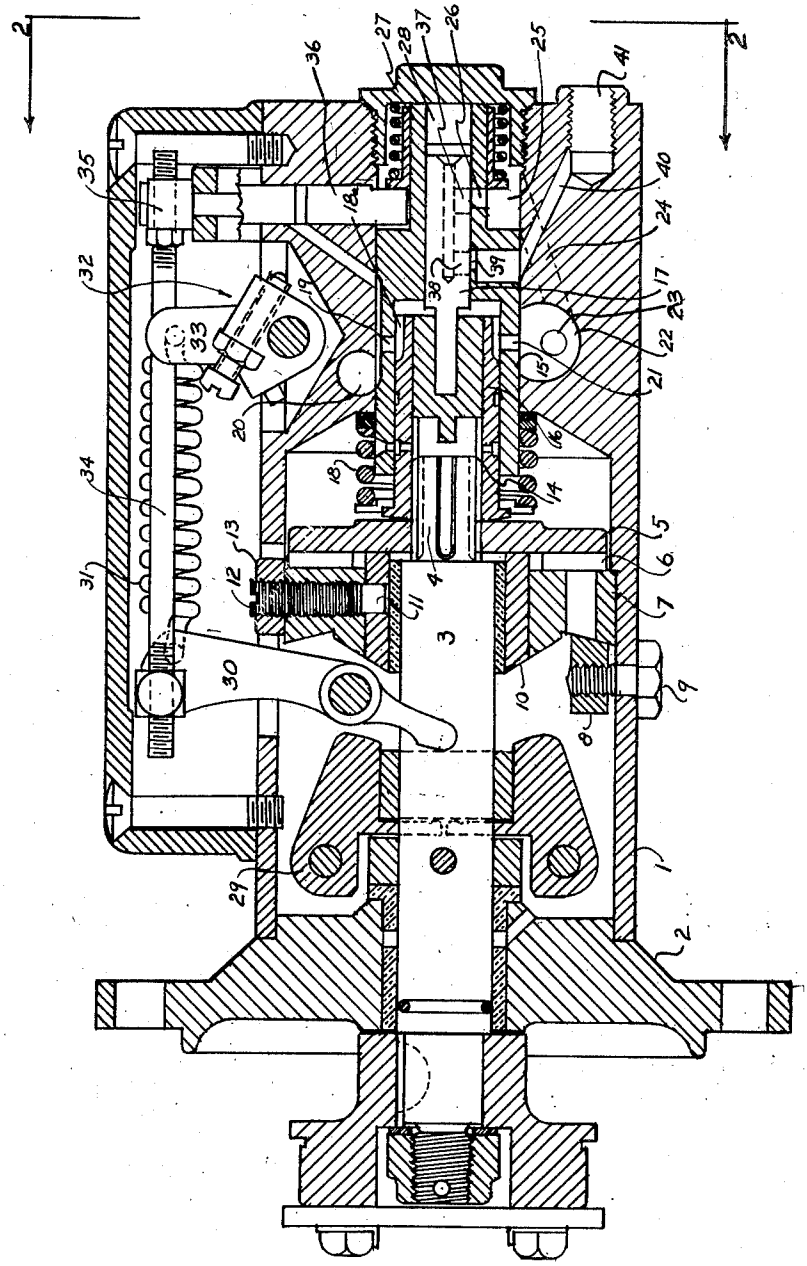
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FUEL INJECTION PUMPS

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FUEL INJECTION PUMPS

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This invention relates to fuel injection apparatus and has particular reference to a new and improved combined fuel injection pump and distributor which is relatively simple and economical and efficient in operation.

An object of the invention is to provide new and improved drive means for the fuel distributor, fuel supply pump and fuel injection pump of fuel injection apparatus of the type set forth.

Another object of the invention is to provide new and improved fuel metering means for fuel injection apparatus of the type set forth.

Another object is to provide new and improved means for adjusting the maximum fuel quantity of such a fuel injection pump.

Other objects and advantages of the invention will be apparent from the following description taken in connection with the accompanying drawings. It will be understood that changes may be made in the details of construction and arrangement of parts without departing from the scope of the invention as set forth in the accompanying claims.

Referring to the drawings, the figure is a longitudinal sectional view of a fuel injection pump embodying the invention.

Referring more particularly to the drawing, the body part 1 is bolted to the flange 2 at four corners by cap screws (not shown).

The shaft 3 terminates in a splined portion 4 which drives a rotatable cam member 5. This member has six lift surfaces 6 or lobes radially of the leftward facing annular face and generally triangular in transverse cross section. These coact with six similarly formed lifts on stationary cam member 7 to cause member 5 to have six quick lifts per revolution of the shaft with a dwell of member 5 in its unlifted position between strokes.

The cam 7 is hold against a shoulder in 1 by two block nuts 8 fastened by cap screws 9.

A bushing 10 is slidable axially in cam 7 to limit the retraction of cam 5 which limits the displacement of pumping plungers (later to appear) for purposes of maximum fuel quantity control. The position of sleeve 10 in cam 7 is adjustable by an eccentric dog point 11 on the screw 12 which may be locked by nut 13.

A fuel transfer pump plunger 14 is internally splined to slide on the splines 4 and be rotatably driven thereby. Plunger 14 is reciprocable in an enlarged portion of the axial bore through sleeve member 15. The top face of plunger 14 is formed by a plug 16 pressed in 14. Plug 16 has a transverse slot for drivingly rotating injection plunger 17 and a tang for engaging a coacting slot in the splined end 4 of shaft 3. A suitable spring 18 returns plunger 14 rotating therewith, its thrust being reacted through a two plate radial annular plain thrust bearing to the right of the spring.

To insure that unavoidable inequalities in the height of the several cam lifts 6 on members 5 and 7 will not cause eccentric forces to be applied to plunger 14 by cam member 5, the abutting surfaces of these are respectively made of spherical and plane conformation and the fit of member 5 on the splines 4 is sufficiently loose to allow articulation between members 5 and 14.

Plunger 14 is formed with one groove 18*a* along an element of its surface for each of the six equally spaced lifts of the cam. On the outward or filling stroke only of plunger 14, three of these equally spaced grooves register with three equally spaced supply ports 19 which traverse the wall of sleeve 15 and are constantly in communication with a transverse fuel supply conduit 20. On the inward or delivery stroke only, two of the grooves 19 register with two equally spaced delivery ports 21 which are in constant communication with delivery passage 22. In the drawing ports 19 and 21 are shown for illustration only in communication. Excess fuel which enters passage 22 may be by-passed back to the fuel supply tank (not shown) via a spring loaded working pressure relief valve indicated at 23. The pressure relief valve 23, though of ball construction differs from conventional pressure relief valves in that the ball acts as a spring pressed piston in a closely surrounding bore at all pressures below the maximum or relieving pressure. When relieving pressure is reached the ball moves outwardly into an enlarged portion of the bore to permit fuel to by-pass the ball. This construction causes the valve 23 to have a dual function as a spring pressed accumulator and a relief valve. It's to be noted that the accumulator function is necessary as port 21 is closed during the filling stroke of plunger 14 and it is during this movement that plunger 17 executes its filling movement as will presently appear.

The fuel to be injected is transmitted from passage 22 to chamber 25 via drilled passage 24. During the filling movement of plunger 14 fuel under pressure of the accumulator 23 may pass through port 26 subject to the variable restriction which may be imposed by the sliding sleeve 27 which performs a throttling or metering function responsive to the governor mechanism later to be described.

In Patent No. 2,361,399, to High is shown a rotating pump plunger with similar means to those included in plunger 14 for communicating with a single suction passage during a filling stroke and a single discharge passage during a discharge stroke.

The injection and distributing plunger 17 is moved in its expulsion direction by abutment of its end against plug 16 of fuel transfer pump plunger 14.

Also a rotating and reciprocating pump plunger for delivering metered quantities of fuel successively into a plurality of conduits leading respectively to a plurality of engine cylinders is shown in High application, Serial No. 546,161 and also in said Patent No. 2,361,399.

The pumps of the High patent and application, however, have been supplied with fuel by a substantially constant displacement primary or fuel transfer pump. In the present instance the fuel transfer pump is a reciprocating differential plunger type pump. The expulsion cavity of the injection pump is closed by the plug 28.

The governor mechanism includes much that is conventional. Governor weights 29 cause movement of a lever arm 30 against the force of a spring 31 which may be varied by a speed control lever and cross shaft assembly 32 including a maximum spring tension limiting screw and its lock nut. This assembly may be moved by speed control arm 33. A drag link 34 connects arm 30 to another arm 35 at the upper end of an oscillable pin 36 having an eccentrically formed lower end engaging throttle sleeve member 27 to move the latter for control of the quantity of fuel to be admitted through port 26.

As plunger 17 rotates one of six (only one shown) equally spaced ports 37 contained in a transverse plane

therein registers with port 26 during each filling period. During each of the expulsion strokes a single port 38 in the plunger registers with one of six equally spaced delivery ports 39 which communicate respectively with drilled passages 40 leading to tapped conduit connections 41 by which conduits leading to the respective engine cylinders may be secured.

A suitable hub and retaining flange is mounted on the outer end of shaft 3 for supporting a driving gear or sprocket.

From the foregoing it will be seen that we have provided simple efficient and economical means for obtaining all of the objects and advantages of the invention.

We claim:

1. In a device of the character described, a shaft, a pumping and distributing member axially aligned with said shaft, a cam member adapted to be rotated by said shaft, a stationary cam member, said first cam member and said stationary cam member having lift portions adapted to engage and effect movement of said first cam member, and a bushing in said stationary cam member, said bushing being axially movable in said stationary cam member and adapted to engage said movable cam to limit the retraction of said first cam member and thereby limit the movement of said pumping and distributing member for controlling the maximum fuel quantity delivered by the pump, and means for adjusting said bushing to thereby adjust said maximum fuel quantity, said means comprising a screw member having an eccentric portion and means for locking said screw member in adjusted position.

2. In a device of the character described, a shaft, a pumping and distributing member axially aligned with said shaft, a cam member adapted to be rotated by said shaft, a stationary cam member, said first cam member and said stationary cam member having lift portions adapted to engage and effect movement of said first cam member, and a bushing in said stationary cam member, said bushing being axially movable in said stationary cam member and adapted to engage said movable cam to limit the retraction of said first cam member and thereby limit the movement of said pumping and distributing member for controlling the maximum fuel quantity delivered by the pump, and means for adjusting said bushing to thereby adjust said maximum fuel quantity including a screw having an eccentric point with said eccentric point engaging said bushing for axial adjustment of said bushing and means for locking said screw in adjusted position.

3. In a device of the character described, a shaft and a fuel pumping and distributing member in axial alignment, said shaft being adapted to effect rotation and reciprocation of said pumping and distributing member, an operative connection between said shaft and said pumping and distributing member, a cam member operatively connected to said shaft and adapted to be rotated thereby and a stationary cam member surrounding said shaft adjacent said movable cam member, said movable cam member and said stationary cam member having cooperative lift portions for effecting reciprocation of said pumping and distributing member, a bushing surrounding said shaft member, and an adjusting member extending through said stationary cam member and engaging said bushing member for effecting axial movement

of said bushing member, said bushing member engaging said movable cam member to limit the retraction of said movable cam and thereby limit the movement of said pumping and distributing member and thereby limit the displacement of the pumping member for controlling the maximum fuel quantity delivered by the pump.

4. In a device of the character described, a shaft, a pumping and distributing member axially aligned with said shaft, a cam member adapted to be rotated by said shaft, a stationary cam member, said first cam member and said stationary cam member having lift portions adapted to engage and effect movement of said first cam member, and a bushing in said stationary cam member, said bushing being axially movable in said stationary cam member and adapted to engage said movable cam to limit the retraction of said first cam member and thereby limit the movement of said pumping and distributing member for controlling the maximum fuel quantity delivered by the pump, and means for adjusting said bushing to thereby adjust said maximum fuel quantity including a screw having an eccentric point with said eccentric point engaging said bushing for axial adjustment of said bushing and means for locking said screw in adjusted position, and a fuel supply pump operatively connected to said shaft and interposed between said shaft and said pumping and distributing member.

5. In a device of the character described, a shaft, a pumping and distributing member axially aligned with said shaft, a cam member adapted to be rotated by said shaft, a stationary cam member, said first cam member and said stationary cam member having lift portions adapted to engage and effect movement of said first cam member, and a bushing in said stationary cam member, said bushing being axially movable in said stationary cam member and adapted to engage said movable cam to limit the retraction of said first cam member and thereby limit the movement of said pumping and distributing member for controlling the maximum fuel quantity delivered by the pump, and means for adjusting said bushing to thereby adjust said maximum fuel quantity including a screw having an eccentric point with said eccentric point engaging said bushing for axial adjustment of said bushing and means for locking said screw in adjusted position, a sleeve for controlling the delivery of fuel by said pumping plunger and means for effecting adjustment of said sleeve.

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