United States Patent

Leitermann et al.

[15] 3,653,784

[45] Apr. 4, 1972

[54] PROPORTIONATING FEED PUMP

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[22] Filed: **June 16, 1970**

[21] Appl. No.: **46,778**

[30] **Foreign Application Priority Data**

June 18, 1969 Germany ..... P 19 30 811.3

[52] **U.S. Cl.** ..... **417/317,** 91/346, 417/531, 123/73 AD

[51] **Int. Cl.** **F04b 9/00**

[58] **Field of Search** ..... 417/534, 521, 531, 417, 322, 417/415, 416, 317, 515; 137/99, 624.14; 222/137; 123/73 AD; 91/346, 275; 92/107

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[57] **ABSTRACT**

The invention relates to a proportioning pump for feeding at least two different liquids in a definite flow proportion. The pump has two interconnected displacement members executing their suction strokes and their delivery strokes simultaneously, each of which members is arranged in its own working chamber communicating with a suction and a pressure line by oppositely acting check valves. In accordance, with a particular application, this pump is employed in internal combustion engines with mixed lubrication for proportioning the fuel and oil, with the fuel-oil mixture being supplied to the float chamber of a carburetor.

2 Claims, 2 Drawing Figures

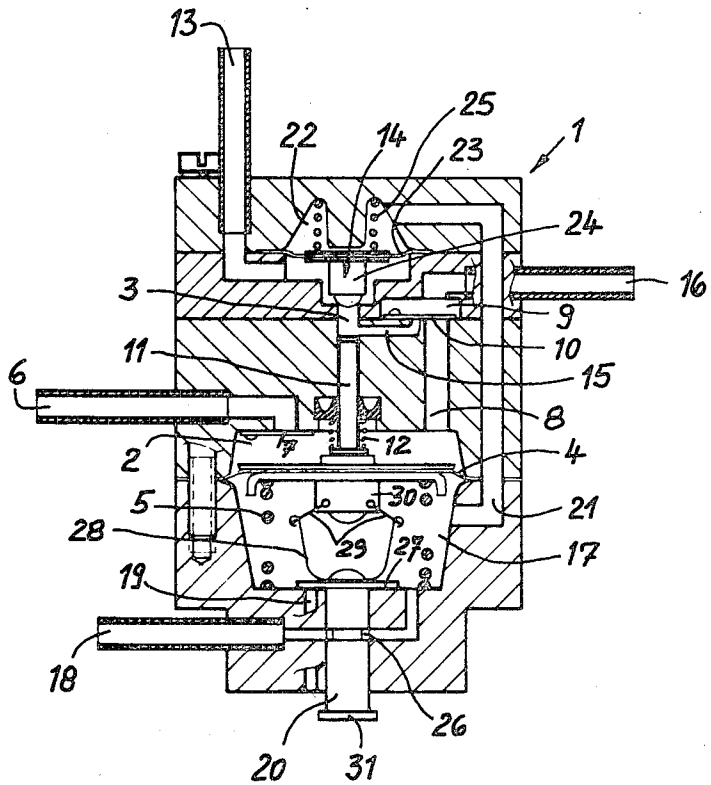


Fig. 1

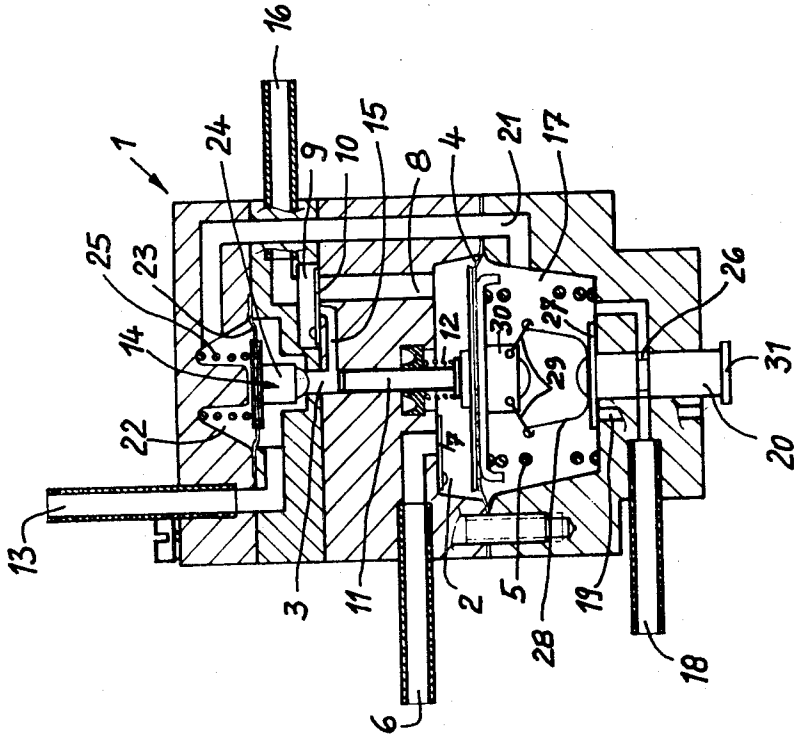
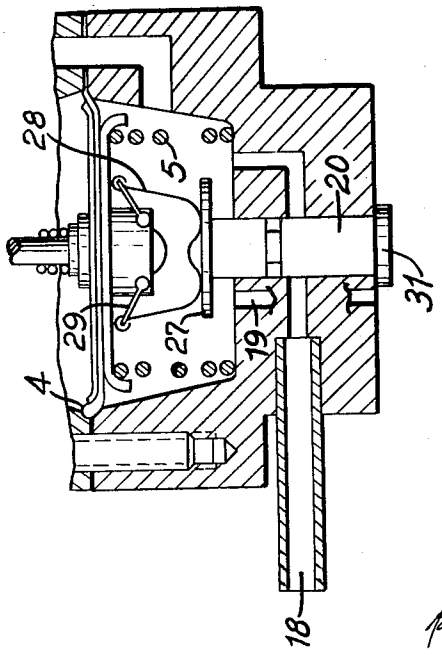


Fig. 1a



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PROPORTIONATING FEED PUMP

Conventionally, the fuel pump will be in the form of a diaphragm pump driven by way of a connecting rod or plunger and feeding when the float pointer of the carburetor has cleared the supply nozzle. In the course of this operation, the diaphragm is placed in oscillation that depends on the speed of the engine, so that when such a fuel pump is combined with an oil proportionating pump, the function of the check valves in the suction and pressure lines is impaired by their lag. The result is that a constant mixture ratio cannot be maintained independently of flow rate.

The problem to which this invention is directed is to provide a proportionating feed pump in which a constant mixture ratio of two liquids is assured independently of flow rate. This problem is solved in that one stroke of the two displacement members is effected in known manner by spring action, and the opposite stroke by a controlled drive medium, a control means capable of being actuated by the displacement members being provided, that starts the supply of drive medium at the end of the full stroke effected by spring action and shuts it off at the end of the opposite full stroke effected by the medium. Inasmuch as the two displacement members always execute both the full suction stroke and the full delivery stroke, proper function of the check valves is assured; and by suitable dimensioning of the working surfaces of the two displacement members, a desired mixture ratio can be maintained very accurately.

Preferably, one of the displacement members is in the form of a spring-loaded diaphragm bounding a working chamber for the liquid to be fed and cooperates with a piston forming the other displacement member and being displaceable in a cylinder. On its side away from the working chamber, the diaphragm may bound a chamber capable of being connected, by a valve capable of being actuated by the diaphragm, to a source of suction at the end of the delivery stroke and for the duration of the suction stroke and to the atmosphere not later than at the end of the suction stroke. When the pump is used in internal combustion engines, the intake line is available as a source of suction.

The valve may be actuated by the diaphragm by way of a toggle spring that puts the valve into a position admitting suction at the end of the delivery stroke of the diaphragm and keeps it in that position until the end of the suction stroke, and then puts the valve in the other position, shutting off the suction, in which the delivery stroke of the diaphragm is effected by the spring. Alternatively, the valve may have a permanent magnet tending to hold the valve in the position of shutting off the suction and connected to the diaphragm by way of a spring. At the end of the suction stroke, the permanent magnet is carried by the suction-actuated diaphragm off the suction line. At the end of the delivery stroke of the diaphragm, effected by the spring, the valve is picked up by the diaphragm and thus opened, so that a new suction stroke can take place.

Another possible way of effecting the back stroke of the displacement members consists in that they are connected to the armature of an electro-magnet effecting the back stroke and cooperate with a switch that switches the electro-magnet on at the end of the spring-actuated stroke and off again at the end of the back stroke.

Preferably, a mixing chamber is provided in the pump housing, into which the delivery lines lead from the two working chambers, the ports of the two delivery lines being controlled by a common check valve.

When the pump is being used to feed fuel and oil, the proportion of oil is quite small, for example, on the order of 1 percent. In order to measure out this flow of oil with sufficient accuracy, it is necessary that the throttling losses in the suction line of the oil pump be as low as possible. The conventional disc or ball check valves do not meet this requirement. In the suction line, therefore, according to this invention, and instead of a conventional check valve, a shut-off valve capable of being actuated by the hydraulic medium effecting the suction stroke is provided, which valve is normally closed by a spring and opens only when the suction stroke is being performed.

A fuel-oil proportioning pump according to the invention will now be described by way of example wherein:

FIG. 1 shows a sectional view of a preferred embodiment, with the control means in one position;

FIG. 1*a* shows a partial section of FIG. 1, with the control means in the other position.

Referring first to FIG. 1, a pump housing 1 has two working chambers 2 and 3. Chamber 2 contains a diaphragm 4 acted upon in a delivery direction by a spring 5. Chamber 2 is served by a fuel supply line 6 closed by a check valve 7. A pressure line 8 leads from chamber 2 to a mixing chamber 9 and is closed by a second check valve 10. In the cylindrical working chamber 3, a piston 11 is displaceable, being held against the diaphragm 4 by a spring 12 and thus executing the same motions as diaphragm 4. Chamber 3 is served by an oil supply line 13, closed by a shut-off valve designated generally as 14. The delivery line 15 of working chamber 3 leads to mixing chamber 9 and is closed by the same check valve 10 as the delivery line 8 of working chamber 2. A mixture line 16 leads from mixing chamber 9 to the float chamber of the carburetor.

The diaphragm 4, on the side away from the working chamber 2, bounds a chamber 17 opening into a negative pressure line 18 connected to the intake duct of the engine. In addition, a line 19 leads from chamber 17 to the atmosphere. Lines 18 and 19 are alternatively capable of being shut off by a valve 20 actuated by diaphragm 4 at the end of each of its suction and delivery strokes. A passage 21 leads from chamber 17 to a chamber 22 bounded by a diaphragm 23 bearing the valve member 24 of shut-off valve 14. Valve member 24 is acted upon in a closing direction by a spring 25.

Valve 20 has a constriction 26 which, in the position shown in FIG. 1, clears the negative pressure line 18. In addition, valve 20 is provided with a plate 27 closing off line 19. The actuation of valve 20 by diaphragm 4 is effected with the aid of a U-shaped toggle spring 28 connected articulately by two spreaders 29 to a projection 30 on diaphragm 4.

In the position shown in FIG. 1, the diaphragm 4 is at the end of its delivery stroke, which is effected by spring 5. The negative pressure now prevailing in chamber 17 draws the diaphragm 4 downward in the drawing, spreading the toggle spring 28 by means of spreaders 29. At the same time, fuel passes through line 6 and the opening check valve 7 into chamber 2, and the negative pressure in chamber 17 acts on diaphragm 23 and opens the shut-off valve 14, so that oil can reach the working chamber 3 by way of line 13. At the end of the downward stroke of diaphragm 4, the spreaders 29 snap past dead center into their other position, shown in FIG. 1a, lifting valve 20 until its stop 31 strikes the pump housing. This shuts off the negative pressure line 18 and opens the vent line 19, so that the negative pressure in chamber 17 is broken and the spring 5 is able to push diaphragm 4 upward. At the same time, the shut-off valve 14 is closed by spring 25. At this time, the delivery strokes of diaphragm 4 and piston 11 take place, and the liquid previously drawn into working chambers 2 and 3 is fed through the opening check valve 10 into mixing chamber 9 and thence through mixture line 16 to the carburetor. When the float pointer of the carburetor has shut off the supply line, diaphragm 4 and piston 11 pause in an intermediate position until the float needle has cleared the supply line once again, whereupon the delivery stroke is completed by spring 5. Only upon termination of the delivery stroke do the spreaders 29, which have now been pulled back past dead center in the other direction, push the valve 20 into the position shown in FIG. 1, shutting off the vent line 19 and opening the negative pressure line 18. Consequently, another complete suction stroke can now be executed.

The suction stroke can begin only when the full deliver stroke has been carried out, and this independently of the duration, determined by the demand, of the delivery stroke. Since only full suction and delivery strokes can be executed throughout, it is possible to keep a given mixture ratio constant within relatively narrow limits.

The suction stroke is effected by negative pressure. Obviously, it would be within the scope of the invention to use a

hydraulic medium instead of, for example, compressed air or a liquid under pressure, without departing from the spirit of the invention.

We claim:

1. A proportionating pump for feeding fuel and oil in a definite mixture ratio for mixture-lubricated internal combustion engines, wherein the pump has two displacement members, one for fuel and the other for oil, which perform their suction strokes simultaneously and their delivery strokes simultaneously, the delivery strokes being effected by spring means and the suction strokes being effected by a controlled drive medium supplied at the end of the full stroke effected by said spring means and shut off at the end of the full stroke effected by said drive medium, each displacement member being arranged in its own working chamber communicating with a suction and a delivery line by way of opposedly acting check valves, the check valve in the suction line of the oil-carrying working chamber being actuated in the opening direction by the drive medium effecting the suction stroke and simultaneously therewith.

2. A pump according to claim 1, comprising a mixing chamber into which the delivery lines from the two working chambers lead, the outlets of the two delivery lines being controlled by a common check valve which opens or closes both delivery lines simultaneously.

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