Nov. 24, 1959 R. A. JOBUS ET AL 2,914,253

MEANS FOR MAINTAINING CONSTANT DELIVERY FROM A FLUID CIRCUIT

Filed May 25, 1956 2 Sheets-Sheet 1

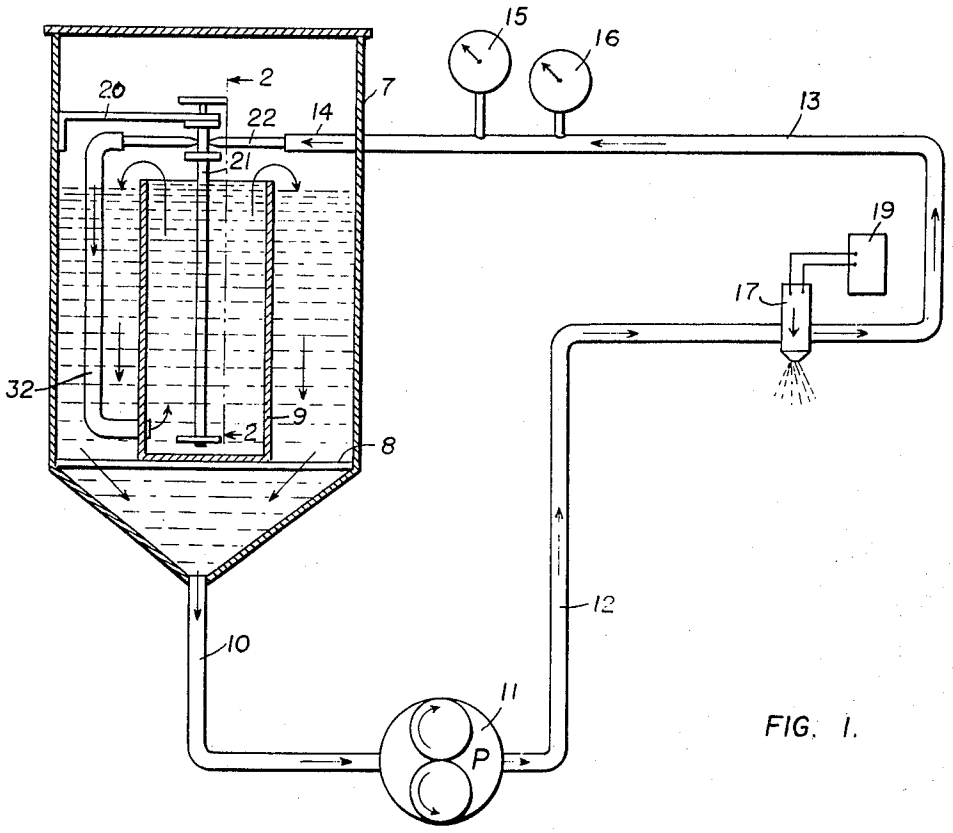


FIG. 1.

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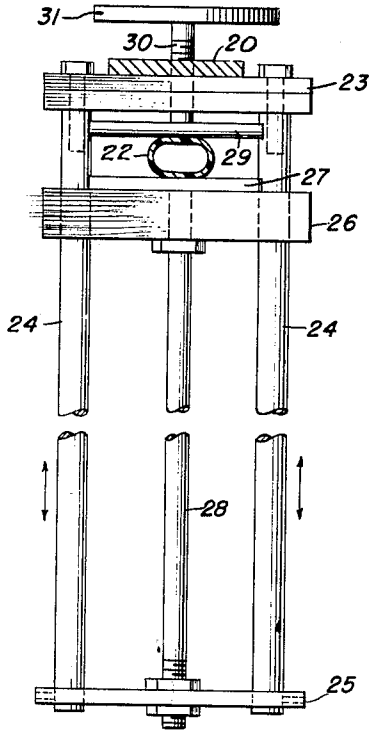


FIG. 2

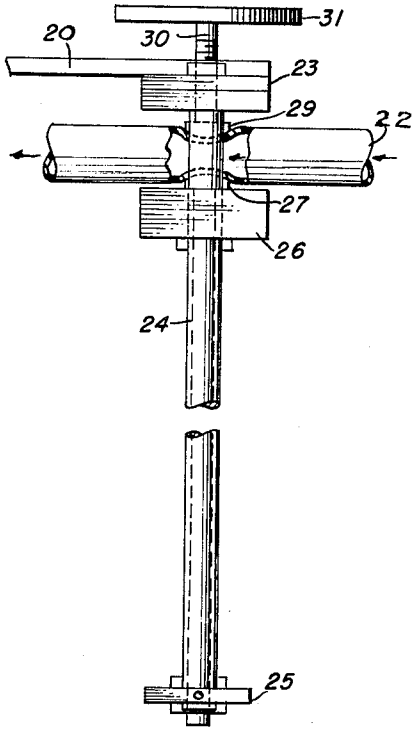


FIG. 3

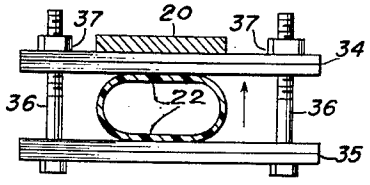


FIG. 4

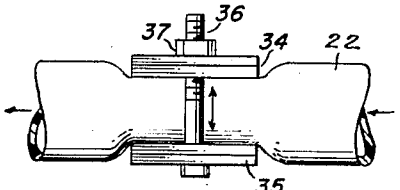


FIG. 5

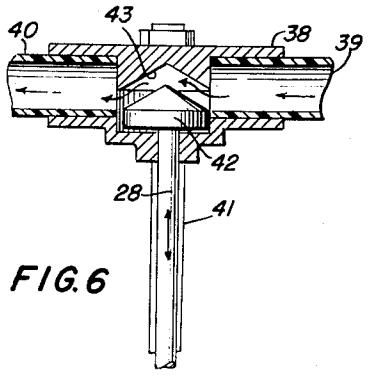


FIG. 6

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MEANS FOR MAINTAINING CONSTANT DELIVERY FROM A FLUID CIRCUIT

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Application May 25, 1956, Serial No. 587,397

1 Claim. (Cl. 239—75)

The invention of which the following specification is a description, relates to means for maintaining a constant rate of volume delivery from a fluid circuit.

In applying a sealing compound to container closures, the present practice involving high speed of operation demands that a constant volume of lining compound be deposited on each closure.

It is usual to work with a lining compound which may have a range of about 20% to about 70% total solids, part of which is in a dispersed colloidal state. Such compounds are normally run at compound temperatures of between 60° F. and 120° F. which temperatures fluctuate with the variation of ambient temperature around the lining machine. Within this range of temperature there is a great variation in the volume of flow delivered from the nozzle orifice of fixed size under a constant pressure condition.

It is well understood that adjustment in the size of the nozzle to compensate for such changes in viscosity is impractical due to the rapidity of operation which is on the order of 600 closures lined per minute.

The volume of compound which is to be deposited on each closure must be constant. The delivery of such a normal, constant volume without adjustment at the delivery nozzle can be obtained since the pressure of the fluid stream at the nozzle can be made to vary with the viscosity, that is, inversely to changes in temperature.

It has been found that direct control of such pressure and consequently constant delivered volume is to be had by maintaining a circulation of the lining compound to the nozzle, returning the excess to the supply tank and varying the back pressure in the line to compensate for temperature changes and resultant variations in viscosity.

Thus, a practically constant volume is obtained at the discharge from the nozzle regardless of changes in temperature of the compound within the range indicated.

It is easily understood that when the temperature of the compound in a closed circuit from the supply tank to the nozzle and return is reduced, the compound tends to increase in viscosity. As this would normally decrease the volume of discharge from the nozzle, the decrease in discharge can be corrected by increasing the back pressure. By such increase of the back pressure the volume of discharge from the nozzle can be maintained constant.

The present invention, therefore, has the purpose of providing means to maintain the discharge from the delivery nozzle constant regardless of changes of viscosity due to variations in temperature.

A further object of the invention is to provide means by which a normally viscous lining compound can be quickly controlled in discharge from a nozzle of fixed size so that the volume of discharge remains constant.

The above and other objects of the invention will be readily understood from the following description of the preferred form of our invention as illustrated by way of example on the accompanying drawing in which:

Fig. 1 is a schematic diagram partly in section showing the recirculating system for a spray nozzle including pressure control;

Fig. 2 is an enlarged side elevation of the pressure control means taken on the line 2—2 of Fig. 1;

Fig. 3 is a similar front elevation of the same;

Fig. 4 is a fragmentary enlarged side elevation of a modified form of thermostat;

Fig. 5 is a similar front elevation of the same, and

Fig. 6 is an enlarged vertical section of a modified form of regulating valve in the device shown in Figs. 1, 2 and 3.

To effectively maintain a constant volume of delivery from the spray nozzle, means have been provided to recirculate the supply of fluid lining compound with attendant control of the flow by means of a device which counteracts the change in viscosity caused by variation in temperature of the lining compound.

As shown in Figs. 1, 2 and 3, the novel arrangement includes a tank 7 in which a supply of lining compound may be placed and replenished from time to time as consumed.

When the replenish supply is at a different viscosity-temperature than that already in the system by placing it in the tank outside the cup it does not affect the thermostat or discharge until it has circulated through the system and returned to the cup due to the 100 to 1 ratio of circulation to discharge.

Centrally supported on a spider 8 in the tank 7 is a cup 9. The cup 9 is at all times maintained full of the compound being applied.

Tank 7 has a drain pipe 10 in the bottom by which lining compound is withdrawn for use.

The drain pipe 10 leads to a gear pump 11. This is representative of numerous types of pumps which may be used, the important feature being the fact that the pump will have constant displacement of the liquid being transferred.

A pipe 12 extends from the delivery side of the pump 11 and merges with a return pipe 13 which has its end 14 within the upper part of the tank 7.

The return pipe has a thermometer 15 and a pressure gage 16 by which the condition of the returning compound may be observed.

The pipe 12 leads directly to the discharge or spray nozzle 17. The usual ratio is that the volume of compound delivered to the spray nozzle and discharged therefrom shall be probably one part in 100 volumes of the amount circulating in the system.

A timing device 19 controls the intermittent discharge of the compound from the nozzle 17. This is intercalated with the operation of the machine which presents the can ends for deposit of the lining compound thereon.

The tank 7 supports a bracket 20 from which hangs a thermostatic clamp 21. This clamp extends to within a short distance of the bottom of the cup 9. The end 14 of the pipe has a flexible or elastic section 22. This section traverses the thermostatic clamp and the effective aperture of the section is controlled by the latter.

The clamp includes an upper fixed cross bar 23 attached to the bracket 20. Two parallel rods 24, 24 extend vertically downward from the cross bar 23 to within a short distance of the bottom of the cup. The lower ends of the rods 24 are connected by a lower cross bar 25.

A slide bar 26 is slidably carried on the rods 24, 24. This slide bar carries a lower pillow block 27 on its upper surface.

The slide bar 26 is supported by a center rod 28. This rod 28 is adjustably mounted on the lower cross bar 25.

An uppper pillow block 29 extends between the rods 24, 24, and partially encircles them. An adjusting screw 30 passes from the upper pillow block 29 through the

fixed cross bar **23** and the bracket **20**. A hand wheel or other adjusting means is provided at the other end of the adjusting screw.

The center rod **28** is made of a metal which has a greater coefficient of thermal expansion than the parallel rods **24, 24**. Thus the rod **28** may be made of steel and the rods **24, 24** of aluminum. The flexible section **22** of the return pipe is constricted between the pillow blocks **27** and **29** in the manner shown in Figs. 2 and 3. The center rod **28** responds to changes in temperature of the return compound by changing the amount of constriction of the flexible pipe section.

By adjusting the upper pillow block **29** this constriction can be made to compensate closely for the change in back pressure caused by the abnormal change in viscosity of the returning compound.

The discharge end of the pipe section **22** connects with the vertical pipe section **32** which delivers into the cup **9** near its bottom.

Assuming the tank **7** to contain the desired quantity of viscous lining compound, the compound will be withdrawn at the bottom and given positive circulation by the pump **11**.

The circulation is maintained at perhaps one hundred times the discharge from the nozzle **17**. Granting that the discharge from the nozzle is the normal volume, the return through the thermostatic clamp will be of minimum restriction.

However, if the lining compound increases in viscosity, there is the possibility that under such circumstances discharge from the nozzle will decrease with subnormal back pressure developing in the return pipe. To counteract such a condition, the thermostatic clamp will constrict to allow less return flow and thus increase the pressure at the nozzle. When the viscosity is lowered, the thermostatic clamp will enlarge the valve section until the normal pressure is applied to the nozzle and the discharge again is constant.

In the form shown in Fig. 4, the lower cross bar **35** is bi-metallic and responsive to changes in temperature and the upper cross bar **34** is bi-metallic but arranged in reverse direction of movement. Thus the inner pair of leaves may be iron and the outer pair brass. The side rods **36** are shorter than the rods **24** and need only extend far enough to encompass the flexible pipe section **22**. The change of temperature of the compound passing through the flexible pipe **22** is sufficient to actuate the bi-metallic elements to constrict the flow as the temperature is lowered and increase the flow at the constriction as the temperature is increased.

Adjusting nuts **37, 37** are threaded on the rods **36** so that the bars **34, 35** may be brought together enough to establish the desired constriction of the pipe section **22** within the range of temperature variation experienced.

In the devices shown in Figs. 4 and 5 the bi-metallic strips **34** and **35** respond to changes in temperature of the returning compound. The passage of relatively thin, high temperature compound through the pipe section **22** will cause the bi-metallic members **34, 35** to bow outward and thus enlarge the pipe opening. However, slower passage of the viscous and relatively cooler compound will cause the members **34, 35** to contract and thus partially close the flexible valve.

Fig. 6 shows how a different form of constricting valve may be arranged in the modification shown in Figs. 1, 2 and 3. The upper cross bar **29** is replaced by a pipe fitting **38**. This pipe fitting is fitted between two portions **39** and **40** of the flexible pipe section **22**.

A pair of side rods **41, 41** correspond to the rods **24, 24**. The center rod **28** is the same as previously described. It terminates at its upper end, and within the pipe fitting **38**, in a valve **42**. The opposite portion of the fitting **38** is hollowed out to form a valve seat **43** complementary to the shape of the valve **42**.

The operation of the form shown in Fig. 6 is the same as that in Fig. 3. The advantage in this instance, however, is in the permanence of the valve and its freedom from deterioration.

The arrangement above described provides for a ready and effective means for maintaining constant flow in the pipe circuit feeding a spraying nozzle or the like.

While the preferred form of the invention has been shown and described, it is to be understood that the invention is not limited to said forms or other than by the scope of the appended claim.

What we claim is:

In combination with a discharge nozzle for a lining compound and the like, a tank for the compound, piping from the tank to the nozzle, a constant volume pump in said piping, a return pipe from the nozzle into the tank, a compressible section in said return pipe, a bracket in said tank, a pair of parallel rods depending from the bracket, a central rod between said parallel rods, a cross bar journaled on said parallel rods and supported adjustably by said central rod beneath the compressible section and an upper cross bar journaled on said parallel rods and adjustably suspended from the bracket above the compressible section, said parallel rods and central rod having dissimilar coefficients of thermal expansion.

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