Feb. 5, 1946. W. L. DAVIS 2,394,371

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Filed March 21, 1945 2 Sheets-Sheet 1

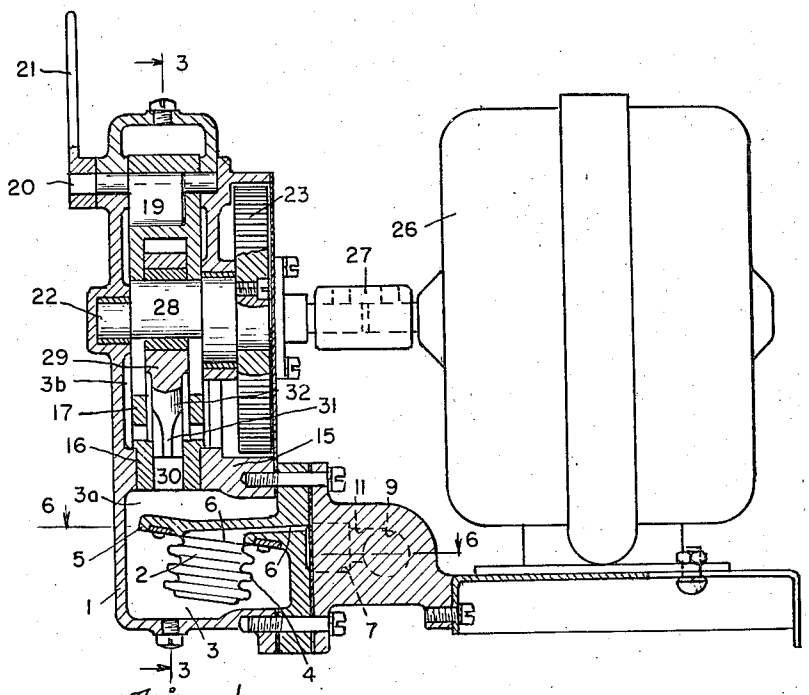


Fig. 1

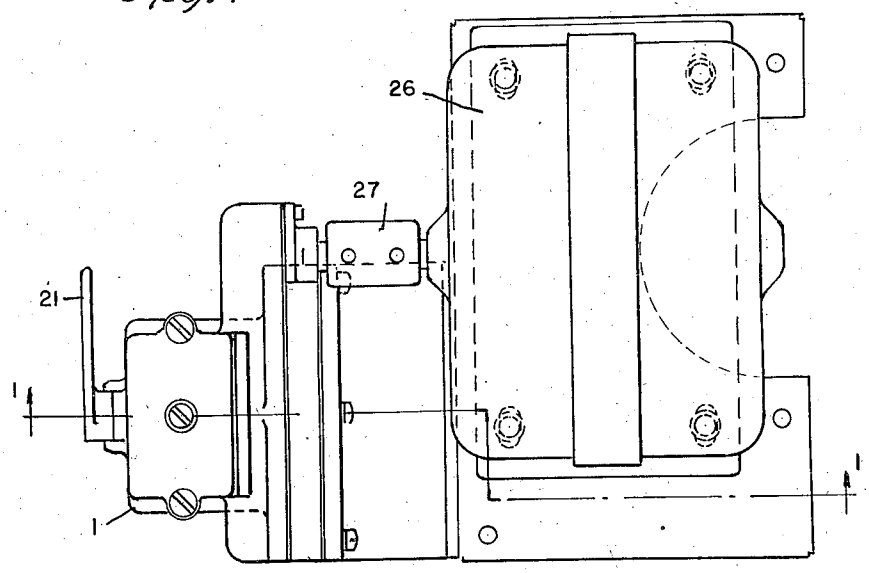


Fig. 2

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Filed March 21, 1945 2 Sheets-Sheet 2

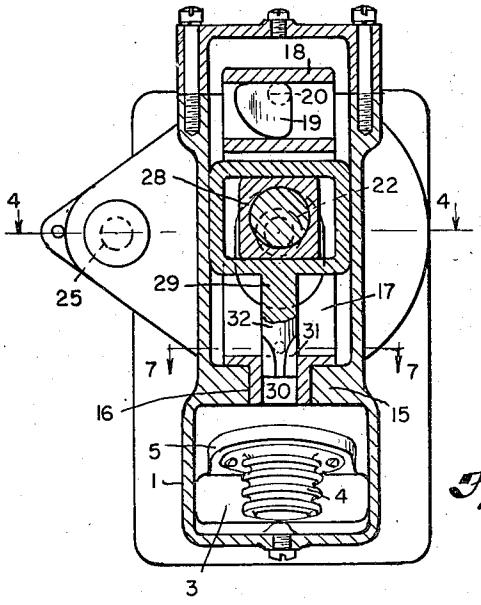


Fig. 3

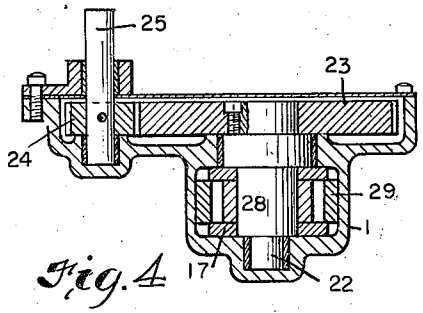


Fig. 4

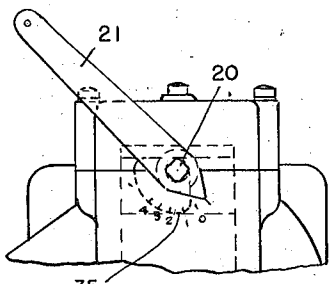


Fig. 5

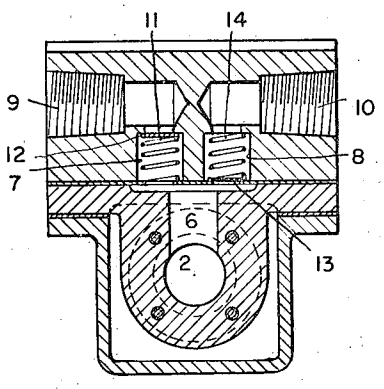


Fig. 6

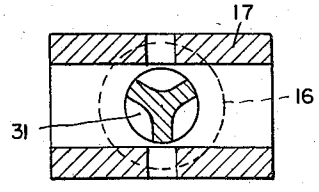


Fig. 7

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Patented Feb. 5, 1946

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UNITED STATES PATENT OFFICE

2,394,371

PUMP

Walwin L. Davis, deceased, late of Avon, Ohio, by Frances L. Davis, executrix, Avon, Ohio, assignor to E. D. McCurdy, trustee, Cleveland, Ohio

Application March 21, 1945, Serial No. 583,982

8 Claims. (Cl. 103—44)

This invention relates as indicated to pumps and more especially to pumps adapted to handle fluid materials which for any reason may not be desirably or safely brought into contact with closely fitting operating parts of the pump mechanism.

It is a principal object of this invention to provide a pump of the character described which may be regulated so as to provide variable discharge per unit of time even when the speed of operation of the pump is maintained constant.

Other and more particular objects of the invention will appear as the description proceeds.

To the accomplishment of the foregoing and related ends, said invention, then, consists of the means hereinafter fully described and particularly pointed out in the claims. The annexed drawings and the following description set forth in detail certain mechanism embodying the invention, such disclosed means constituting, however, but one of various mechanical forms in which the principle of the invention may be used.

In said annexed drawings:

Fig. 1 is a vertical section view through a pump constructed in accordance with the principles of the invention;

Fig. 2 is a plan view of the assembly illustrated in Fig. 1, it being noted that Fig. 1 is taken on a plane substantially indicated by the line 1—1 on Fig. 2;

Fig. 3 is a section view of the apparatus illustrated in Fig. 1 taken on a plane substantially indicated by the line 3—3;

Fig. 4 is a transverse sectional view of the apparatus illustrated in Fig. 3 taken on a plane substantially indicated by the line 4—4;

Fig. 5 is a broken side elevational view of the upper left-hand portion of the apparatus illustrated in Fig. 1;

Fig. 6 is a transverse sectional view of the apparatus illustrated in Fig. 1 taken on a plane substantially indicated by the line 6—6; and

Fig. 7 is an enlarged sectional view drawn to double scale of the apparatus illustrated in Fig. 3 taken on a plane substantially indicated by the line 7—7.

Referring now more specifically to the drawings and more especially to Fig. 1, the pump here illustrated as one embodiment of the invention comprises a body generally indicated at 1 which is provided with a cavity therein, which cavity is divided into two non-communicating compartments 2 and 3 respectively. Compartment 2 is defined by a bellows, generally indicated at 4, attached to a flange 5 in which is formed a passage 6 leading to branch passages 7 and 8 which are respectively in communication with inlet and outlet orifices 9 and 10 respectively..

In the branch passage 7 is a check valve member 11 urged by the spring 12 into engagement with the remote end of the branch passage 7. In the branch passage 8 there is a check valve member 13 which is urged into engagement with the near end of the branch passage 8 by means of a spring 14.

It will be observed that as a vacuum is created in the compartment 2, the check valve 11 will be unseated and the check valve 13 will be seated, thus drawing fluid from the inlet orifice 9 into the compartment 2. When pressure is built up in the compartment 2, then the check valve 11 will be seated and the check valve 13 will be unseated causing the fluid in the compartment 2 to flow into and through the outlet passage 10.

Compartment 3 in the pump body is divided by means of the partition 15 into a pressure compartment 3*a* and a relief compartment 3*b*. In the partition 15 there is an opening which receives in close fitting telescopic engagement a sleeve 16, the latter being carried by the lower end of a yoke 17. The upper end 18 of the yoke 17 is adapted to receive in close fitting engagement a cam member 19 carried by a shaft 20 on the end of which is an adjusting lever 21. It will be observed that as the lever 21 is rotated effecting a rotation of the shaft 20 and its attached cam member 19, the yoke 17 will be raised and lowered causing the sleeve 16 to be raised and lowered in the opening in the partition 15.

Journalled in the body of the pump is a crankshaft 22 which, at one end, carries a gear 23 which is in mesh with a driving pinion 24 carried by a shaft 25 to which is connected the motor 26 by means of the driving coupling 27. Mounted on the off-set or crank portion 28 of the crankshaft 22 is a piston rod 29 which at its lower end carries a piston 30. The lower end 31 of the piston 30 is cut away in the form of intervening flutes and lands as most clearly illustrated in Fig. 7, so that the lands, being in engagement with the inside of the sleeve 16, serve as a means for guiding the lower end of the piston 30 for reciprocation in the sleeve 16.

The upper portion of the piston 30 is cylindrical as at 32 and of such diameter as to have close fitting telescopic engagement with the inside of the sleeve 16.

The operation of the above described pump is briefly as follows:

The compartments 3*a* and 3*b* will be filled with

a fluid preferably an incompressible fluid and one which has lubricating properties such as a high-grade refined mineral oil. The inlet port 9 will be connected to the source of fluid to be pumped and the port 10 will be connected to the out-fall or pressure conduit. When the motor 26 is started this will cause a reciprocation of the piston 30. As the piston descends, the lower end 31 thereof will displace fluid in compartment 3a and such fluid will flow upwardly past the piston, i. e. through the flutes therein into the compartment 3b. When, however, the piston descends to the point where the uninterrupted cylindrical portion 32 thereof moves into engagement with the upper end of the sleeve 16, then further downward movement of the piston 30 must result in a displacement of the fluid in compartment 3a in some other direction, i. e. the effective volume of compartment 3a is thus reduced.

This will result in a building up of pressure in compartment 3a causing the bellows 4 to be collapsed forcing the contents thereof outwardly through the discharge conduit 10. When the piston has reached the limit of its downward stroke and then begins moving upwardly, this will cause not only a relief of the pressure in the compartment 3a, but also a vacuum therein causing the bellows 4 to be distended, whereupon the check valve 13 will close and the check valve 12 will open, filling compartment 2, i. e. the interior of the bellows, with a fresh supply of fluid which will be pumped out into the discharge conduit 10 the next time the piston descends.

It will be observed that by adjusting the sleeve 16 axially in the partition 15 it is possible to vary the effective stroke length of the piston, i. e. as the sleeve 16 is raised from its lowermost position, as illustrated in Fig. 1, the cylindrical portion 32 of the piston will seal off the passage through the sleeve 16 at an earlier point in the downward movement of the piston causing a greater volumetric displacement in compartment 3a for each stroke of the piston and correspondingly increasing the output of the pump even though the speed of rotation of the crankshaft 28 is maintained constant.

Instead of employing a bellows of the character illustrated in Fig. 1, any other deformable diaphragm may be employed to separate compartments 2 and 3. For example, a flat sheet of deformable material might be stretched across the mouth of passage 6 in a further modification of the construction illustrated in the drawings.

The pump described above has all of the moving parts which are subject to wear operating in a bath of lubricating oil and without any possibility of contamination from the material being handled which is sealed off by means of the diaphragm or bellows. This makes possible a construction capable of handling materials which would be corrosive or otherwise detrimental to the operating parts of the pump. A pump of this design is also admirably suited for use in pumping food products such as milk because the parts, with which the material being handled by the pump comes in contact, may be readily cleaned and sterilized.

The adjustment of the output of the pump is readily controlled by means of the handle 21 and, as illustrated in Fig. 5, ordinals such as those indicated at 35 may be placed on the pump casing adjacent the handle 21 as an indication of the setting of the pump.

Other modes of applying the principle of the invention may be employed instead of the one explained, change being made as regards the mechanism herein disclosed, provided the means stated by any of the following claims or the equivalent of such stated means be employed.

It is therefore particularly pointed out and distinctly claimed as the invention:

1. A fluid pump having a body provided with a cavity therein, a partition including a flexible diaphragm dividing said cavity into first and second compartments, said body provided with inlet and outlet ports leading to said first compartment, a fluid in said second cavity, means for setting up pulsations in said fluid, including a plunger having valving fluid passway means and a cooperating port-providing sleeve, means for axially adjusting the sleeve, and plunger-operating means between the latter means and the plunger.

2. A fluid pump having a body provided with a cavity therein, a partition including a flexible diaphragm dividing said cavity into first and second non-communicating compartments, said body provided with inlet and outlet ports leading to said first compartment, a fluid in said second cavity, plunger means for setting up pulsations in said fluid, means including a sleeve cooperating with the plunger means for adjustably varying the magnitude of such pulsations, and operating means for the plunger means between the latter means and the plunger means.

3. A fluid pump having a body provided with a cavity therein, a partition including a flexible diaphragm dividing said cavity into first and second non-communicating compartments, said body provided with inlet and outlet ports leading to said first compartment, a ported partition dividing said compartment into pressure and relief compartments, a fluid in said second compartment, and means for effecting a reciprocating flow of such fluid between said pressure and relief compartments whereby said diaphragm is flexed, including a plunger having valving fluid passway means and a cooperating port-providing sleeve, means for axially adjusting the sleeve, and plunger-operating means between the latter means and the plunger.

4. A fluid pump having a body provided with a cavity therein, a partition including a flexible diaphragm dividing said cavity into first and second non-communicating compartments, said body provided with inlet and outlet ports leading to said first compartment, a fluid filling said second compartment, and means for periodically increasing and decreasing the effective size of said second compartment, including a plunger having valving fluid passway means and a cooperating port-providing sleeve, means for axially adjusting the sleeve, and plunger-operating means between the latter means and the plunger.

5. A fluid pump having a body provided with a cavity therein, a partition including a flexible diaphragm dividing said cavity into first and second non-communicating compartments, said body provided with inlet and outlet ports leading to said first compartment, a second partition dividing said compartment into pressure and relief compartments, an opening through said last named partition, and a plunger fluted in part of its length and reciprocable in said opening.

6. A fluid pump having a body provided with a cavity therein, a partition including a flexible diaphragm dividing said cavity into first and second non-communicating compartments, said body provided with inlet and outlet ports leading to said first compartment, a second partition

dividing said compartment into pressure and relief compartments, an opening through said last named partition, a port-providing sleeve in said last named opening, means for adjusting the axial position of said sleeve, a plunger in said sleeve axially channeled along part of its length, and means for reciprocating said plunger in said sleeve with strokes of equal throw.

7. A fluid pump having a body provided with a cavity therein, a partition including a flexible diaphragm dividing said cavity into first and second non-communicating compartments, said body provided with inlet and outlet ports leading to said first compartment, a second partition dividing said compartment into pressure and relief compartments, an opening through said last named partition, a port-providing sleeve in said last named opening, means for adjusting the axial position of said sleeve, a plunger in said sleeve having an axially channeled reduced forward guiding portion followed by a portion in close fitting telescopic engagement with said sleeve, and means for reciprocating said plunger in said sleeve with strokes of equal throw.

8. A fluid pump having a body provided with a cavity therein, a partition including a flexible diaphragm dividing said cavity into first and second non-communicating compartments, said body provided with inlet and outlet ports leading to said first cavity, check valves in said ports, a second partition dividing said compartment into pressure and relief compartments, an opening through said last named partition, a port-providing sleeve in said last named opening, means for adjusting the axial position of said sleeve, a plunger in said sleeve having an axially channeled reduced forward guiding portion followed by a portion in close fitting telescopic engagement with said sleeve, and means for reciprocating said plunger in said sleeve with strokes of equal throw.

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