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LIQUID FUEL PUMPING APPARATUS

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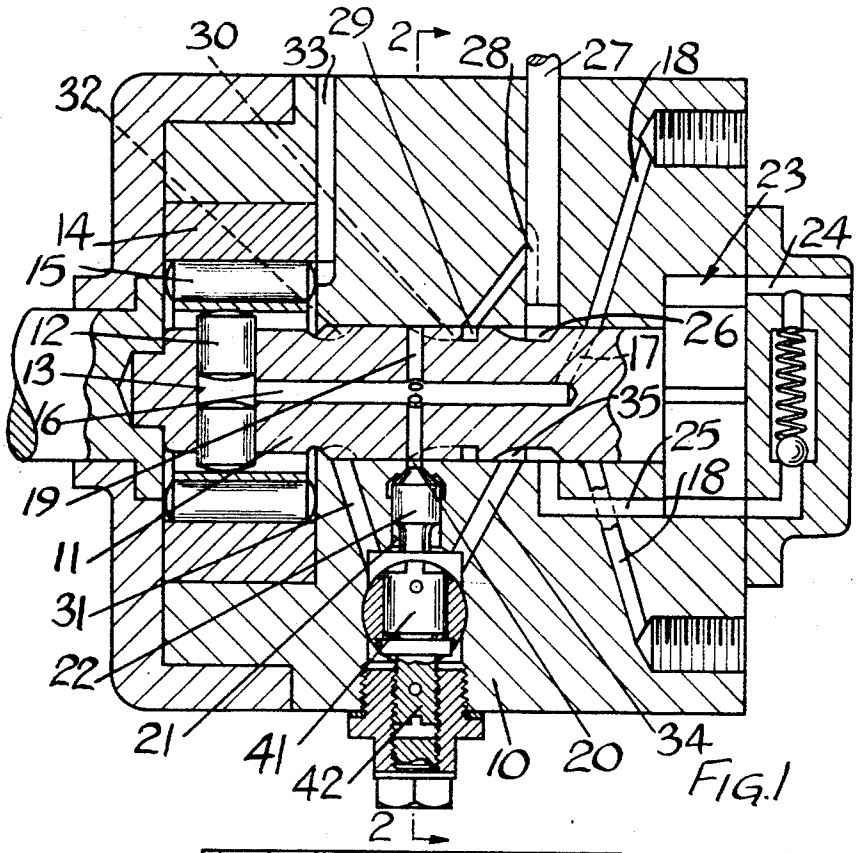

FIG. 1

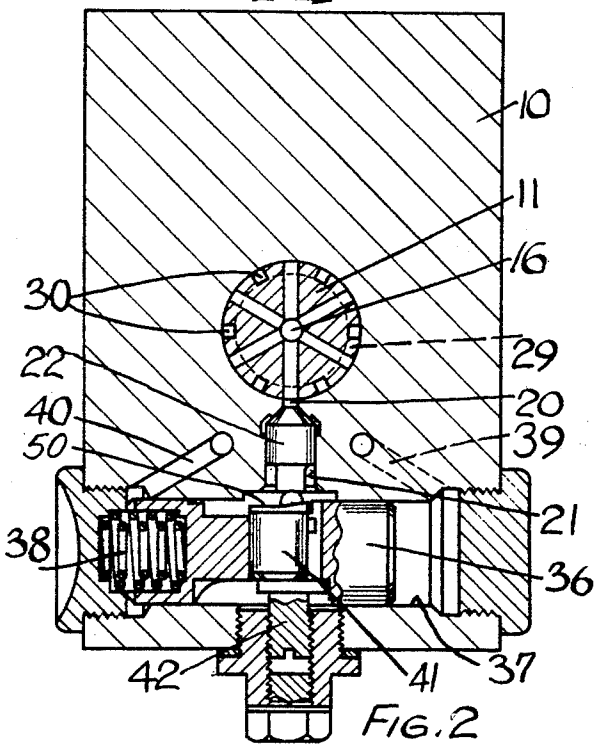

FIG. 2

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LIQUID FUEL PUMPING APPARATUS

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ABSTRACT OF THE DISCLOSURE

A liquid fuel pumping apparatus comprising a shuttle slidable within a cylinder, the excursion of the shuttle determining the maximum amount of fuel which can be supplied by the pump, and a stop slidable in a direction substantially at right angles to the longitudinal axis of the cylinder, said stop mounting a part having a shaped surface with which the shuttle co-operates and having an adjustable member upon which the part bears during movement of the stop.

This invention relates to liquid fuel pumping apparatus and of the kind comprising an injection pump having a pumping chamber from which fuel is displaced during an injection stroke of the pump, a cylinder from one end of which fuel is supplied to the pumping chamber of the pump during a filling stroke thereof, a shuttle slidable within said cylinder, the permitted excursion of said shuttle serving to determine the maximum amount of fuel which can be supplied to the pumping chamber of the injection pump, and a stop slidable in a direction substantially at right angles to the longitudinal axis of the cylinder said stop having a shaped surface against which the shuttle can bear whereby the maximum amount of fuel which can be fed to the pumping chamber is varied in accordance with the setting of said stop.

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

According to the invention in an apparatus of the kind specified the shaped surface is formed on a part which is adjustably mounted in the stop for movement in a direction substantially parallel to the longitudinal axis of the cylinder.

In the accompanying drawings:

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

FIGURE 2 is a section on the line 2—2 of FIGURE 1.

Referring to the drawings there is provided a body part **10** in which there is mounted a rotary cylindrical distributor **11** which is adapted to be driven in tme relationship with the engine. At one end of the distributor there is located an injection pump including a pair of pumping plungers **12** which are disposed within a transverse bore **13** formed in the distributor. Surrounding this end of the distributor is a cam ring **14** having formed on its internal periphery a plurality of pair of cams. Intermediate the plungers respectively and the cam ring are a pair of rollers **15** which bear upon the cam ring so that as the distributor rotates inward movement will be imparted to the plungers as the rollers ride over the cams. Intermediate the plungers the bore defines a fuel pumping chamber which is in communication with a longitudinal passage **16** formed in the distributor. At one point the passage is in communication with a radially disposed delivery passage **17** which is arranged to register in turn as the distributor rotates, with a plurality of outlet passages **18** formed in the body part. This registration of the delivery passage with an outlet passage takes place during the whole of the time the plungers **12** are moving

inwardly and the arrangement is such that fuel will be displaced from the pumping chamber to the outlet passages **18** in turn as the distributor rotates. The outlet passages are in use connected to injection nozzles respectively mounted on the engine.

At another point the longitudinal passage is in communication with a plurality of radially disposed inlet passages **19** formed in the distributor and which can communicate in turn with an inlet port **20** formed in the body part. This communication takes place whilst the delivery passage **17** is out of register with the outlet passages **18** and during this time fuel flows from the inlet port **20** to the pumping chamber of the injection pump, to provide a fresh charge of fuel for the next injection stroke of the injection pump. The inlet port is in constant communication with one end of a cylinder **21** formed in the body part and mounted within the cylinder is a cylindrical and movable shuttle **22.**

Also provided is a vane type feed pump **23** the rotor of which is formed integrally with the distributor at the end thereof remote from the transverse bore. The feed pump is provided with an inlet **24** which in use, is connected to a reservoir of fuel and an outlet **25.** Moreover, the outlet pressure of the feed pump is controlled by any convenient valve so that the output pressure of the feed pump varies in a manner dependent upon the speed at which the distributor and hence the engine rotates.

The outlet **25** of the feed pump is in communication with a circumferential groove **26** formed in the periphery of the distributor and this is additionally in communication with the inner end of a cylindrical cavity which contains an angularly adjustable throttle member **27.** The setting of this can be varied by means of a speed sensitive governor in a well known manner. The throttle member functions by varying the effective size of a port **28** formed in the wall of the cavity and this port is in communication with a further circumferential groove **29** formed in the periphery of the distributor. From the groove **29** extend a plurality of longitudinal grooves **30** and these are of a length so that they can register with the inlet port **20** and are alternately arranged with the passages **19.**

When one of the grooves **30** registers with the inlet port **20** fuel flows into the cylinder **21** and the shuttle **22** is moved outwardly. During the outward movement of the shuttle **22** fuel flows from the end of the cylinder **21** remote from the inlet port by way of a passage **31,** and grooves **32** formed in the periphery of the distributor to drain space within the apparatus. Surplus fuel from this space can leave the apparatus by way of an outlet **33.** As the distributor rotates one of the inlet passages **19** moves into register with the inlet port **20** and fuel under pressure from the outlet **25** of the pump flows to the end of the cylinder **21** remote from the inlet port by way of a passage **34** and grooves **35** on the distributor the latter extendng from the circumferential grove **26.** The pressure of fuel moves the shuttle **22** towards the inlet port and the previously throttled quantity of fuel is displaced to the pumping space of the injection pump.

In order to limit the maximum quantity of fuel which can be supplied to the engine a stop is provided to limit the excursion of the shuttle **22** away from said one end of the cylinder. It has been found that it is desirable to vary the maximum quantity of fuel which can be supplied to the engine in a manner which depends upon the speed of the engine and for this purpose the stop takes the form of a fluid pressure operable piston **36** which is accommodated and movable within a cylindrical chamber **37** disposed substantially at right angles to the longitudinal axis of the cylinder **21** containing the shuttle. The piston is loaded towards one end of the chamber by coiled compression springs **38** and is movable against the action of

the springs by fuel under pressure from the outlet **25** of the feed pump supplied to the one end of the chamber through a passage **39**, fuel leaving the other end of the chamber by way of a passage **40**.

In the piston **36** is formed a tranverse bore in which is mounted a part **41** which can be moved relative to the piston in a direction substantially parallel to the axis of the cylinder **21** but which is fixed against angular movement by a pin which slides within a groove in the wall of the bore. The end surface of the part **41** which is presented to the shuttle defines a shaped surface **50** against which the end of the shuttle can strike. The surface is suitably shaped so that for instance as the piston **36** is moved against the action of its springs the permitted movement of the shuttle away from said one end of its cylinder is reduced. The other end of the part bears against the flat head of an adjusting screw **42** which can be adjusted from the exterior of the apparatus, so that during movement of the piston no relative movement of the part relative to the piston occurs. By this means the maximum quantity of fuel which can be supplied to the engine is controlled and moreover by altering the setting of the adjusting screw **42** the apparatus can be adjusted quickly to suit a particular engine or a particular type of engine. In addition when manufacturing the apparatus it is only necessary to produce a range of such parts **41** to enable the apparatus to be used to supply fuel a different types of engines. Furthermore, for starting purposes the surface may be so shaped that an extra quantity of fuel can be supplied to the engine.

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

1. A liquid fuel pumping apparatus of the kind comprising in combination, a body part, an injection pump mounted within the body part and having a pumping chamber from which fuel is dsplaced during an injection stroke of the pump, a cylinder formed in the body part, passage means through which one end of the cylinder is placed in communication with the pumping chamber of the injection pump during a filling stroke thereof, a shuttle slidably mounted within said cylinder, the permitted excursion of said shuttle serving to determine the maximum quantity of fuel which can be supplied to the injection pump during a filling stroke thereof, a further cylinder formed in the body part, the longitudinal axis of said

further cylinder being disposed substantially at right angles to the longitudinal axis of the first mentioned cylinder, a fluid pressure operable piston mounted in the further cylinder, a part slidably mounted within a bore formed in the piston said part being slidable in a direction substantially parallel to the axis of the first mentioned cylinder, a shaped surface formed on the end of the part which is directed towards the shuttle, the adjacent end of the shuttle in use, contacting the shaped surface to limit its extent of movement, and adjusting means operable from the exterior of the body part whereby the relative setting of the part and the piston can be adjusted the arrangement being that the axial position of the piston within its cylinder determines the extent of movement of the shuttle, the extent of movement of the shuttle for a given position of the piston being adjustable by said adjusting means.

2. A liquid fuel pumping apparatus according to claim **1** in which the adjusting means comprises a screw operable from the exterior of the body part and which bears against the end of the part remote from that end which is formed with the shaped surface.

3. A liquid fuel pumping apparatus according to claim **2** in which the part is restrained against angular movement in the bore by a pin connected to the part and slidable within an axial groove formed in the wall of the bore.

References Cited

UNITED STATES PATENTS

2,539,085	1/1951	Kerseg	74—110
2,650,571	1/1953	Mitchell	92—138
3,107,661	10/1963	Wemp	103—41 X
3,292,546	12/1966	Evans	103—2
2,965,073	12/1960	Alfieri	74—110 X

FOREIGN PATENTS

1,253,386	12/1959	France.
968,877	9/1964	Great Britain.

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U.S. Cl. X.R.

103—2; 92—138;74—110; 103—41