

[54] **LIQUID FUEL INJECTION PUMPING APPARATUS**

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[58] Field of Search **417/462, 253;**
92/107, 108

[56] **References Cited**

UNITED STATES PATENTS

3,498,226	3/1970	Mowbray	417/253
2,955,578	10/1960	Flessate et al.	92/108
2,882,861	4/1959	Hillman	92/108

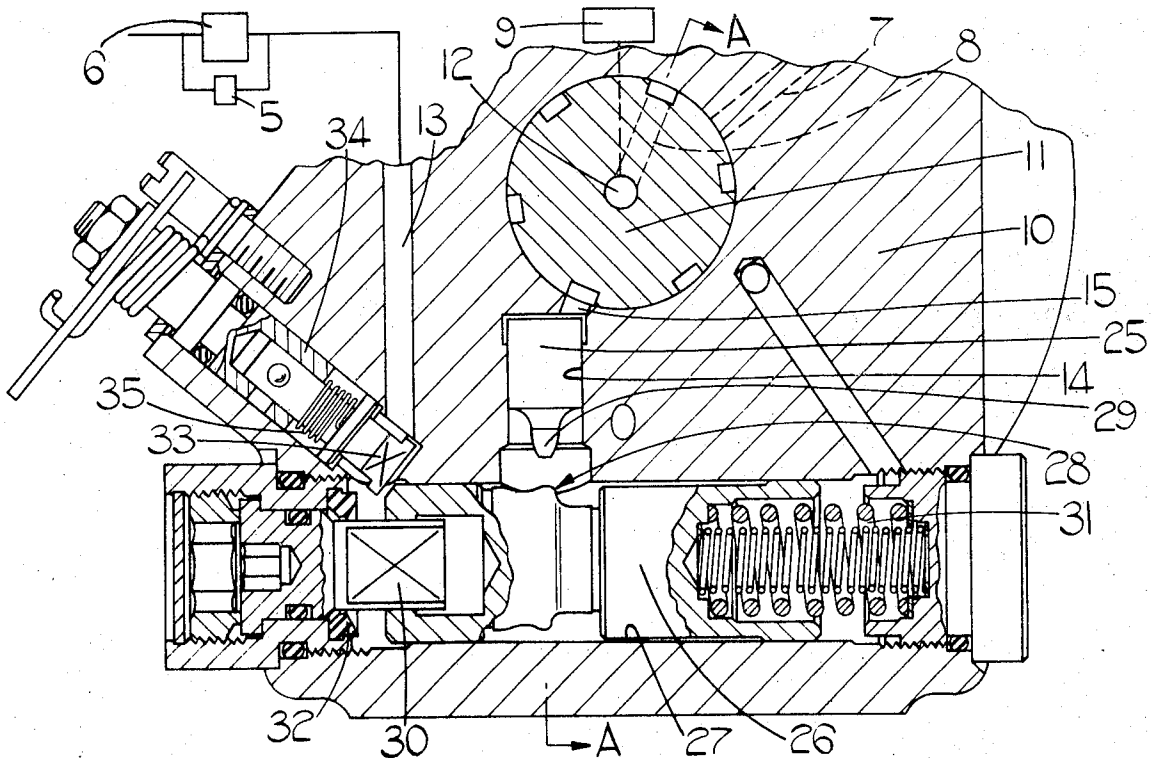
3,433,160 3/1969 Kemp 417/253

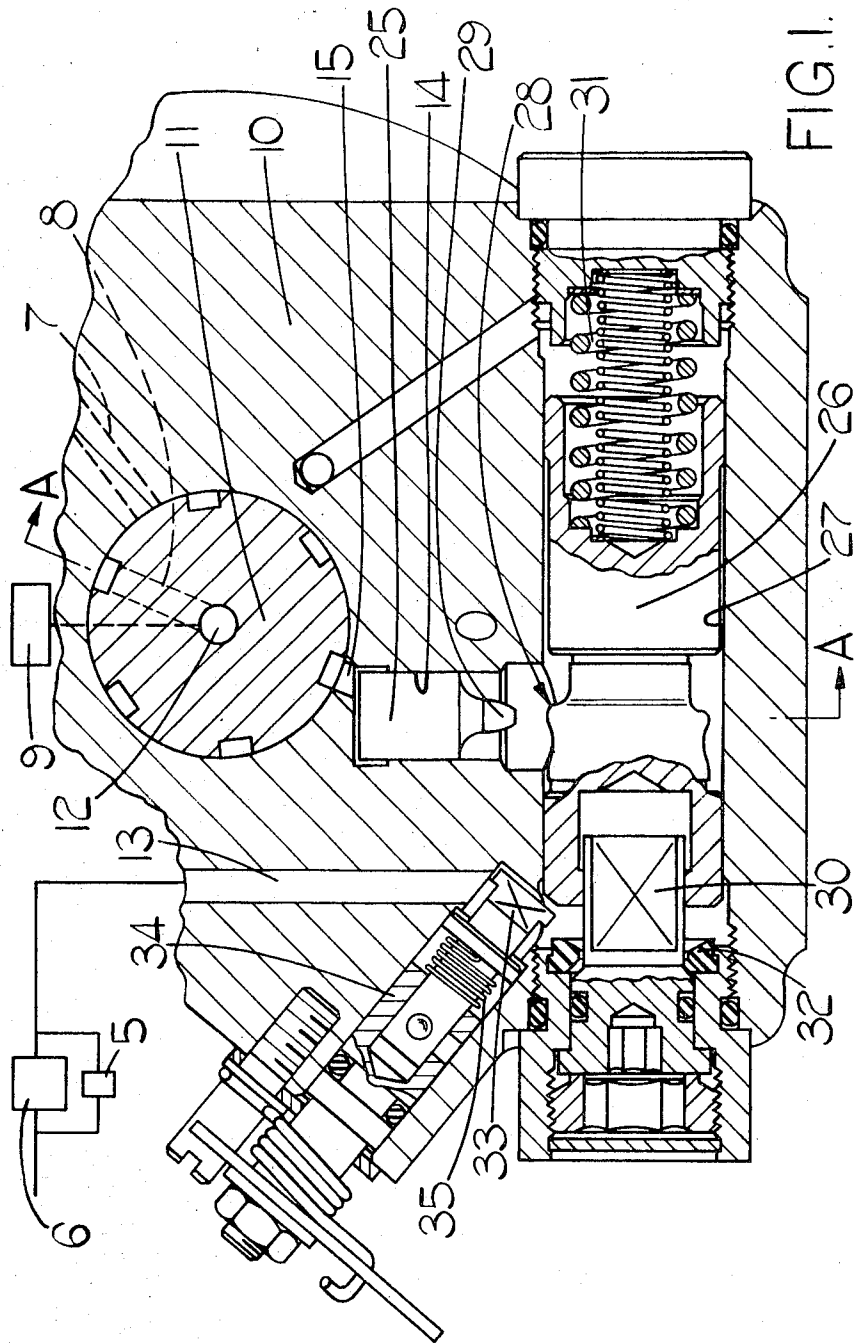
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[57] **ABSTRACT**

A fuel injection pumping apparatus for an internal combustion engine includes a piston movable under the action of a fluid pressure which varies in accordance with the speed at which the apparatus is driven. The piston controls the maximum amount of fuel which can be fed to the engine by acting as a stop for a shuttle piston. A spring is provided to load the piston against the action of fuel pressure and a resilient seal is provided to engage the end of the piston subjected to the fluid pressure to initially shield a portion of the piston from the fluid pressure. In this manner a higher initial value of fluid pressure is required to effect initial movement of the piston.

2 Claims, 3 Drawing Figures





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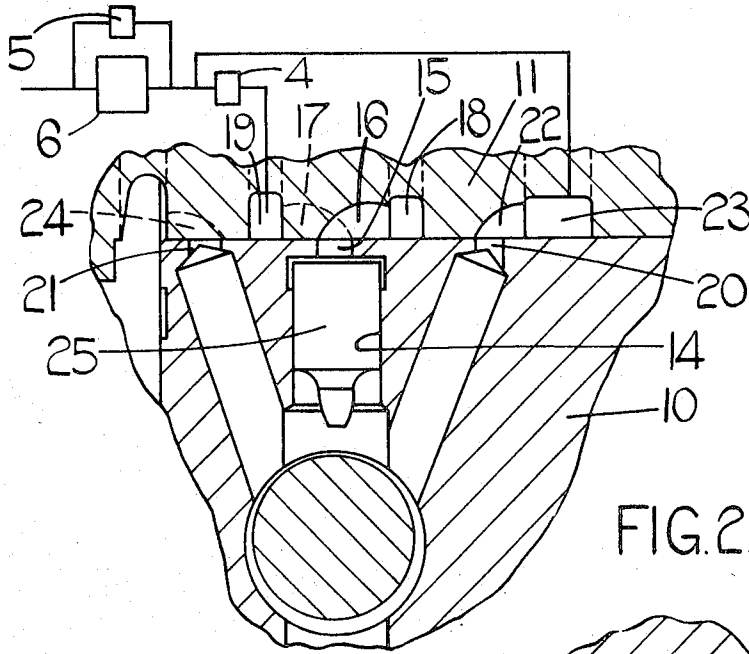


FIG. 2.

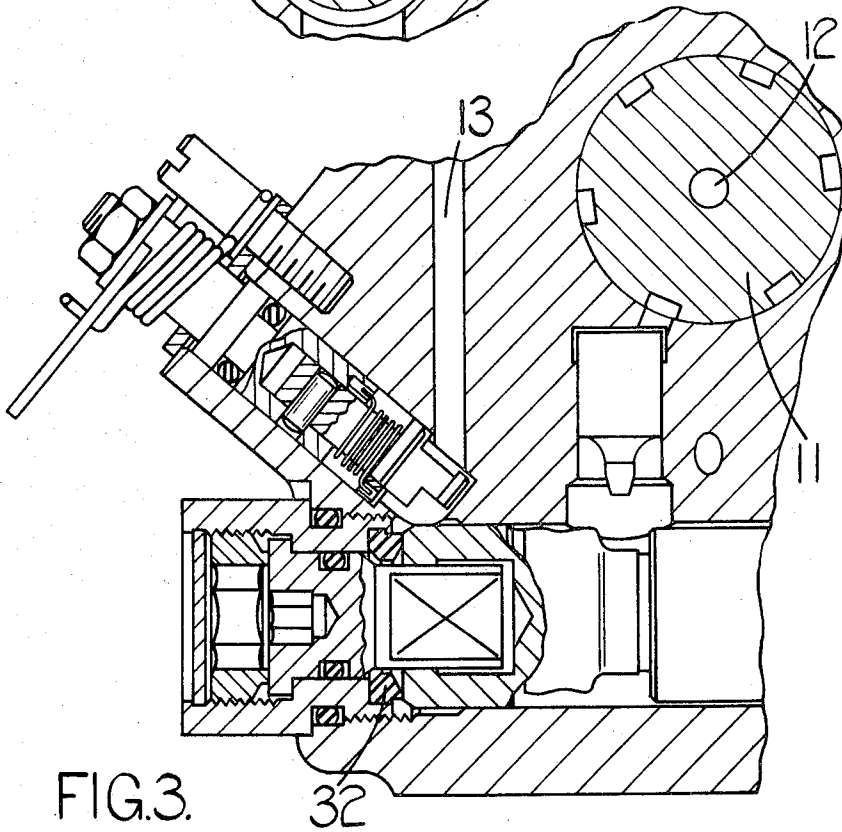


FIG. 3.

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LIQUID FUEL INJECTION PUMPING APPARATUS

This invention relates to liquid fuel injection pumping apparatus of the kind comprising in combination, an injection pump for delivering fuel in timed relation to an associated engine, a feed pump for supplying fuel to the injection pump, valve means for providing fuel under pressure at a value which varies in accordance with the speed at which the apparatus is driven, a metering shuttle the excursion of which in a cylinder determines the maximum quantity of fuel which can be supplied to the injection pump and a resiliently loaded piston which acts as a stop to determine the extent of movement of the metering shuttle, the piston mounting a cam profile which is shaped so that at one extreme position of the piston as determined by the resilient loading of the spring, the metering shuttle is allowed to move to an extent such that an excess of fuel is provided for starting purposes, the piston being subjected at one end to said fuel under pressure so that as the speed at which the apparatus is driven increases, the piston moves against the action of the resilient loading to reduce the excursion of the shuttle.

With such apparatus it is desirable to maintain the supply of excess fuel to the engine when starting the engine, until the engine speed has attained a value which is above the normal idling speed of the engine. However, it is essential that once this value of speed has been attained the engine can idle without excess fuel being provided.

The object of the invention is to provide such an apparatus in a form in which the above desiderata are achieved.

According to the invention in an apparatus of the kind specified the cylinder in which the piston is mounted is provided at its end adjacent said one end of the piston with a seal member, the seal member when the piston is at its extreme position masking a portion of said one end of the piston to prevent the fuel pressure acting thereon, the arrangement being that the fuel pressure must build up to a higher value to effect initial movement of the piston away from the seal member.

In the accompanying drawings:

FIG. 1 is a section through a part of an apparatus in accordance with the invention,

FIG. 2 is a part section on the line A—A of FIG. 1, and

FIG. 3 is a view similar to FIG. 1 showing the parts of apparatus in an alternative position.

Referring to the drawings the apparatus includes a body portion 10 in which is mounted a rotary cylindrical distributor member 11. The fluid is directed to and discharged from the rotary cylindrical distributor via a pump of the type disclosed in my previously issued U.S. Pat. No. 3,433,160. The distributor member is arranged to be driven in timed relationship with an associated engine. Formed within the distributor member is an axially extending passage 12 which at one end communicates with an injection pump 9 and which at another point, communicates with a delivery passage 8 which extends to the periphery of the distributor member. The delivery passage is arranged to register with each in turn of a plurality of outlet ports 7 which are connected to the injection nozzles respectively of the associated engine. The communication between the de-

livery passage and an outlet port occurs whilst the injection pump is delivering fuel under pressure.

Also mounted upon the distributor member is the rotary part of a vane type feed pump 6 and accommodated within the apparatus is a control valve 5 the operation of which results in the supply of fuel under pressure to a passage 13 formed in the body part 10. The action of the valve is to ensure that the fuel pressure within the passage 13 varies in accordance with the speed at which the apparatus is driven.

The feed pump is arranged to supply fuel to the injection pump during the filling periods of the latter but in order to control the maximum quantity of fuel which can be fed to the injection pump a metering shuttle arrangement is provided. Again referring to the drawings there is formed in the body part 10 a cylinder 14 the inner end of which terminates in a port 15 opening onto the periphery of the distributor member. The port 15 can communicate alternately with two series of longitudinal grooves 16, 17 formed in the periphery of the distributor member and communicating respectively with circumferential grooves 18, 19. Groove 18 communicates with the passage 12 by way of a non-return valve (not shown) and groove 19 communicates with the outlet of the feed pump by way of a throttle device 4. The outer end of the cylinder 14 communicates with a pair of ports 20, 21 opening onto the periphery of the distributor member and the port 20 can communicate with each in turn of a plurality of longitudinal grooves 22 which extend from a circumferential groove 23. This latter groove is in constant communication with the outlet of the feed pump 6. The port 21 can communicate in turn with longitudinal grooves 24 formed on the periphery of the distributor member and these open into the interior of the apparatus.

Located within the cylinder 14 is a metering shuttle 25 and the arrangement is such that when the port 20 registers with a groove 22 fuel will be supplied to the outer end of the cylinder 14 and the shuttle 25 displaced towards the distributor member. During this movement fuel flows from the port 15 through one of the grooves 16, the circumferential groove 18 to the passage 12. This flow of fuel continues until the shuttle 25 strikes the end of the cylinder 14. This occurs during a filling stroke of the injection pump and whilst the latter is delivering fuel to the associated engine a groove 17 moves into register with the port 15 and a groove 24 moves into register with the port 21. When this occurs fuel flows to the inner end of the cylinder 14 and the shuttle 25 is moved outwardly.

In order to control the maximum quantity of fuel which is supplied to the injection pump, the excursion of the shuttle is limited by an adjustable stop. This takes the form of a piston 26 which is slidable within a cylinder 27. An intermediate portion of the piston 26 is shaped at 28 to define a cam surface against which a projection 29 on the shuttle can bear to limit the extent of movement of the shuttle. The piston 26 is restrained from angular movement within the cylinder 27 by means of a guide member 30 which extends within a cavity formed in the piston. The angular position of the guide member 30 is adjustable so that the angular position of the piston can be varied. Moreover, the cam surface 28 is eccentrically disposed about the axis of the piston so that an initial setting of the cam surface can be effected.

3

The piston 26 is loaded towards one end of the cylinder 27 by means of coiled compression springs 31 and the passage 13 opens into the side wall of the other end of the cylinder. When the piston 26 is at its extreme position under the action of the spring 31 the shuttle 25 can partake of a stroke such that an excess of fuel is provided for starting purposes. When the engine starts however fuel under pressure is applied to the piston and the latter is moved against the action of the springs 31.

In order to delay the movement of the piston 26 the end wall of the cylinder 27 remote from the springs 31 mounts an annular resilient seal member 32 which is contacted by the piston 26 in the extreme position thereof. The seal member 32 has the effect of preventing fuel under pressure acting upon a substantial portion in this case the central portion of the end face of the piston. The fuel pressure must therefore rise appreciably before the piston 26 moves against the action of its spring. Once it has moved however the whole end surface of the piston is exposed to the fuel pressure and the result is that excess fuel is supplied to the engine when starting until a value of speed is reached which is above the normal idling speed of the engine. However, after this speed has been reached the engine can be returned to idling speed without excess fuel being selected.

Since the provision of excess fuel will not be necessary at all times when starting the engine a manually operable release member 33 is provided. As shown in FIG. 1 the member is in a position to engage the end of the piston thereby to prevent the latter moving to its extreme position under the action of the springs 31. The member 33 is angularly movable to a position as shown in FIG. 3, in which the piston can move its maximum extent under the action of the springs, into contact with the seal member 32. The member 33 is coupled to a member 34 movable from the exterior of the casing, through the intermediary of a coiled torsion spring 35 which allows the manually operable member 33 to return to the non-excess fuel position without undue force being exerted upon the piston by the member 33.

We claim:

1. A liquid fuel injection pumping apparatus comprising an injection pump for delivering fuel in timed relation to an associated engine said fuel injection pump comprising an inlet port, at least one outlet port and at

4

least one working member adapted to move to draw fluid into and discharge fluid from a working chamber forward in part by said working member, a feed pump having an outlet for supplying fuel to the injection pump, valve means for controlling the output pressure of said feed pump so that it varies in accordance with the speed at which the apparatus is driven, a metering shuttle the excursion of which in a cylinder determines the maximum quantity of fuel which can be supplied to the injection pump, a further cylinder, a piston mounted in said further cylinder resilient means loading said piston to one end of said further cylinder, conduit means communicating said one end of the cylinder with the outlet of the feed pump, said piston acting as a stop to determine the extent of movement of the metering shuttle, a cam profile formed on said cam profile being shaped so that at one extreme position as determined by the resilient means, the metering shuttle is allowed to move to an extent such that an excess of fuel is supplied for starting purposes, the piston being subject at one end to fuel under pressure from the outlet of the feed pump so that as the speed at which the apparatus is driven increases, the piston will move against the action of the resilient means to reduce the excursion of the shuttle, an annular seal member positioned in said end of the further cylinder in which the piston is mounted, the seal member when the piston is at said one extreme position masking a portion of said one end of the piston to prevent the fuel pressure acting thereon, and latch means for preventing said piston moving to said one extreme position, said latch means being releasable to permit movement of the piston to said one extreme position in the absence of fuel pressure acting on said piston, the arrangement being such that when the piston is in said extreme position the fuel pressure must attain a higher value to effect initial movement of the piston away from the seal member.

2. A pumping apparatus as claimed in claim 1 in which said latch means comprises a pair of relatively movable members one of which is operable from the exterior of the apparatus, the other member being positioned to contact said piston to prevent the piston moving to said one extreme position, resilient means coupling the pair of members together whereby said other member may be moved out of engagement with the piston by operation of said one member.

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