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LIQUID FUEL PUMPS FOR INTERNAL COMBUSTION ENGINES

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2 Sheets-Sheet 2

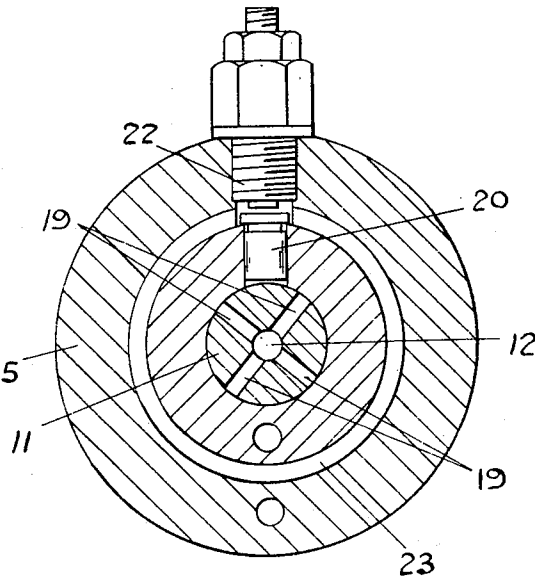


Fig. 3

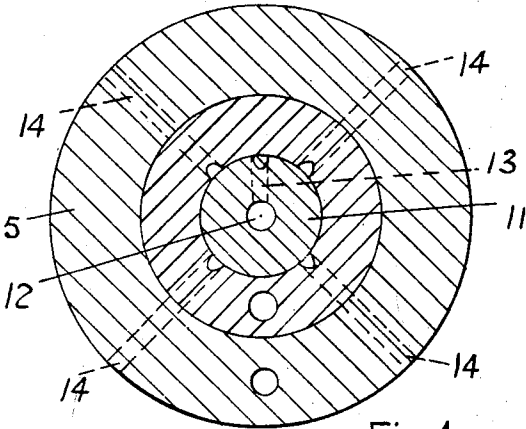


Fig. 4

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1 Claim. (Cl. 103—37)

This invention relates to liquid fuel pumps for internal combustion engines, and of the kind comprising a body part, a rotary distributor within the body part, a head at one end of the distributor and rotatable therewith, said head having formed therein a radial bore, a plunger in the bore, an annular cam surrounding the head for actuating the plunger as the head rotates, a longitudinal passage in the distributor in communication with said bore, a plurality of angularly spaced ports in the body part adapted for connection to the cylinders of the engine respectively, a radial passage in the distributor in communication with the longitudinal passage, said radial passage being arranged to communicate with each in turn of said ports as the distributor rotates, and during the injection strokes of the injection pump, and means for supplying fuel to the longitudinal passage in the distributor whilst said radial passage is removed from the ports.

The object of the present invention is to provide in such a pump convenient means for enabling an extra supply of fuel to be given by the pump when starting the engine with which it is associated.

According to the invention a pump of the kind specified has in combination therewith a cylinder formed in the body part, a shuttle occupying the cylinder and permitting limited axial movement therein, a plurality of radial passages in the distributor in communication with the longitudinal passage and adapted to communicate in turn with one end of said cylinder as the distributor rotates and during the injection strokes of the injection pump, and means for supplying fuel to the opposite end of the cylinder under the control of a pressure responsive valve.

In the accompanying drawings FIGURE 1 is a partial sectional side view illustrating one example of the invention, whilst FIGURES 2, 3 and 4 respectively are sections on the lines 2—2, 3—3 and 4—4 in FIGURE 1.

Referring to the drawings, there is provided a hollow body part 5 which at one end contains a feed pump 6 of the kind comprising a rotary impeller provided with vanes. The pump 6 has an inlet and an outlet passage in the body part which may be interconnected through a spring loaded relief valve to limit the pressure which can be generated by the pump.

At the other end of the body part is a fuel injection pump comprising a rotary cylindrical head 7 in which is formed a diametrical bore containing a pair of reciprocable plungers 8 which co-operate with a surrounding annular cam 9.

The rotary parts of the two pumps, which are adapted to be rotated by the engine through a co-axial driving shaft 10 connected to the head 7, are interconnected by a cylindrical distributor 11 which is formed as an integral part of the head 7. In the distributor is formed an axial passage 12 which at one end communicates with the bore in the head 7, and at another position is in communication with a radial passage 13 in the distributor and which communicates (as the latter rotates) with each in turn of a plurality of angularly spaced ports 14 in the body part which are adapted for connection to the different cylinders of the engine respectively.

The feed pump 6 is adapted to deliver fuel to an annular chamber 15 surrounding the distributor 11, and thence through a manually or governor controlled throttle 16 to an inlet passage 17 in the body part 5. In the distributor 11 are formed a first series of equi-angularly spaced

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radial passages 18 (equal in number to the number of the engine cylinders) opening into the axial passage 12 and which communicate in turn with the passage 17 as the distributor 11 rotates, and during the intervals in which the passage 13 is not in communication with the ports 14.

In action, as the distributor 11 rotates fuel is fed by the feed pump 6 to the passage 12 and is discharged thence to the engine cylinders in turn by the inward movements of the plungers 8 under the action of the cam 9.

The pump so far described follows known practice, but in applying the invention to such a pump there is formed in the distributor 11 a second series of equi-angularly spaced radial passages 19 (equal in number to the number of the engine cylinders) and in communication at their inner ends with the passage 12. The passages 19 are arranged to communicate in turn (as the distributor rotates) with the inner and smaller end of a stepped cylinder 20 formed in the body part. Moreover, each of these passages 19 establishes communication with the cylinder 20 at the instant at which the passage 13 establishes communication with a port 14 but remains in communication with the cylinder 20 during the interval after the passage 13 has been removed from a port 14 and before communication is established between the passage 17 and the next passage 18. Within the cylinder is a stepped shuttle 21, outward movement of which is limited by an adjustable stop in the form of a screw-threaded plug 22.

The outer end of the cylinder 20 is in communication with an annular passage 23 in the body part to which fuel can be fed from the feed pump 6 through a spring-loaded piston valve 24. The action of the valve 24 is such that it opens to admit fuel to the passage 23 from the feed pump 6 when the output pressure of the latter exceeds a given value, but when closed opens the passage 23 through a spill passage 25.

When starting the engine the output pressure of the feed pump 6 is insufficient to overcome the spring pressure of the piston valve 24 with the result that the outer end of the cylinder 20 remains in communication with the spill passage 25. In consequence the first injection stroke will move the shuttle 21 to the outward limit of its travel in which position the shuttle will remain until the feed pump output pressure exceeds the given value. Whilst the shuttle 21 is in this position a maximum amount of fuel in excess of normal requirements will be fed to the engine on all subsequent strokes. However, when the engine starts and the feed pump output pressure exceeds the given value fuel will be fed to the outer end of the cylinder 20 thereby moving the shuttle 21 inwardly after each injection during the period in which a radial passage 19 remains in communication with the inner end of the cylinder 20 after the injection stroke of the plungers 8. As a result part of the fuel displaced by the injection stroke of the injection pump is used to move the shuttle 21 outwardly, thereby reducing the quantity of fuel fed to the engine to normal requirements.

It will be appreciated that adjusting the plug 22 will vary the quantity of fuel fed to the engine under normal conditions. The plug may be adjustable by any convenient means having associated with it indicia representative of different grades of fuel, so that the stop can readily be adjusted to the appropriate setting for different fuels.

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

A liquid fuel pump of the kind specified, comprising in combination a hollow body provided with a cylindrical bore, a fuel inlet passage extending outwardly from one side of said bore, and a plurality of fuel delivery ports extending outwardly from said bore in angularly spaced relationship, feed means for supplying fuel under pressure to said fuel inlet passage, a rotary cylindrical distributor

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mounted in said bore and provided with an axial passage, a plurality of angularly spaced fuel inlet passages extending outwardly from said axial passage at positions for enabling them to communicate in turn with the fuel inlet passage in said hollow body during rotation of said distributor, and a fuel outlet passage extending outwardly from said axial passage at another position for enabling said outlet passage to communicate in turn with the fuel delivery ports in said hollow body during rotation of said distributor, a head provided on one end of said distributor so as to be rotatable therewith, and having a radial bore in communication with the adjacent end of the axial passage in said distributor, a plunger mounted in said radial bore, an annular cam which surrounds said head, and through the medium of which said plunger is movable inwardly during rotation of said distributor, a cylinder formed in, and open at one end to the cylindrical bore in, said hollow body, a shuttle mounted in said cylinder and capable of a limited amount of axial movement relative thereto, and a spring-loaded valve which is exposed at one end to the fuel output pressure of said feed means, and under the control of which fuel from said feed means is admissible to the other end of said cylinder when said fuel output pressure is sufficient to move said

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valve in opposition to the spring loading thereof, said distributor being provided with a plurality of additional passages corresponding in number to the fuel delivery ports in said hollow body, and extending outwardly in angularly spaced relationship from the axial passage in said distributor at positions for enabling said additional passages to communicate in turn with the first mentioned end of said cylinder when the fuel outlet passage in said distributor communicates in turn with the delivery ports in said hollow body during rotation of said distributor, and said hollow body being provided with a spill passage which is in communication with the other end of said cylinder, and which is closable by said valve when the latter assumes a position for admitting fuel from said feed means to the last mentioned end of said cylinder.

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