Feb. 27, 1962 R. LE BARON BOWEN, JR 3,022,736

VARIABLE VOLUME PUMP FOR VISCOUS FLUIDS

Filed March 15, 1961 2 Sheets-Sheet 1

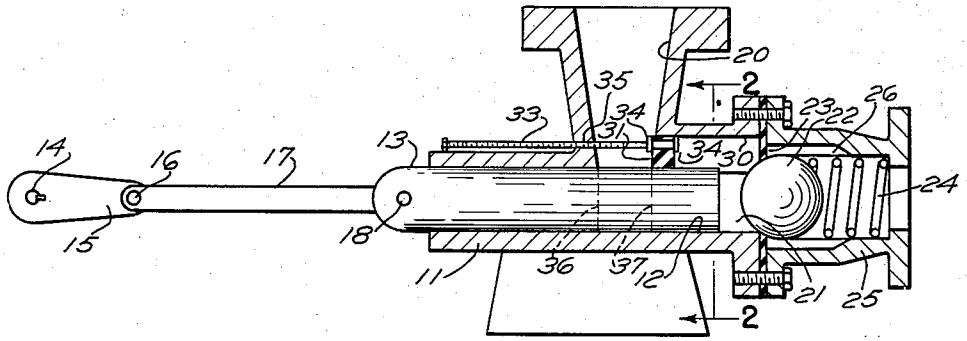


FIG. 1

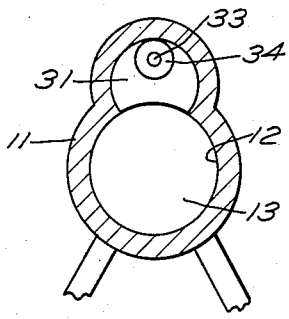


FIG. 2

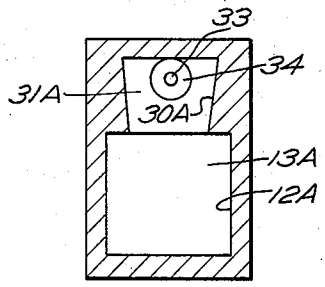


FIG. 4

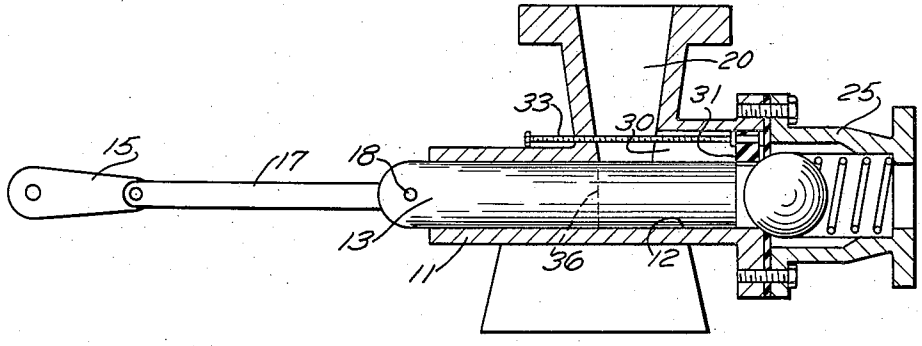


FIG. 3

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VARIABLE VOLUME PUMP FOR VISCOUS FLUIDS

Filed March 15, 1961 2 Sheets-Sheet 2

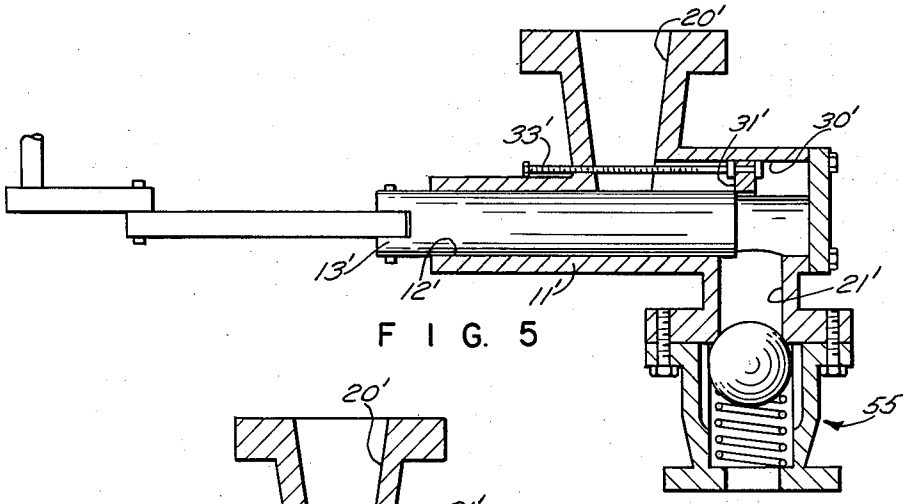


FIG. 5

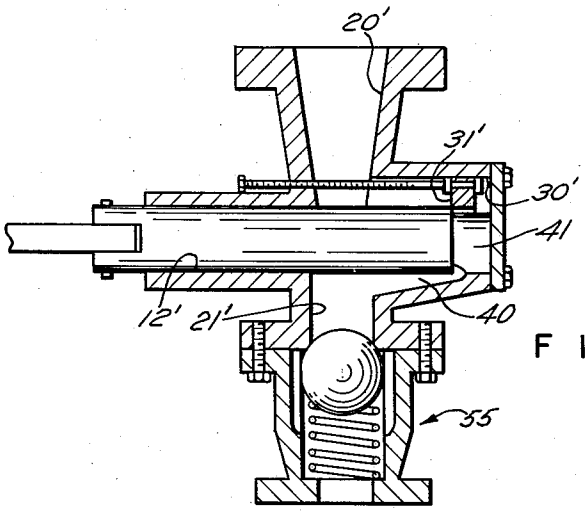


FIG. 6

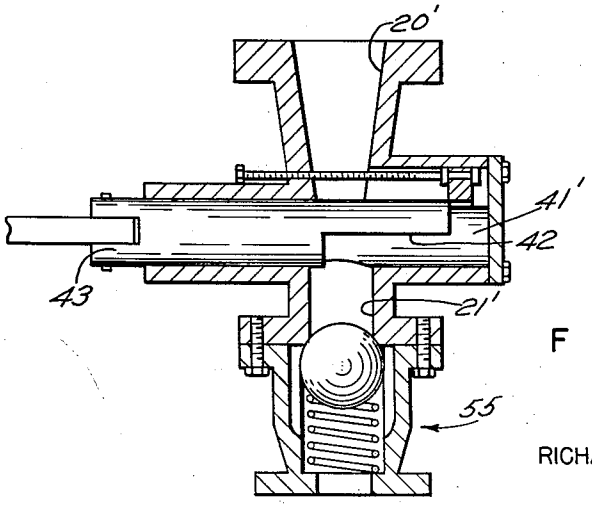


FIG. 7

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VARIABLE VOLUME PUMP FOR VISCOUS FLUIDS

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8 Claims. (Cl. 103—37)

This invention relates to piston pumps of the metering type, and more particularly to those for handling fluids of a viscous nature, such as heavy oils, grease, pastes, slurries, and the like and is a continuation-in-part of my application Serial No. 847,567 filed October 20, 1959.

The primary object of this invention is to provide a pump for handling viscous fluids which can be easily adjusted so that the discharge rate can be varied from zero flow to a maximum rate of flow.

Previously such pumps have been provided for adjustment by either changing the length of stroke of the piston in the pump, or by moving the relative location of the piston in relation to the pump housing while keeping the length of the stroke constant.

A more specific object of the invention is to adjust the rate of discharge of the pump by changing the physical shape of the housing in relation to the piston, rather than either of the above mentioned methods.

A further object is to provide a means of adjustment of the rate of discharge of the pump which can be adjusted while the pump is in operation without stopping the operation of the pump. Other means for adjusting such pumps usually require that the pump be stopped for the adjustment.

Another object is to provide a pump adjustment which gives a linear change between the amount an adjusting screw is turned and the amount the rate of discharge is changed.

Also an object of the invention is a simple and highly efficient mechanism for handling viscous materials under varying discharge requirements.

Additional objects and advantages will become apparent in the following description and claims.

FIGURE 1 is a side elevation partly in section of the pump shown adjusted for maximum rate of discharge;

FIGURE 2 is a section taken on lines 2—2 of FIGURE 1;

FIGURE 3 is a side elevation partly in section of the pump shown adjusted to zero flow;

FIGURE 4 is an alternate construction of the pump shown in the same section as FIGURE 2;

FIGURE 5 is a top view partly in section of an alternate construction of the pump shown in FIGURES 1 and 3, with the pump shown adjusted for zero flow;

FIGURE 6 is a top view partly in section of an alternate construction of the pump shown in FIGURE 5, with the pump adjusted for zero flow; and

FIGURE 7 is a top view partly in section of another alternate construction of the pump shown in FIGURE 5, with the pump adjusted for zero flow.

Referring to FIGURE 1, a pump body 11 having a bore 12 is fitted with a piston 13 which moves back and forth along the axis of the bore. Motion is imparted to piston 13 by means of rotating shaft 14 fitted with crank arm 15 with a crank pin 16 connected to one end of a connecting rod 17 which is connected to piston 13 by means of pin 18.

Along the bore 12 there is provided a suction opening 20 and at the end thereof is a discharge port 21. A ball check valve 22 is received on a valve seat 23 fitted over discharge port 21 of the pump body. Ball 22 is urged towards seat 23 by means of a spring 24 which is held in place by discharge housing 25, internal guides 26 being provided for guiding the ball valve 22 to seat 23 when

the valve closes as understood by those skilled in the art.

The housing 11 is provided with a recess 30 that has an opening leading into the bore 12. This recess is located between the suction opening 20 and the discharge opening 21 and has slidably received therein a plug 31 which in cross-section completely fills the cross-section of the recess 30 up to the limits of the bore 12. Reciprocation of the plug 31 is had by fastening a screw 33 as by collars 34 to the plug 31. The screw then passes through the housing 11 as through a threaded opening 35 and permits reciprocation of the plug 31 relative to the housing 11 by rotation of the screw 33.

The operation of the pump can best be described by referring first to FIGURE 1 where the pump is shown at the point of completing the discharge stroke with the piston 13 in its extreme position toward the discharge port. As the shaft 14 continues to rotate in either clockwise or counter-clockwise direction, the piston 13 will be withdrawn toward the suction opening 20, and as soon as the end of the piston is in alignment with the end of plug 31, which position is represented by the broken line 37, the material will begin to flow into the bore 12. As shaft 14 continues to rotate, piston 13 will be further withdrawn to alignment with an edge of opening 20 as at the broken line 36. Further rotation of the shaft 14 will move the piston 13 from the position at broken line 36 toward the discharge port 21. As this motion continues the material in front of piston 13 will be forced ahead of it and any excess material will tend to be forced back into the suction opening 20. Once the piston has reached the edge of plug 31, which position is represented by the broken line 37, material can no longer flow back up through suction opening 20 since the plug 31 forms in effect a seal in association with the bore 12, permitting material at this point to leave only through discharge opening 21.

FIGURE 1 shows the pump adjusted for a maximum rate of discharge. To decrease the rate of discharge, threaded screw 33 is turned to move plug 31 to the right. FIGURE 3 shows the plug 31 moved all the way to the right so that the flow rate from the pump is zero. The piston 13 still moves between its maximum limits as shown in FIGURE 1, but with plug 31 all the way to the right, the material in front of the piston 13 simply passes back through recess 30 into opening 20 as the piston 13 moves to the right. Thus adjustment of the pump can be easily made while the pump is in operation. The movement of screw 33 which in turn moves the plug 31 will produce the linear change in rate of flow from the pump by virtue of the fact that the volume of the bore 12 together with the recess 30 will be linearly decreased as plug 31 moves to the right as viewed in the drawing. Thus, a straight line function is had with respect to linear movement of the screw 33 versus the flow of discharge from the pump. It should also be mentioned that the plug 31 need not attempt in any fashion to completely close up the recess 30 since the volume discharged from the pump is purely dependent upon when the end of piston 13 meets the edge of plug 31, thus cutting off any back flow into suction opening 20. Further it should be mentioned that it is not necessary that the recess 30 have communication with the discharge port 21, it being merely necessary that the recess have communication with the suction opening 20.

FIGURE 4 shows a variation in the construction of the pump wherein the piston 13A is square instead of round and plug 31A is almost rectangular instead of a portion of a cylinder. Otherwise the modification operates in the same manner as described above.

FIGURES 5, 6 and 7 show an alternate construction of the pump illustrated in FIGURES 1 and 3 in which the

discharge is located along the bore of the pump rather than at the end of the bore. Referring first to FIGURE 5, there is a pump body 11' having a bore 12' in which is fitted a piston 13' that moves back and forth along the axis of the bore in the mannner already described. Along bore 12' there is provided a suction opening 20' and longitudinally spaced therefrom a discharge port 21' in which is located a check valve assembly 55. Housing 11' is provided with a recess 30' which has an opening leading into bore 12'. This recess 30' runs along the bore 12' starting at the suction opening 20' and leading away from the driven end of the piston 13'. Recess 30' has slidably received therein a plug 31' which in cross-section completely fills the cross-section of the recess 30' up to the limits of bore 12'. Plug 31' is moved axially in recess 30' by means of screw 33' as described above. FIGURE 6 is essentially similar to FIGURE 5, like parts bearing identical reference numerals, except that discharge opening 21' is not located near the end of bore 12', but rather is located on the bore 12' opposite suction opening 20'. A passageway 40 connects discharge opening 21' with the end chamber 41 of bore 12'. FIGURE 7 is similar to FIGURE 6 in that the discharge opening 21' is located on the bore 12' opposite suction opening 20'. Here, however, the passageway 40 of FIGURE 6 between chamber 41' and opening 21' is provided by a recess 42 in the end of piston 43. The operation of FIGURES 5, 6 and 7 is identical to that of FIGURES 1 and 3, the flow being varied from zero to a maximum by movement of plug 31' in recess 30', and as previously mentioned. The configuration of the piston can be either round, square, or some other geometry.

I claim:

1. A variable volume pump comprising a body having a bore therein a suction opening along said bore, a discharge opening at one end of said bore, a piston fitted for reciprocation therein, walls contiguous and opening off said bore forming a recess communicating with said bore, said walls extending to intersect said suction opening so that one end of the recess is located at said suction opening, and the major extent thereof is located along said bore towards said discharge opening, a plug received by the walls within said recess, and means operatively connected to said plug for moving said plug in said recess.

2. A pump as in claim 1 wherein said recess is pseudo cylindrical and said first bore is cylindrical.

3. A pump in claim 1 wherein the means for moving the plug include a screw having one end thereof secured in said plug and the threaded section thereof received in a female threaded section fixed to said body of the pump.

4. A variable volume pump comprising a body having a bore therein, a suction opening along said bore, a discharge opening along said bore, a piston fitted for reciprocation therein, walls contiguous and opening off said bore forming a recess communicating with said bore, said walls extending to intersect said suction opening so that one end of said recess is located at said suction opening and the major extent thereof is located along said bore away from the driven end of said piston, a plug received by the walls within said recess, and means operatively connected to said plug for moving said plug in said recess.

5. A pump as in claim 4 wherein said recess is pseudo cylindrical and said first bore is cylindrical.

6. A pump as in claim 4 wherein the means for moving the plug include a screw having one end thereof secured in said plug and the threaded section thereof received in a female threaded section fixed to said body of the pump.

7. A pump as in claim 4 wherein a passageway is located in said body of the pump for connecting the discharge opening with the end of the bore opposite the driven end of said piston.

8. A pump as in claim 4 wherein said piston is provided with a recess extending from its free end towards said discharge opening.

No references cited.