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B. C. W. HAGELIN ET AL

2,681,253

LIQUID DISTRIBUTING SYSTEM

Original Filed May 13, 1949

FIG. 3.

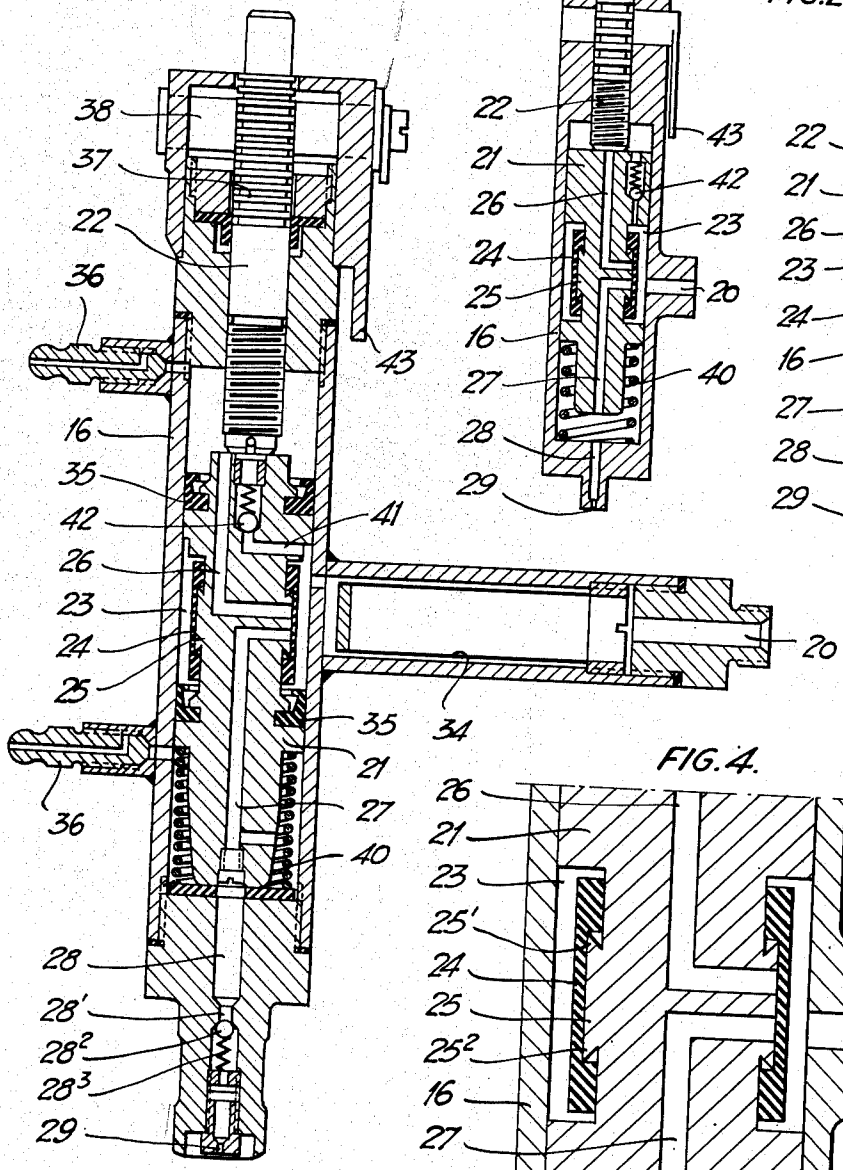


FIG. 1.

FIG. 2.

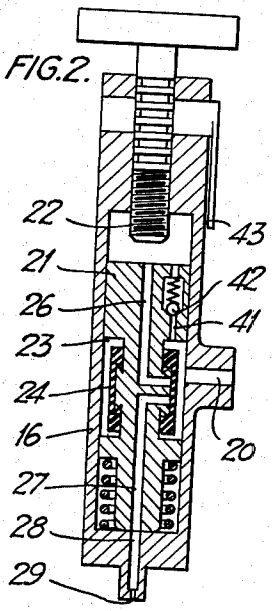


FIG. 4.

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LIQUID DISTRIBUTING SYSTEM

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Original application May 13, 1949, Serial No. 93,042. Divided and this application December 27, 1951, Serial No. 263,662

Claims priority, application Sweden May 15, 1948

8 Claims. (Cl. 299—97)

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The present application is divided out from our copending application Serial No. 93,042, filed May 13, 1949, entitled Method of and Means for Distributing Liquid Matters.

The invention relates to a liquid injection device for use in connection with liquid distributing system in which the liquid fed to the injection devices is subjected to a pulsating pressure. An example of such a system is described in our copending application Serial No. 93,042, filed May 13, 1949.

An object of the invention is to provide a liquid injection device having means operable under the control of the pulsating pressure of the liquid fed to the device for effecting a forced ejection of the liquid at intervals corresponding to the frequency of the pressure pulsations of the liquid.

Another object of the invention is to provide such a liquid injection device having means for adjusting the capacity of the device.

According to a feature of the invention the injection device is of a pump like structure, comprising as main elements a cylinder and a reciprocable plunger therein with connections and controlling means therefor so arranged as to allow each impulse of the liquid fed to the device to effect an operative stroke of the plunger, causing it to eject a quantity of liquid supplied to the cylinder by the preceding impulse.

According to another feature of the invention the injection device is provided with a passage extending between the cylinder chamber at the rear end of the plunger adapted to be acted on by the pressure impulses and the cylinder chamber at the front end of the plunger in communication with the outlet opening of the cylinder, and an automatic valve for controlling the flow of liquid through said passage, so as to allow such flow during the return stroke of the plunger while interrupting it during the operative stroke of the plunger.

A further feature of the invention related to said last-mentioned feature resides in the provision of a non-return valve between the inlet of the cylinder and the cylinder chamber at the rear end of the plunger for allowing the operation of said automatic valve under the influence of pressure differences inside the device.

In the accompanying drawing two forms of the invention are illustrated by way of example.

Figs. 1 and 2 are longitudinal sections of an embodiment in the two end positions of the plunger,

Fig. 3 is an axial section of the other embodiment and

Fig. 4 is a portion of Fig. 2 on a larger scale.

With reference to Figs. 1 and 2, the reference numeral 16 indicates a cylinder, having a laterally positioned inlet 20 and an outlet 28, 29 in its bottom end. Preferably, the outlet may take the shape of a spraying nozzle, especially where

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the device is to be used in a fuel distributing system. Slidably mounted in the cylinder is a plunger 21 which may reciprocate between the bottom of the cylinder and an upper stop formed by a screw 22 which may be controlled from outside the cylinder. The plunger is formed between its ends with an annular recess 23 in the circumferential surface in the middle portion of which an annular projection 25 is made, the upper and lower edges of which are obliquely undercut so as to form sharp knife-edges as best shown at 25^1 and 25^2, respectively, in Fig. 4. Placed in said recess 23 so as to snugly surround the projection 25 is an elastic sleeve 24 having inwardly projecting flanges at its ends which embrace the upper and lower edges of the projection 25, preferably under a certain initial pressure. By this means a high sealing effect is obtained at the sharp edges of projection 25. The middle thin portion of sleeve 24 covers the openings of two channels formed in the plunger, viz. an upwardly extending channel 26 opening into the top surface of the plunger and a downwardly extending channel 27 opening into the bottom surface of the plunger. Formed in the bottom of the cylinder in register with the channel 27 is a boring 28 ending in a narrow aperture 29, which as already stated may be shaped like a spraying nozzle.

The lower end portion of the plunger is of a reduced diameter and is surrounded by a spring 40 resting on the bottom of the cylinder which tends to force the plunger upwardly. The annular recess 23 communicates with the space above the plunger through a channel 41 having a widened central portion in which a non-return valve 42 is inserted for allowing a flow of liquid from recess 23 to the upper cylinder chamber above the top surface of the plunger while preventing flow in the opposite direction. The screw 22 may be geared to a pointer 43 for indicating the set position of the screw on an appropriate scale (not shown) and thus the length of the quantity of liquid to be ejected at each operative stroke of plunger. The operation is as follows:

The inlet 20 is adapted to be connected to a liquid conduit, as for instance, a fuel conduit, in which a pulsating pressure is produced in the one way or the other.

Let it now be assumed that liquid is contained in the cylinder including the lower cylinder chamber, below the bottom end of the plunger.

As soon as a pressure impulse reaches the inlet 20 the pressure of said impulse is imparted through recess 23 and connection 41 past the non-return valve 42 up into the cylinder chamber above the plunger. In such case the pressure prevailing on the external surface of sleeve 24 will be equal to the pressure prevailing on that surface thereof which covers the opening of channel 26, but since the operative pressure sur-

face of the sleeve is much larger on the external surface of the sleeve than it is on the internal surface thereof, the bypass channel will remain closed as long as the pressure is acting. The pressure in the cylinder chamber above the plunger will consequently force the plunger downwards, thereby forcing the liquid in the cylinder chamber below the plunger out through the outlet 28, 29 by an elevated pressure. When the plunger reaches its lowermost position, as shown in Fig. 2, its downward movement, that is, its operative stroke is ended. As soon as the pressure impulse ceases, the return spring 40 will raise the plunger. Since the non-return valve 42 prevents the liquid from returning to the recess 23 and the inlet 20, a pressure above atmospheric will be attained on the top surface of the plunger and since no external pressure acts on the elastic sleeve 24, the pressure resulting from the liquid in the bypass channel section 26 will force the middle portion of the sleeve outwards, so that during the upward, that is, return stroke of the plunger fuel may pass from channel section 26 to channel section 27 and reach the cylinder chamber below the plunger.

Fig. 3 illustrates the construction of the liquid injection device more in detail. The reference numerals are the same as those used in Figs. 1 and 2. In addition to the elements shown in Figures 1 and 2, Fig. 3 shows amongst others a filter 34 for the fuel entering through the inlet 20, furthermore there are packings 35 and 35 provided in combination with the plunger on both sides of the annular recess 23, and vents 36 leading from the spaces above and below the plunger in the pump casing 16. The connection between the screw 22 and the pointer 43 comprises a rounded rack 37 formed integrally with the screw 22 and axially extending teeth, not shown, of a transverse shaft 38 which in its turn controls the pointer.

In this embodiment the outlet boring 28 is formed with a reduced area approximately between its upper and lower ends, as shown at 28^1, and inserted in the wider lower portion of boring 28 is a non-return valve 28^2 loaded by an upwardly acting spring 28^3.

The non-return valve 28 prevents dribbling in the intervals between the ejections, since said valve is normally closed and opened only under the action of the rising pressure in the lower cylinder chamber during the downward stroke of the plunger.

We claim:

1. A liquid injection device of the class specified comprising in combination, a casing having an inlet for a liquid adapted to be supplied thereto under a pulsating pressure and an outlet for said liquid, a reciprocable plunger in said casing adapted to be operated by the pressure impulses of the liquid supplied to said inlet for effecting a forced ejection of a quantity of liquid through said outlet at each operation stroke of said plunger, a bypass being provided inside the device between the end surface of the reciprocable plunger adapted to be acted on by the pressure impulses and the outlet, an automatic valve for controlling the flow of liquid through said bypass, and a non-return valve inserted between the inlet and said liquid-operated area of the reciprocable plunger, said automatic valve being adapted to interrupt the flow of liquid through the bypass when the liquid pressure in front of the non-return valve is higher than the pressure behind said valve, and to allow the flow of liquid through the bypass when the pressure behind the non-return valve is higher than the pressure in front thereof.

2. In a liquid injection device in combination, a cylindrical casing having a lateral inlet for a liquid adapted to be supplied thereto under a pulsating pressure and an outlet for said liquid at one end, a reciprocable plunger in said casing for discharging the liquid through said outlet at an elevated pressure, a passage being provided between the liquid inlet and the end of the plunger remote from the outlet for allowing the liquid to displace the plunger towards the outlet, a non-return valve for controlling said passage, the plunger having further a by-pass formed in it which comprises two channel sections extending from opposite ends of the plunger to spaced points of the circumference thereof, and an elastic sleeve snugly fitting around the plunger so as to cover said points with its external surface exposed to the pressure of the liquid at the inlet.

3. A liquid injection device as claimed in claim 2, and in which the plunger is formed on its circumference with annular knife edges to act as tightening elements in cooperation with the elastic sleeve, said knife edges being engaged by portions of said sleeve under an initial pressure for securing a high sealing effect per unit of area.

4. A liquid injection device as claimed in claim 2, and in which the plunger is under the control of a spring action for effecting its return stroke, an adjustable stop being provided for determining the termination of said stroke and thus the quantity of liquid to be ejected at next operative stroke.

5. A liquid injection device as claimed in claim 2, and in which the plunger is externally formed with an annular recess between its ends for receiving the elastic sleeve, said recess being in permanent communication with the liquid inlet of the casing.

6. A liquid injection device as claimed in claim 2, and in which the plunger is externally formed with an annular recess between its end in permanent communication with the liquid inlet of the casing, characterized by the further feature that the plunger is formed with a channel between said annular recess and the end of the plunger to be acted on by the pressure impulses, the non-return valve being mounted in said passage in such a way as only to allow a flow of liquid in the direction from said inlet to said end of the plunger while positively preventing any flow of liquid in the reverse direction.

7. A liquid injection device as claimed in claim 2, and in which the outlet of the cylindrical casing is provided with a spraying nozzle.

8. A liquid injection device as claimed in claim 2, and in which the outlet of the cylindrical casing is provided with a spraying nozzle, characterized by the provision of a non-return valve in front of said spraying nozzle.

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