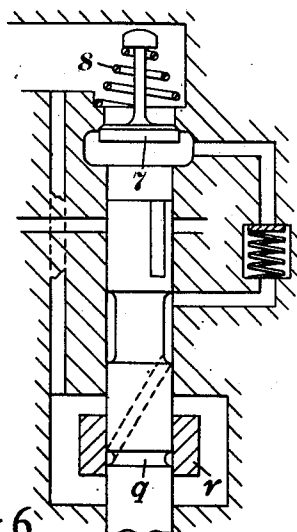


Fig. 6

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LIQUID FUEL INJECTION PUMP FOR
INTERNAL-COMBUSTION ENGINES

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5 Claims. (Cl. 103—2)

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This invention relates to liquid fuel injection pumps for internal combustion engines, of the kind comprising a plunger which by reciprocation effects the desired pump action and which by rotation about its longitudinal axis establishes communication with each in turn of a plurality of discharge ports.

The object of the invention is to provide improved means for varying the pump output.

The invention comprises a pump of the kind aforesaid provided with a spill passage or passages, a spring loaded valve for controlling the spill-flow, and adjustable means for determining the instant in the delivery stroke of the plunger at which spill can occur.

In the accompanying drawings:

Figure 1 is a sectional side elevation of a pump embodying the invention.

Figures 2-6 are diagrammatic views illustrating various alternative embodiments of the invention.

Referring to Figure 1, the body part *a* of the pump has formed therein a core *b* containing the plunger *c*, any convenient means being employed for reciprocating and rotating the plunger. In this example the plunger is loaded by a spring *d* and receives reciprocatory motion from a lever *e* which is actuated by a rotary cam *f*. Rotary motion is imparted to the plunger through helical gear wheels *g*, the plunger being in spline connection with one of these wheels. In the body is provided at least one suction port *h* but more usually (and as shown) two or more such ports are provided in the same plane around the bore. These ports are controlled by the forward end of the plunger, being opened when the plunger is at the commencement of its stroke, and being closed during the initial part of the discharge movement of the plunger. In the plunger is formed an axial passage *i* which at an intermediate part of its length communicates with a radial passage *j* leading to a longitudinal groove *k* in the periphery of the plunger, the groove being located adjacent to the discharge passages *m* in the body part, the said passages being in the same plane at equal distances apart.

At the inner end of the said axial passage in the plunger is arranged a valve *n* loaded by a spring *o* to a pressure rather less than that at which the liquid is to be delivered by the pump, and at a position beyond the valve a radial spill passage (or passages) *p* is or are provided in communication with an annular groove *q* around the plunger. The portion of the plunger adjacent to the said groove carries a slidably adjustable

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sleeve *r* whereby the groove can be exposed at any desired position during the discharge stroke of the plunger, and this sleeve is contained in a chamber *s* in the body part which communicates by way of one or more other spill passages *t* with the inlet port or ports *h*. Adjustment of the position of the sleeve *r* is effected in any convenient manner, as for example, by a manually or otherwise operable lever *u*.

The arrangement is such that during each delivery stroke of the plunger, the inlet port or ports is or are first cut off by the plunger, and thereafter the liquid entrapped in the bore flows down the axial passage in the plunger to the discharge passage which at that time is open to the longitudinal groove in the plunger. Meanwhile the plunger also moves relatively to the above mentioned sleeve, and when the associated circumferential groove is exposed, the valve can open under the pressure of the liquid acting on it and so allow liquid to escape past the sleeve to the pump inlet, thus interrupting the flow through the discharge passage. By suitably adjusting the position of the sleeve the volume of liquid delivered to the discharge passage during movements of the plunger can be suitably varied to suit the requirements of the engine.

In the modified construction shown in Figure 2, the spring loaded valve *n* is arranged in the sleeve, and the latter is provided with an internal annular groove *w* for co-operating with the groove *q* around the plunger, the valve being arranged to control a passage *x* in the sleeve leading from the groove to the surrounding chamber.

In the further modification shown in Figure 3, the sleeve is formed at one end with an annular recess *2* which at the desired position of the plunger can receive liquid from the groove *q* around the plunger, and the open end of the recess is covered by an annular valve *n* loaded by a spring or springs *o*.

In the further modification shown in Figure 4, the spring loaded valve *n* is arranged in a passage *3* leading from the above mentioned chamber *s* to the pump inlet.

In the construction shown in Figure 5, there is provided in the body part *a* an additional spill passage *4* leading from the closed end of the bore to a relatively long and additional circumferential groove *5* around the plunger at a position between the discharge groove *k* and the sleeve *r*, the said additional passage containing a spring loaded return valve *n*. In the plunger is also provided a passage *6* leading from the additional circumferential groove *5* to the groove *q* con-

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trolled by the sleeve. The mode of action is essentially the same as that of the first described form of pump.

In any of the forms of pump above described, there may be provided at one end of the bore a fuel inlet valve 7 loaded by a spring 8, as shown in Figure 6, the fuel inlet to the bore being controlled by this valve instead of by the plunger.

By this invention the control of the pump output can be effected in a simple and satisfactory manner, which also obviates dribbling at the discharge nozzles in the engine cylinders after each discharge.

Having thus described our invention what we claim as new and desire to secure by Letters Patent is:

1. A liquid fuel injection pump comprising, in combination, a body, a pump plunger movable in a bore in the body, means for continuously reciprocating the plunger, means for continuously rotating the plunger about its longitudinal axis, passage means in the plunger communicating with a lateral opening therein, a plurality of discharge ports in the bore circumferentially disposed about the plunger so that communication is established by each in turn of said ports with the plunger passage means, spill passage means for permitting escape of a proportion of the fuel entrapped by the plunger at each stroke, a spring loaded valve controlling the spill flow in said passage means, and adjustable means for determining the instant in the delivery stroke of the plunger at which spill can occur, the arrangement being such that the aforesaid determination of the instant of spill flow is effected independently of the relation between the rotational and longitudinal positions of the pump plunger.

2. A pump according to claim 1, comprising a formation in the body constituting a spill chamber surrounding the pump plunger, spill passage means in the plunger leading to said chamber, a sleeve member surrounding the plunger for controlling the outlet of said spill passage, and means

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for adjusting the position of said sleeve member to vary the time at which the said spill passage outlet is opened.

3. A pump according to claim 1, comprising a formation in the body constituting a spill chamber surrounding the pump plunger, spill passage means in the plunger, a sleeve member surrounding the plunger for controlling said spill passage, and means for adjusting the position of said sleeve member to vary the time at which the outlet of said spill passage is opened, the spring loaded spillage control valve being combined with the plunger.

4. A pump according to claim 1, comprising a formation in the body constituting a spill chamber surrounding the pump plunger, spill passage means in the plunger, a sleeve member surrounding the plunger for controlling said spill passage, and means for adjusting the position of said sleeve member to vary the time at which the outlet of said spill passage is opened, the spring loaded spillage control valve being combined with the sleeve member.

5. A pump according to claim 1, comprising a formation in the body constituting a spill chamber surrounding the pump plunger, spill passage means in the plunger, a sleeve member surrounding the plunger for controlling said spill passage, and means for adjusting the position of said sleeve member to vary the time at which the outlet of said spill passage is opened, the spring loaded spillage control valve being arranged in the pump body.

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