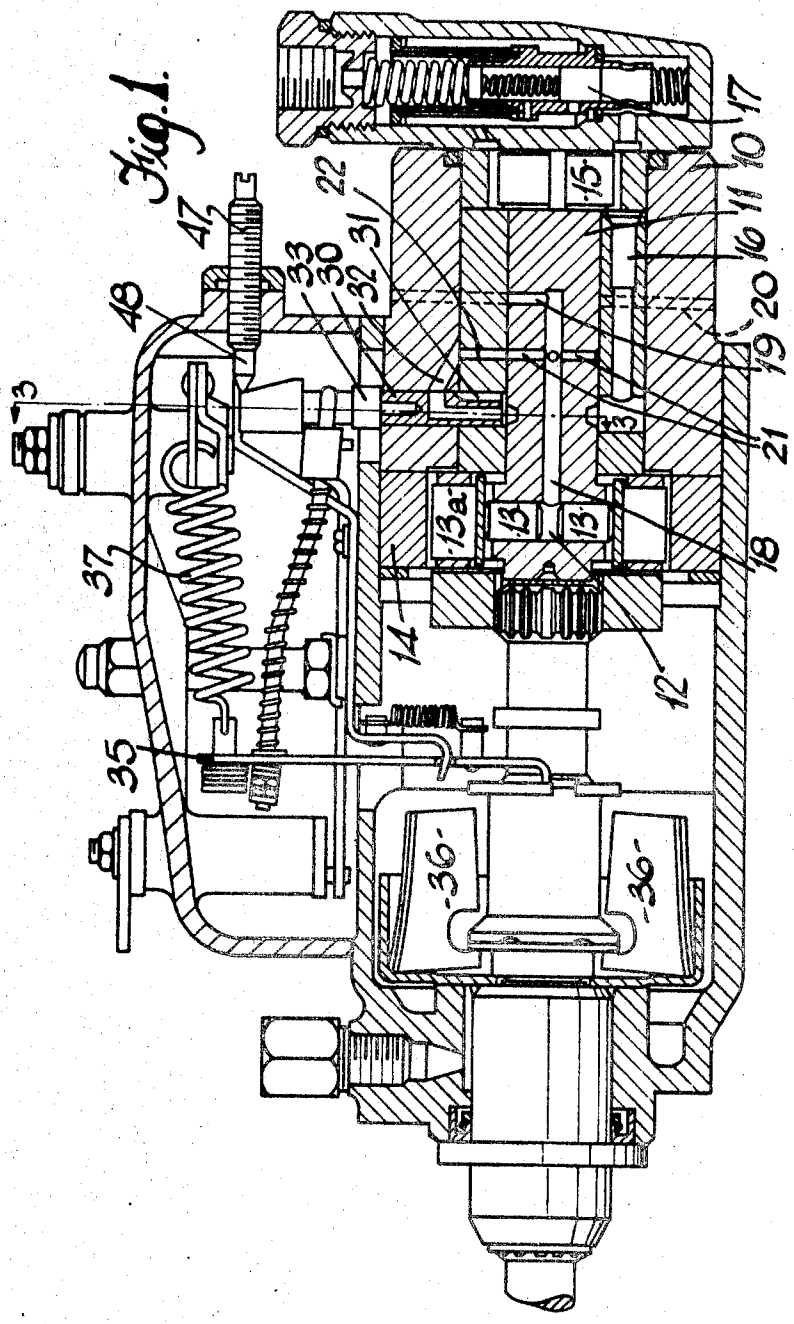
Aug. 12, 1969 K. A. W. KEMP 3,460,479

LIQUID FUEL PUMPING APPARATUS

Filed March 6, 1967 2 Sheets-Sheet 1

Fig. 1.



Aug. 12, 1969 K. A. W. KEMP 3,460,479

LIQUID FUEL PUMPING APPARATUS

Filed March 6, 1967 2 Sheets-Sheet 2

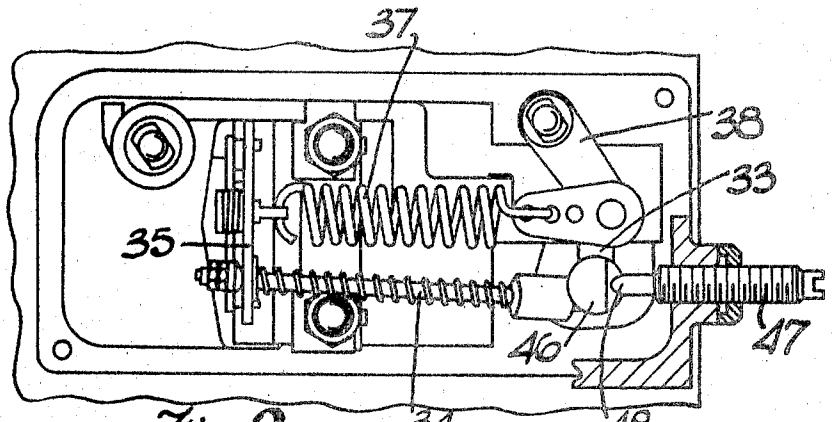


Fig. 2.

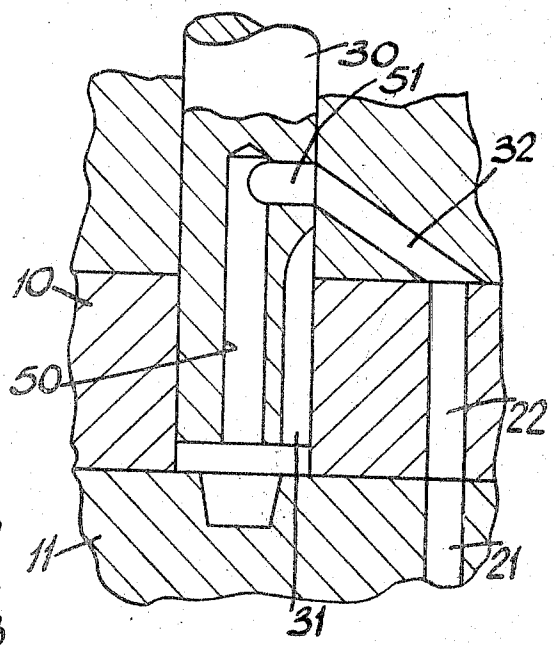


Fig. 4.

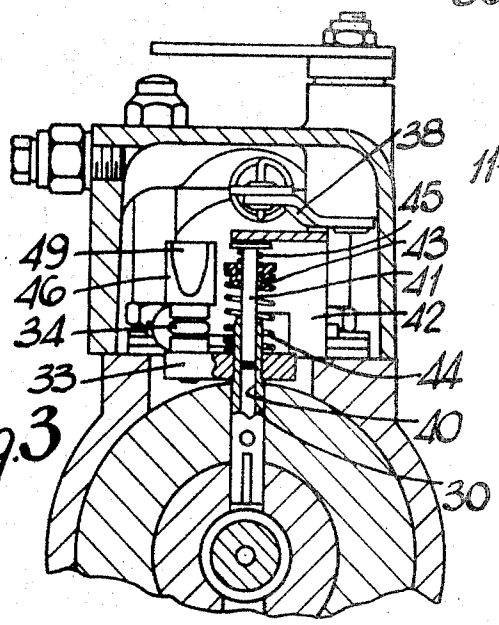


Fig. 3

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3,460,479

LIQUID FUEL PUMPING APPARATUS

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Int. Cl. F04b *23/04, 13/02;* F04d *1/06*
U.S. Cl. 103—5 4 Claims

ABSTRACT OF THE DISCLOSURE

A pumping apparatus for supplying fuel to an internal combustion engine and including an angularly and axially adjustable throttle member, the angular setting of which determines the quantity of fuel supplied to the engine. The angular setting of the throttle member being determined by a speed sensitive governor and there being provided on the throttle member a radial arm which carries at its free end a first abutment having a cam surface. Also provided is a fixed second abutment and the throttle member is arranged to move axially in accodance with the speed at which the apparatus is driven the cam surface and the second abutment contacting each other to determine the permissable angular movement of the throttle member under the action of the governor.

This invention relates to liquid fuel pumping apparatus for supplying fuel to internal combustion engines and of the kind comprising in combination, a pressure pump having a pumping chamber from which fuel flows during an injection stroke of the apparatus and to which fuel is delivered during a filling stroke of the apparatus from a source of fuel under pressure, the pressure of which varies in accordance with the speed at which the apparatus is driven, valve means being provided to control the rate at which fuel flows from said source to the pumping chamber, said valve means being adjustable either manually or by a governor to control the quantity of fuel which flows from the pumping chamber during an injection stroke of the apparatus.

The object of the 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 valve means comprises a cylindrical member accommodated within a cylindrical bore, said member having a groove formed thereon and the cylinder wall having a port formed therein, the port and groove forming part of a passage through which the fuel flows from said source to the pumping chamber, the member being movable angularly about its axis to vary the degree of registration of the groove and port, resilient means urging the member towards one end of the cylinder, the member being subjected to the pressure of fuel from said source so that its axial setting will be dependent upon the speed at which the apparatus is driven, an arm extending from said member, a first abutment piece carried by said arm and a scond abutment piece mounted adjacent to the first abutment piece one of said abutment pieces defining a cam surface so that as the member moves axially the amount of angular movement which can be imparted to the member whilst still maintaining registration of the groove and port will be varied.

In the accompanying drawings:

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

FIGURE 2 is a plan view of the upper portion of the apparatus of FIGURE 1 with a portion of the cover removed to show the interior parts.

FIGURE 3 is a fragmentary sectional view on the line 3—3 of FIGURE 1, and

FIGURE 4 is a view to an enlarged scale of part of the apparatus shown in FIGURE 1.

Referring to the drawings the pumping apparatus comprises a body part **10** in which is mounted a rotary cylindrical distributor **11** which is arranged to be driven in timed relationship with the engine with which the apparatus is associated. At one end of the distributor is formed a transverse bore **12** in which are mounted a pair of pumping plungers **13** which are arranged to be moved inwardly during an injection stroke of the apparatus, in known manner by cam lobes formed on the internal periphery of a cam ring **14** surrounding the distributor at this point, rollers **13***a* acting between the plungers and the cam lobes. At the other end of the distributor is mounted the rotary part of a feed pump **15** which is arranged to draw fuel from a supply and to deliver fuel to a supply conduit **16** formed in the body part. The output pressure of the feed pump which delivers an excess of fuel, is controlled by spring loaded valve means **17** so that the pressure varies in accordance with the speed at which the distributor is driven.

Within the distributor is a longitudinal bore **18** one end of which is in communication with the transverse bore **12** and the other end of which is in communication with a radial delivery passage **19**. The delivery passage is arranged to register in turn, as the distributor rotates with a plurality of outlet ports **20** which in use, are connected respectively to the injection nozzles of the associated engine. The registration of the delivery passage with a delivery port occurs whilst the plungers **13** are being moved inwardly by the cam lobes.

At another position the bore communicates with a plurality of radial inlet passages **21** and these are arranged to register in turn and as the distributor rotates with an inlet port **22** formed in the body part and the registration of an inlet passage **21** and the inlet port **22** occurs during a filling stroke of the apparatus, i.e., during the time when the plungers **13** are permitted to move outwardly by the cam lobes. The inlet port **22** is supplied with fuel from the supply conduit by way of an adjustable valve means (to be described) and which controls the quantity of fuel which flows to the bore.

In use, at the end of the filling stroke the inlet port **22** is closed and the delivery passage **19** is open to the appropriate delivery port **20**. As the plungers are moved inwardly fuel is delivered to the engine. As the distributor further rotates the delivery passage **19** is closed and the inlet port **22** and one of the inlet passages **21** are brought into registration and fuel flows into the bore the amount of fuel depending upon the setting of the valve means.

The valve means comprises a cylindrical valve member **30** which is movable angularly and axially within a cylinder defined in the body part of the apparatus. Formed in the periphery of the valve member and extending from one end thereof is an axially extending groove **31** and for registration with this groove there is provided in the wall of the cylinder a port **32** which is in communication with the inlet port **22**.

The end of the cylinder adjacent said one end of the valve member **30** is arranged to be in communication with the supply conduit **16** so that fuel can flow by way of the groove **31** in the valve member to the port **32**. Moreover, the pressure of fuel acting on this end of the valve member imparts an axial thrust to the valve member which is opposed by a coiled compression spring (to be referred to) so that the axial setting of the valve member depends upon the pressure of fuel delivered by the feed pump and hence the speed of the engine.

The other end of the valve member extends from the cylinder and upon this end there is mounted a radial

arm 33 to which is connected one end of a link member 34 the other end of which is connected to one end of a pivotal lever 35. Moreover, the end of the lever 35 is movable by a pair of centrifugal weights 36 which are mounted upon a drive shaft for the distributor 11. The weights upon rotation of the drive shaft move outwardly under the action of the centrifugal force and move the pivotal lever 35 against the action of a governor spring 37 and in so doing the valve member 30 is moved angularly to reduce the effective opening of the port 32 in the wall of the cylinder. In this manner as the speed of rotation of the distributor and drive shaft and hence the engine, is increased so the amount of fuel which flows to the pumping chamber is reduced and hence the quantity of fuel which is delivered to the engine by the apparatus is reduced and the engine speed governed. The restraining force exerted by the governor spring 37 can be adjusted manually by an operator controlled lever 38 to enable the governed speed to be varied.

Referring now to FIGURE 3, the valve member 30 is provided with a blind axial bore 40 which extends inwardly from the end of the valve member remote from that end which is exposed to the output pressure of the feed pump. Extending into the bore 40 is a guide rod 41 which is mounted on a support 42 carried by the body part of the apparatus. A spring abutment collar 43 is loosely mounted about the guide rod 41 and a coiled compression spring 44 (previously referred to) as mounted intermediate the collar and the arm 33. Furthermore, a further but lighter coiled compression spring 45 is mounted intermediate the collar and a flange on the guide rod 41.

The radial arm 33 carries at its free end an abutment 46 (FIGURE 2) and mounted on an adjustable screw 47 supported in the body part is a further abutment 48. The abutment 46 defines a cam surface 49 and the arrangement is such that before the governed speed is attained the two abutments will engage each other. The cam surface is so shaped that as the valve member 30 moves axially against the action of its spring, it will also be moved angularly in a direction to vary the effective opening of the port 32. The cam surface can be shaped in any required manner so that the maximum quantity of fuel which can be delivered to the engine can be varied in accordance with the speed of the engine in a predetermined manner. Since the screw 47 is also adjustable the datum setting can be adjusted when the apparatus is assembled or even when it is mounted on the engine.

For starting purposes an excess of fuel is required and for this purpose the valve member 30 is provided with a further blind bore 50 (FIGURE 4) which extends axially from the end of the valve member which is exposed to the outlet pressure of the feed pump. The bore communicates with a transverse drilling 51 which when the apparatus is at rest (as shown in all the FIGURES) or driven at the slow cranking speed of the engine, communicates with the port 32. In this manner the pumping chamber will receive a larger quantity of fuel than its normal maximum quantity to facilitate starting of the engine. As soon as the output pressure of the feed pump increases the valve member 30 will initially move against the action of the spring 45 and the apparatus will then operate as described.

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

1. A liquid fuel pumping apparatus comprising in combination a pressure pump having a pumping chamber from which fuel flows during an injection stroke of the apparatus; a feed pump for delivering fuel under pressure to the pmping chamber during a filling stroke; a valve for controlling the output pressure of the feed pump so that it varies in accordance with the rate at which the apparatus is driven; adjustable valve means for controlling the rate at which fuel flows from the feed pump to the pumping chamber, said valve means comprising: a cylindrical member accommodated within a complementary cylindrical bore; a groove formed in said cylindrical member; a port formed in the wall of said cylindrical bore, said groove and port forming part of a passage through which fuel flows from said feed pump to the pumping chamber; said cylindrical member being movable angularly about its axis to vary the degree of registration of said groove and port; resilient means urging said cylindrical member towards one end of said cylindrical bore; said one end of said cylindrical bore being in communication with the fuel passage from said feed pump whereby the fuel then passes through said groove and bore respectively and on to the pumping chamber, said cylindrical member being subjected to the output pressure of the feed pump so that its axial setting is dependent upon both said resilient means and the rate at which the apparatus is driven; an arm extending from said cylindrical member; a first cam abutment piece carried by said arm and a second abutment piece operably mounted adjacent to said first abutment piece so that as said cylindrical member moves axially the amount of angular movement which can be imparted to said cylindrical member while still maintaining registration of said groove and port will be varied.

2. Apparatus as claimed in claim 1 comprising a further port formed in said cylindrical member, said further port being positioned to communicate with said port when said cylindrical mmeber is moved its fullest extent by said resilient means, said further port communicating with the outlet of said feed pump so that an excess of fuel will be supplied to the pumping chamber for starting purposes, said further port being moved out of registration with said port as said cylindrical member moves axially due to an increase in the output pressure of said feed pump.

3. A liquid fuel pumping apparatus comprising in combination, a pressure pump having a pumping chamber from which fuel flows during an injection stroke of the apparatus, a feed pump for delivering fuel under pressure to the pumping chamber during a filling stroke, a valve for controlling the output pressure of the feed pump so that it varies in accordance with the rate at which the apparatus is driven, adjustable valve means for controlling the rate at which fuel flows from the feed pump to the pumping chamber, said valve means comprising a cylindrical member accommodated within a complementary cylindrical bore, a groove formed on the member, a port formed in the wall of said cylinder, the groove and port forming part of a passage through which fuel flows from said feed pump to the pumping chamber, the member being movable angularly about its axis to vary the degree of registration of the groove and port, a pair of coiled compression springs acting in series to urge the member towards one end of the cylinder, one of said springs being relatively weak, the member being subjected to the output pressure of the feed pump so that its axial setting will be dependent upon the rate at which the apparatus is driven, an arm extending from said member, a first abutment piece carried by said arm and a second abutment piece mounted adjacent to the first abutment piece, one of said abutment pieces defining a cam surface so that as the member moves axially, the amount of angular movement which can be imparted to the member whilst still maintaining registration of the groove and port will be varied, a further port formed in the member, said further port being positioned to communicate with said port when the member is moved its fullest extent by the action of said resilient means, said further port communicating with the outlet of the feed pump so that excess of fuel will be supplied to the pumping chamber for starting purposes said further port being moved out of registration with said port as the member moves axially due to an increase in the output pressure of the feed pump, the weaker of said pair of springs being compressed when the further port is moved out of register with said port.

4. A liquid fuel pumping apparatus comprising in com-

bination, a pressure pump having a pumping chamber from which fuel flows during an injection stroke of the apparatus, a feed pump for delivering fuel under pressure to the pumping chamber during a filling stroke, a valve for controlling the output pressure of the feed pump so that it varies in accordance with the rate at which the apparatus is driven, adjustable valve means for controlling the rate at which fuel flows from the feed pump to the pumping chamber, said valve means comprising a cylindrical member accommodated within a complementary cylindrical bore, a groove formed on the member, a port formed in the wall of said cylinder, the groove and port forming part of a passage through which fuel flows from said feed pump to the pumping chamber, the member being movable angularly about its axis to vary the degree of registration of the groove and port, a pair of coiled compression springs acting in series to urge the member towards one end of the cylinder, one of said springs being relatively weak, the member being subjected to the output pressure of the feed pump so that its axial setting will be dependent upon the rate at which the apparatus is driven, an arm extending from said member, a first abutment piece carried by said arm and a second abutment piece mounted adjacent to the first abutment piece, one of said abutment pieces defining a cam surface so that as the member moves axially, the amount of angular movement which can be imparted to the member whilst still maintaining registration of the groove and port will be varied, a further port formed in the member, said further port being positioned to communicate with said port when the member is moved its fullest extent by the action of said resilient means, said further port communicating with the outlet of the feed pump so that excess of fuel will be supplied to the pumping chamber for starting purposes said further port being moved out of registration with said port as the member moves axially due to an increase in the output pressure of the feed pump, the weaker of said pair of springs being compressed when the further port is moved out of register with said port, and a speed sensitive governor for controlling the angular setting of said member.

References Cited

UNITED STATES PATENTS

3,035,523	5/1962	Kemp et al.	103—41 X
3,219,020	11/1965	Roosa	123—140
3,288,124	11/1966	Roosa	123—140
3,319,616	5/1967	Glikin	123—139
3,330,265	7/1967	Giraudon et al.	123—140

WILLIAM L. FREEH, Primary Examiner

U.S. Cl. X.R.

103—2, 41; 123—139, 140