FUEL INJECTION PUMP MECHANISM

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7 Claims. (Cl. 123--140)

Fig. 5 is a fragmentary sectional view taken on the line V--V of Fig. 2.

Referring to the drawings in greater detail, the pump housing 10 is illustrated as having a central bore 11 for the reception of a pump assembly supported principally by a pump body 12. The pump body 12 contains a pump cylinder 13 retained in place therein in a more or less conventional manner by an externally threaded nut member 14. The plunger 15 is reciprocally carried in the cylinder 13 and is provided adjacent its pressure end with a scroll shaped metering relief portion 16 of conventional construction which serves in a manner well known to vary the quantity of fuel pumped upon each reciprocal stroke of the plunger depending upon its position of adjustment within the cylinder. Fuel is directed to the pump cylinder through an intake passage 17 formed in the pump body 12 and communicating as illustrated with a manifold chamber 18 formed in the pump housing. The manifold chamber 18 may also communicate through passages not shown with other pump assemblies where the invention is employed in conjunction with a multiple cylinder engine. Fuel received in the cylinder through intake passage 11 is discharged by action of the plunger through a conventional check valve 19 and fitting 20 forming a connection with a fuel line conduit 21 adapted to direct the fuel toward the combustion chamber of an engine, not shown.

The pump body 12 carries a sleeve-like extension 22 which is pressed or shrunk onto the pump body to effect a secure attachment and fits within the bore 11 of the pump housing. A spring 23 contained within the sleeve 22 normally urges the plunger toward its retracted position in the cylinder 13. The spring is seated at one end against a shoulder 24 on the pump body and at its other end against a washer 25. The washer 25 bears against the upper edge of a cup 26 carried for reciprocal movement with the plunger and in the sleeve 22. The lowermost end of the plunger 15 is connected as by a fitting 28 with a tappet assembly 29 of conventional construction reciprocally mounted in the bore 11 and engaged at its extremity by a cam 30 on a fuel pump camshaft 31 adapted to be rotated in timed relationship with the operation of the engine.

Thus, while the spring 23 serves to retract the plunger, the plunger is periodically advanced by engagement of the cam 30 with the tappet assembly 29 connected with it.

A segment gear 32 is non-rotatably secured to the pump plunger as by a screw 33, illustrated...
in Fig. 2, and meshes with a control gear 34 fixed to and rotatable with a shaft 35. The shaft 35 is connected through mechanism, not illustrated, with similar shafts for other pumps of multipletogether with the engine governor control for rotatable adjustment related to the fuel requirements of the engine as is common practice. Thus, as the governor responds to the demands of the engine for more or less fuel, the shaft 35 is rotated. Through the meshing gears 32 and 34, the plunger 15 is rotatably adjusted to effect metering of the required amount of fuel through its scroll shape relief 16. It is apparent, therefore, that in placing the pump assembly into the pump housing, it is essential that the gears 32 and 34 come into meshing engagement in their proper phase positions in order to maintain the required relationship between plunger positions of the several pumps and the governor setting. This is accomplished by a construction of the pump assembly designed to prevent its removal from or insertion into the pump housing except when both of the gears 32 and 34 are in a certain position. For convenience, this position has been taken as the shut-off or no fuel position of the governor and the plunger. As shown in Fig. 2 of the drawings, this position is established on the gear 34 by a shoulder 38 engaging with a stop screw 39 arranged to project through the housing enclosing the gear.

The plunger gear 32 is retained against rotation away from its no fuel position by the following mechanism. Referring to Figs. 1 and 3, the shaped member 26 surrounding the plunger gear 32 is shown as held against rotation with relation to the sleeve 22 within which it reciprocates by a key 40. The key 40 engages the upper edge of the cup through registering notches 41 and 42 and is received for sliding movement in a slot 43 formed in the sleeve 22. The key 40 also extends upwardly through a notch 44 formed in the edge of the washer 25 so that in assembly the top surface of the key is engaged and the key retained against vertical displacement by pressure of the spring 23 where it seats on the washer 25.

A dished washer 45 (Figs. 1, 4 and 5) is retained in, and serves as an end member for the sleeve 22 by means of a snap ring 46. This washer has ears 47 projecting radially and engageable with notches 48 in the bottom of the sleeve to prevent its rotation with relation thereto. The washer 45 is cut away or notched as indicated at 49 and the control gear 34, as shown in Fig. 2, is relieved as at 50. It is, therefore, only when the notched portion 45 of the washer properly registers with the control gear in its no fuel position that the fuel pump assembly can be withdrawn from the bore 11 in the pump housing. To prevent rotation of the pump plunger and the plunger gear 32 after the assembly has been withdrawn and, therefore, to sliding movement in a slot 51 formed in the sleeve 22. To prevent rotation of the pump plunger and the plunger gear 32 after the assembly has been withdrawn and, therefore, to sliding movement in a slot 51 formed in the sleeve 22. The downward movement of the cup 26 under influence of the spring 23 is limited at the position illustrated in Fig. 5 wherein the cup engages the washer 45, and in this position the ear 52 extends through the perforations 53 and 54 to prevent rotation of the gear 32 and thus to retain the gear in its proper phase position for re-assembly.

When the construction described the washer member 45 prevents removal of the pump assembly from its housing except when the meshing gears are both in a pre-determined phase position. Furthermore, it prevents re-assembly unless the gears are in this position and it serves, through its upwardly bent ear 52, to prevent rotation of the pump plunger away from this pre-determined position while the parts are disassembled.

The control gear 34 herein illustrated is representative of any control member adapted to register or mesh with the plunger gear 32 and may be varied in its construction without forfeiting the advantages of the present invention. For example, a rack-bar is employed for registry with the gear and condition of the plunger gears of a plurality of aligned fuel injection pumps and the invention herein described will apply in such construction so long as means are provided for establishing a definite no fuel position of the rack-bar.

I claim:
1. In a fuel injection pump for an internal combustion engine, a pump housing, a pump assembly removably disposed in the housing, means for adjusting the pump including parts carried by the housing and parts carried by the pump assembly and registering with each other, and means to prevent removal or replacement of the pump assembly except when the registering parts are in a predetermined phase position, and means operable upon removal of the pump assembly to retain said parts carried by the pump assembly in said phase position.
2. In a fuel injection pump for an internal combustion engine, a pump housing, a pump assembly removably disposed in the housing and including a plunger adjustable by rotation for metering fuel delivered by the pump, a gear like part on the plunger, a gear like part in the housing meshing therewith and adapted to be controlled by an engine governor, and means to prevent removal of the pump assembly from the housing except when said meshing gear parts are in a predetermined phase position, and means effective upon removal of the pump assembly to lock the plunger against rotation in the pump assembly.
3. In a fuel injection pump for an internal combustion engine, a pump housing, a pump assembly removably disposed in the housing and including a plunger adjustable by rotation for metering fuel delivered by the pump, a gear on the plunger, a control gear in the housing meshing with the gear on the plunger, and means operable with an engine governor, means to stop the control gear in a predetermined phase position, said control gear having a relieved portion in its periphery, and means on the pump assembly preventing its removal except through said relief when the control gear is in said position.
4. In a fuel injection pump for an internal...
5 combustion engine, a pump housing, a pump assembly removably disposed in the housing and including a plunger adjustable by rotation for metering fuel delivered by the pump, a gear on the plunger, a control gear in the housing meshing therewith and associated with an engine governor, means to stop the control gear in a predetermined phase position, said control gear having a relieved portion in its periphery, and means on the pump assembly preventing its removal except through said relief when the control gear is in said position, and means for locking the plunger gear against rotation in the pump assembly in a corresponding phase position when the pump assembly is removed from the housing.

5 In a fuel injection pump for an internal combustion engine, a pump housing, a pump assembly removably disposed in the housing and including a plunger adjustable by rotation for metering fuel delivered by the pump, a gear on the plunger, a control gear in the housing meshing therewith and associated with an engine governor, means to stop the control gear in a predetermined phase position, said control gear having a relieved portion in its periphery, and means on the pump assembly preventing its removal except through said relief when the control gear is in said position, and means for locking the plunger gear against rotation in the pump assembly in a corresponding phase position when the pump assembly is removed from the housing, and releasing the plunger gear when the pump assembly is replaced in the housing.

6 In a fuel injection pump assembly adapted to be contained by a pump housing and having a plunger of the metering type with a gear for imparting metering adjustment thereto, a sleeve surrounding the plunger and having an end member through which the plunger extends for engagement with an actuating cam, spring means in the sleeve urging the plunger into contact with said cam and tending when the assembly is removed from the housing to position the gear on the plunger adjacent the end member of the sleeve, and means carried by said end member and engageable with the gear to prevent its rotation in the pump assembly while the pump assembly is removed from the housing.

7 In a fuel injection pump for an internal combustion engine, a pump housing, a pump assembly removably disposed in the housing and including a plunger adjustable by rotation for metering fuel delivered by the pump, a gear like part on the plunger, a gear like part in the housing meshing therewith and adapted to be controlled by an engine governor, means to prevent removal of the pump assembly from the housing except when said meshing gear parts are in a predetermined phase position, a spring for retracting the plunger, and means actuated by said spring upon removal of the pump assembly to hold said first named gear like part against rotation in the assembly.

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