# United States Patent [19]

**Mowbray**

[11] **3,712,761**

[45] **Jan. 23, 1973**


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


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[22] Filed: **Oct. 2, 1970**

[21] Appl. No.: **77,687**

[30] **Foreign Application Priority Data**

Oct. 3, 1969 Great Britain.....48,628/69

[52] **U.S. Cl.**.....**417/462**

[51] **Int. Cl.**.....**F04b 19/02**

[58] **Field of Search**.....417/462, 245, 212, 485



[56] **References Cited**

UNITED STATES PATENTS

| | | | |
|---|---|---|---|
| 3,194,225 | 7/1965 | Kemp | 417/212 |
| 3,433,160 | 3/1969 | Kemp | 417/245 |
| 3,506,381 | 4/1970 | Kemp | 417/485 |
| 3,507,579 | 4/1970 | Kemp | 417/485 |
| 3,500,749 | 3/1970 | Kemp et al. | 417/485 |



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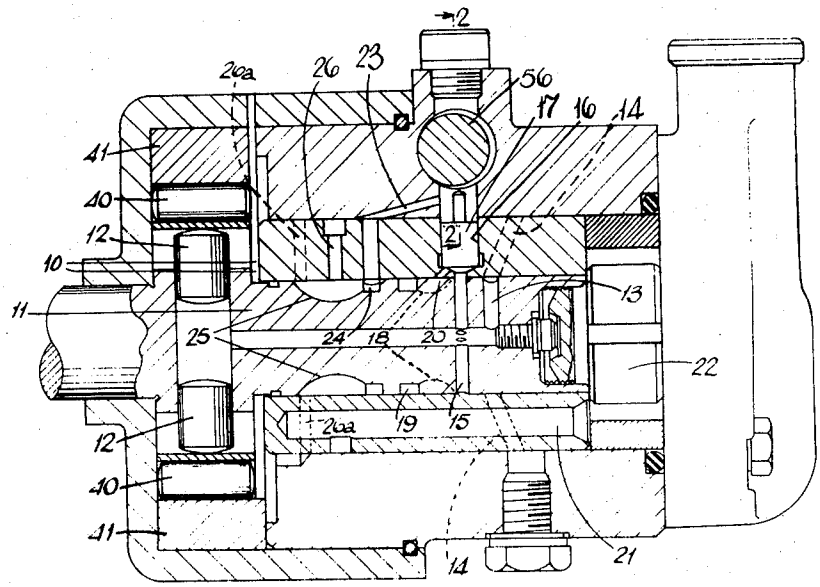
[57] **ABSTRACT**

A liquid fuel pumping apparatus including an axially movable shuttle, the extent of movement of which is limited by fluid pressure operable piston member having a cylindrical portion which is eccentrically disposed relative to the axis of the bore containing the piston member, the surface of the cylindrical portion defining a stop surface for the shuttle.


**3 Claims, 2 Drawing Figures**



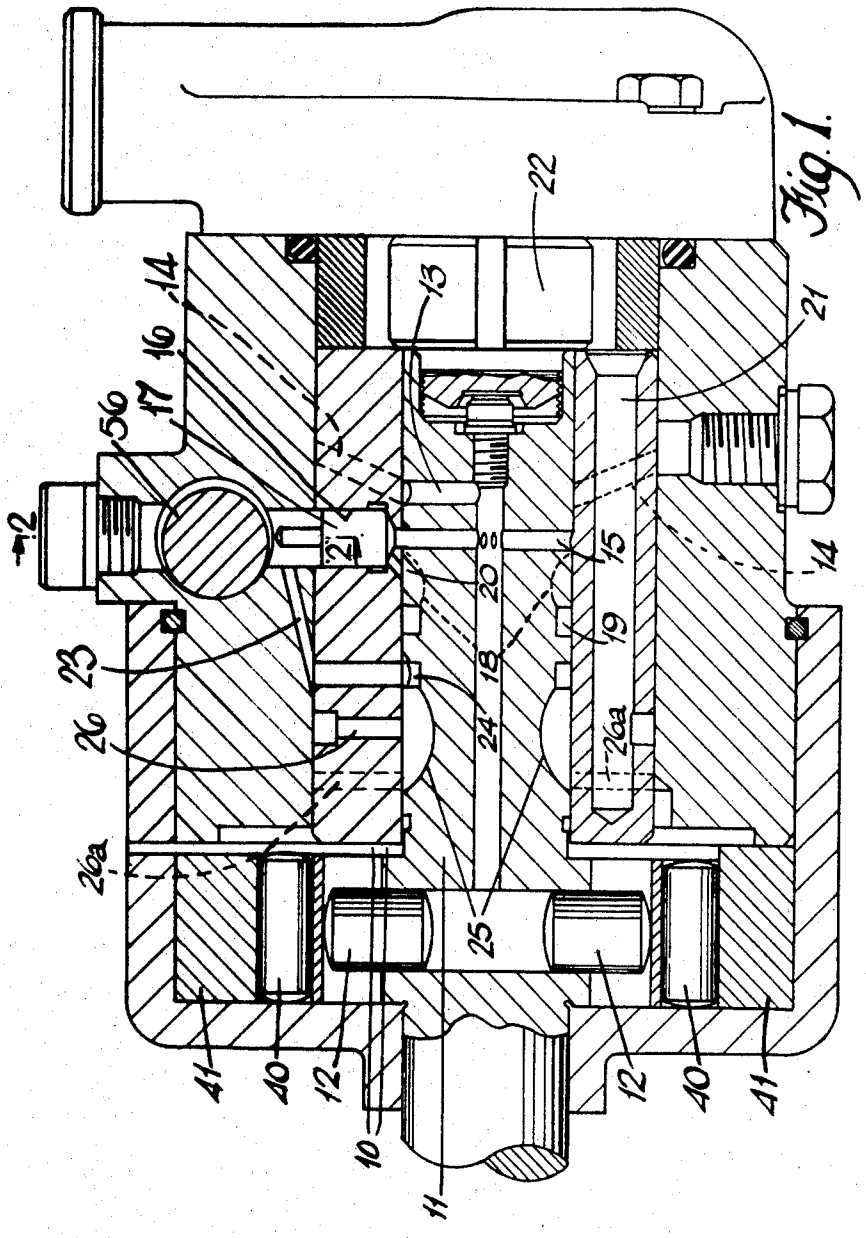



Fig. 1.

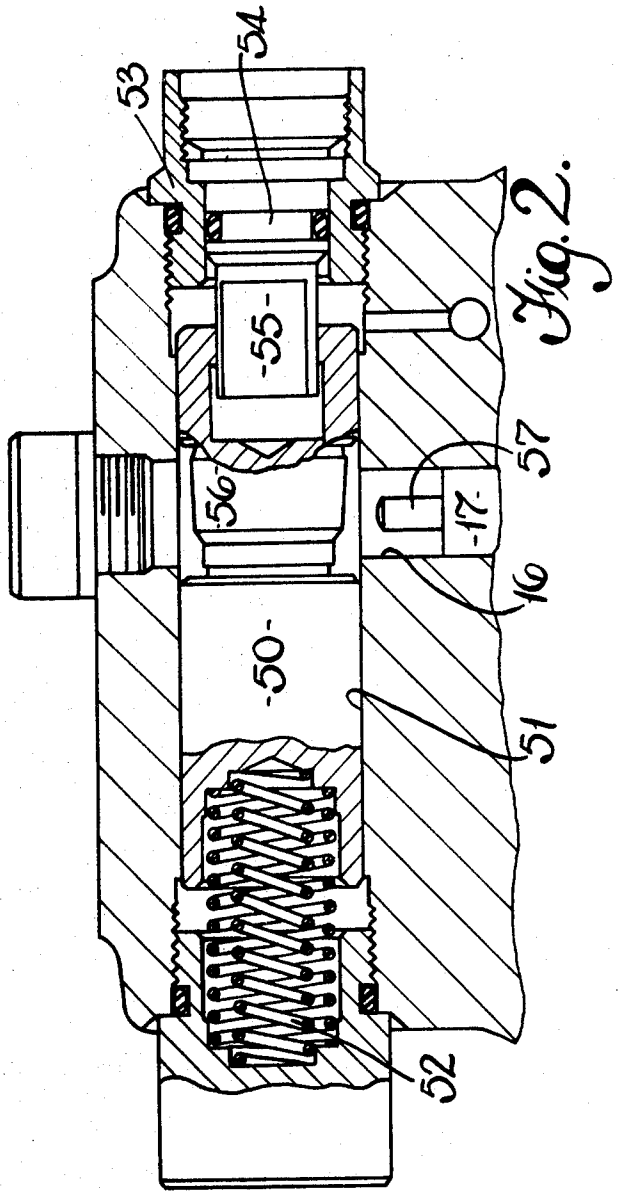



Fig. 2.

# LIQUID FUEL INJECTION PUMPING APPARATUS

This invention relates to liquid fuel pumping apparatus for supplying fuel to internal combustion engines and of the kind comprising a shuttle movable in a bore and adjustable stop means positioned at one end of the bore for limiting the excursion of said shuttle.

The object of the invention is to provide such a pumping apparatus in a simple and convenient form.

According to the invention a liquid fuel pumping apparatus of the kind specified comprises in combination, an axially movable member disposed for movement along an axis disposed substantially at right angles to the axis of the bore, a cylindrical portion of said member being eccentrically disposed relative to the axis of movement of the member, and the cylindrical portion having a contoured stop surface against which the shuttle bears, the arrangement being that axial movement and angular movement of the member or both will vary the permitted excursion of the shuttle in the bore.

In the accompanying drawings:

FIG. 1 is a sectional side elevation of one example of a pumping apparatus in accordance with the invention, and

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

With reference to the drawings there is provided a body part **10** in which is mounted a rotary cylindrical distributor **11**. This is arranged to be driven in timed relationship with the engine with which the apparatus is associated and at one end is provided with a transverse bore which accommodates a pair of plungers **12**. The portion of the bore lying between the plungers communicates by way of a longitudinal passage in the distributor with a radial delivery passage **13** also formed in the distributor and this is arranged to communicate in turn and as the distributor rotates, with a plurality of outlet ports **14** formed in the body part and in communication respectively with injection nozzles mounted in known manner on the associated compression ignition engine.

The plungers **12** are arranged to be moved inwardly as the distributor rotates, by means of cam followers **40** which co-act with cam surfaces formed on a surrounding annular cam ring **41**. The cam ring, followers and plungers constitute an injection pump which partakes of an injection stroke so that fuel is expelled from the bore containing the plungers **12** during the time the delivery passage **13** is in register with an outlet port **14**.

At a point axially removed from the delivery passage **13** the longitudinal passage communicates with a plurality of radial inlet passages **15** and these are arranged to register in turn as the distributor rotates, with an inlet port formed in the body part and in communication with one end of a cylinder **16** containing an axially movable cylindrical shuttle **17**. The aforesaid registration of the inlet port and an inlet passage **15** takes place during a filling period of the injection pump during the time when the plungers **12** are allowed to move outwardly and whilst the delivery passage **13** is out of register with a delivery port **14**.

Fuel is supplied to said one end of the cylinder **16** by way of a plurality of longitudinal grooves **18** formed in the periphery of the distributor and extending from a circumferential groove **19**. The registration of one of the grooves **18** with a supply passage **20** occurs during an injection stroke of the injection pump so that fuel



which is delivered to the groove **19** from an outlet **21** of a feed pump **22**, by way of a throttle flows to the inner end of the cylinder **16** and causes the shuttle **17** to be moved outwardly. Fuel leaves the other end of the cylinder **16** by way of a passage **23** in the body part. This passage is in communication with a further circumferential groove **24** formed in the periphery of the distributor and from this groove **24** extend further axial grooves **25** and these during the movement of the shuttle towards the other end of the cylinder, communicate with spill passages **26***a*. During the filling period of the injection pump one of the grooves **25** communicates with a feed passage **26** which is in communication with the outlet **21** of the feed pump, so that fuel under pressure is supplied to the other end of the cylinder **16** and the shuttle is moved towards said one end of the cylinder thereby causing the previously throttled quantity of fuel contained therein to be delivered to the injection pump for delivery to the engine during the next injection stroke. The excursion of the shuttle in the cylinder therefore determines the quantity of fuel which will next be delivered to the engine.

In order to control the maximum quantity of fuel which is supplied to the engine the excursion of the shuttle **17** is limited by a stop. As shown in the drawing the stop has the form of an axially movable cylindrical member in the form of a piston **50** which is slidably mounted within a cylinder **51** the axis of which is at right angles to the axis of rotation of the distributor. The piston **50** is loaded by a pair of coiled compression springs **52** and is moved against the action of the springs by fluid under pressure which is supplied to the right hand end of the cylinder **50** through a passage (not shown). The fuel under pressure is obtained from the outlet of the feed pump, the outlet pressure of the feed pump being controlled in such a manner that it varies in accordance with the speed at which the apparatus is driven.

The right hand end of the cylinder **51** is closed by a plug housing **53** in which is located an angularly adjustable plug **54**. At its inner end the plug **54** is provided with a projection **55** of a non-circular section and this is located within a complementary recess formed in the piston **50**. In this manner the piston **50** is allowed to move axially but its angular movement is prevented. However, by rotating the plug member **54** the angular setting of the piston can be adjusted. Intermediate its ends the piston is provided with a cylindrical portion **56** which is eccentrically disposed relative to the axis of the bore **51**. Furthermore, the surface of the cylindrical portion is contoured and defines a stop surface against which a projection **57** on the shuttle **17** can bear. The arrangement is such that for a given setting of the plug **54** the permitted outward movement of the shuttle **17** will vary in accordance with the speed at which the apparatus is driven. However, to enable initial adjustment of the maximum fuel quantity to take place the plug member **54** can be moved angularly to adjust the datum position of the stop surface.

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

**1**. A liquid fuel pumping apparatus for supplying fuel to internal combustion engines and comprising an injection pump including a plunger reciprocable within a cylinder, means for imparting movement to the

plunger, an outlet communicating with said cylinder and through which fuel flows when movement is imparted to said plunger by said means, an inlet communicating with said cylinder and through which fuel flows to fill the injection pump, a bore in which fuel is stored prior to flowing through said inlet to the injection pump, a shuttle movable in said bore, an axially movable member disposed for movement along an axis disposed substantially at right angles to the axis of the bore, a cylindrical portion of said member being eccentrically disposed relative to the axis of movement of the member, and a contoured stop surface formed on the cylindrical portion and against which the shuttle bears, the arrangement being that axial movement and angular movement of the member or both will vary the permitted excursion of the shuttle in the bore to control the volume of fuel flowing to the inlet.



2. An apparatus as claimed in claim 1 in which said member constitutes a fluid pressure operable piston and there is provided a plug member which is angularly adjustable from the exterior of the apparatus, and means connecting the members which permits relative axial movement but which prevents relative angular movement.

3. An apparatus as claimed in claim 2 in which the plug member is provided with a projection of non-circular section and which is engaged within a complementary recess in the piston.

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