ABSTRACT

A so-called hose or peristaltic pump is designed so that the pump itself limits the maximum pressure of the viscous liquids or the like delivered therefrom. In one embodiment, the peristaltic pump and its accessories, such as the driving motor, are mounted on a rocker arm pivotally supported adjacent one end by a base carrying a circularly curved support member engageable with the hose, so that pinching rollers on a roller carrier forming part of the pump compress the hose against this circularly curved member. The weight of the pump and its accessories constitutes a pressure regulating means. In other embodiments of the invention, the pinching rollers are spring biased radially outwardly so that, responsive to excessive pressure, they will move inwardly against the spring bias. The spring bias may be applied directly to the axles for the pinching rollers or to pivoted levers on which the pinching rollers are mounted.

20 Claims, 6 Drawing Figures
BACKGROUND OF THE INVENTION

The present invention relates to a peristaltic or hose type pump, and, more particularly, to such a pump which is especially useful for conveying viscous liquids including mortar and the like, or liquids with glimmer particles, rock powder, glass powder, and the like, with the pump itself being arranged to limit the maximum pressure so that separate pressure relief valve means are obviated.

Prior art pumps of the so-called hose or peristaltic type are rather simple and rugged in construction and are thus suitable for conveying of viscous materials including even mortar and the like. These pumps are provided with means for controlling the conveyed quantity of viscous material or the conveying pressure. These control means are adapted to influence the squeezing or pinching effect. One embodiment for controlling the squeezing effect provides means for adjusting the radial spacing of the pinching rollers from the hose section as is described, for example, in British Pat. No. 897,022.

In this prior art pump a tilted surface is arranged in the pump frame. A hose support member is movable along the tilted surface, whereby the bent hose section may be placed more or less closely relative to the squeezing rollers whereby the squeezing effect may be varied.

Varying the position of the hose section relative to the squeezing rollers for controlling the conveyed quantity or the conveying pressure does not involve an automatic control, in addition to which it employs elements which require continuous maintenance. Another drawback is seen in that separate pressure relief valve means are required since an automatic control of the squeezing action is not accomplished according to the prior art.

OBJECTS OF THE INVENTION

In view of the foregoing, it is the aim of the invention to accomplish the following objects singly or in combination:

- to provide an applicator hose pump in which the conveying pressure is automatically controlled and thus the need for a pressure relief valve is obviated;

- to provide pressure control means for a hose pump whereby the squeezing force is controlled or determined substantially by the weight of the driving motor and the elements attached thereto;

- to provide a hose pump in which a constant conveying pressure adjusts itself automatically whereby such pump is especially suitable as a dosing pump for viscous materials;

- to provide a hose pump which may be shut off instantaneously by removing the squeezing rollers out of their effective range;

- to provide a hose pump which together with its accessories will result in a light weight compact structure so that the entire apparatus is easily portable from construction site to construction site as well as on the job itself;

SUMMARY OF THE INVENTION

According to the invention there is provided a peristaltic or hose type pump in which the pump itself is arranged to limit the maximum pressure so that separate pressure relief valve means are obviated. Path by means of rollers which are followed by reshaping rollers to continuously vary the cross-sectional shape of the circular hose section. A pressure relief valve is obviated by pressure control means which control the force of the pinching or squeezing rollers. In one embodiment this control is accomplished by attaching the drive motor with its accessories to a rocker arm which is journaled about a shaft in a pump frame so that the weight of the motor with its accessories will determine the force with which the pinching rollers bear against the circular hose length.

In another embodiment the pinching rollers are movably supported on a roller carrier whereby the movement of the pinching rollers is determined by compression or tension springs which in turn determine the force with which the pinching rollers act against the hose section.

In a specific example, in which the pump is used to supply a viscous material applicator, the peristaltic pump has the advantage that the danger to the hose section, for example, due to a sudden closing of the outlet end at the applicator roller, is obviated because either the motor on the rocker will be lifted by the increasing pressure in the hose or the squeezing rollers will be lifted against the respective spring means so that in any event the quantity of conveyed viscous material is reduced or altogether stopped. This is advantageous because it obviates the use of a pressure relief valve which is an expensive element and rather subject to failures especially where very viscous materials such as mortar are to be conveyed.

Another advantage of the pump according to the invention is seen in that, in the embodiment where the motor is located on a rocker arm, the pumping action may be instantly stopped by simply lifting the rocker arm so that the pinching rollers are disengaged from the hose section. The rocker arm embodiment has the further advantage that the weight effect may be limited to an upper value by means of a setscrew which will determine the extent to which the squeezing rollers may move toward the hose.

The embodiment wherein the squeezing or pinching rollers are movably supported on a roller carrier against the action of compression or tension springs has the advantage that the entire apparatus may be even lighter and still more compact.

BRIEF DESCRIPTION OF THE DRAWINGS

In order that the invention may be clearly understood, it will now be described, by way of example, with reference to the accompanying drawings, wherein:

FIG. 1 illustrates, at its lower portion, a schematic side view of one embodiment of a hose pump according to the invention and, at its upper portion, a front view of the applicator means connected to the hose pump whereby the drive motor and the pinching rollers are arranged on a rocker arm and the roller wetting tubular member is pressed against the applicator roller by spring means as well as by hydraulic pressure means and wherein pivoting linkage means secure the wetting member to a carrier bracket;

FIG. 2 illustrates a top view of the hose pump according to FIG. 1;

FIG. 3 is a side view similar to that of FIG. 1, wherein, the drive motor is rigidly secured to a pump
frame and the pinching rollers are movably supported on a roller carrier against the action of compression spring means;

FIG. 4 is a side view of the applicator section, the front view of which is shown in FIG. 1.

FIG. 5 is a side view of another embodiment of a hose pump according to the invention, wherein the pinching or squeezing rollers are movably supported on drag levers which are spring biased;

FIG. 6 is a partial side view similar to that of FIG. 5, but with the pinching rollers supported on spring biased rocker arms.

**DETAILED DESCRIPTION OF EXAMPLE EMBODIMENTS**

While the peristaltic or hose type pump of the present invention has a wide range of applications, it will be described, solely by way of example, as used for supplying paint to a paint applicator.

FIG. 1 illustrates an overall view of the present apparatus in a somewhat schematic manner. The paint pump is supported on a pump frame 2 and sucks the liquid paint 31 out of a paint container 100. An inlet conduit or suction conduit 4 is connected to the inlet end of a hose 6. The outer end of the suction conduit 4 is provided with a suction piece 30 and reaches into the paint container 100. The outlet end 5 of the pump is connected through conduit means 24 to the applicator section of the present apparatus.

Operation of the pump conveys the paint through the conduit 24 to the applicator section, for example, at a gauge pressure of five atms. The conduit 24 may be provided with a handle and/or with a control valve 26 operable by an actuator 27. The outlet end of the conduit 24 is connected to bracket means 28 to which are attached an applicator roller 112 and a tubular wetting member 111 which supplies the paint to the outside surface of the paint roller 112. The operator merely has to move the roller 112 up and down along the wall surface 118 after he has opened the valve 26 whereby a uniform paint application to the wall 118 is assured.

Referring first to FIGS. 1 and 2, the pump frame 2 includes a base plate 1 which carries a curved support member 3 at least a portion 7 of which conforms to part of a circular arc for supporting the length of hose 6 along such circular arc. As mentioned, the suction conduit 4 and the supply or outlet 5 are interconnected by the curved length of hose 6. The curved portion of the length of hose 6 covers a circular arc of about 120°.

A rocker arm 15 is journaled to the pump frame by means of a shaft 16. The outer end 14 of the rocker arm 15 extends sufficiently above the base 1 to permit a rocking motion of the rocker arm 15. A drive motor 12 is secured to the outer end 14 of the rocker arm 15. A roller carrier 8 is attached to the shaft 13 of the motor 12. Pinching rollers 9 are secured to the roller carrier 8. Behind the pinching rollers 9, as viewed in the direction of rotation of the roller carrier 8, there are arranged hose reshaping rollers 10. The rotational axes of the reshaping rollers 10 are displaced by 90° relative to the rotational axes of the pinching rollers 9. The rotational axes of the pinching rollers 9 extend substantially parallel to the shaft 13. The reshaping rollers 10 are arranged in pairs so that one reshaping roller is arranged on one side of the hose while the opposite reshaping roller is arranged on the opposite side of the hose. Each pinching roller and its respective reshaping rollers are spaced from each other along the circumference of the roller carrier 8 in such a manner that the rotation of these rollers along the length of the hose 6 will repeatedly squeeze and reshape the hose 6 whereby a rather effective pumping action is accomplished.

The motor shaft 13 and the pivot axis 16 of the rocker arm 15 extend in parallel to each other. The rocker arm 15 and its free end 14 are of such a dimension that the motor 12 will be in a position to bear with its rollers 9 and 10 against the hose 6 in its curved arc portion 7. Since hose pumps as such are known it is not necessary to explain their operation in further detail.

Due to the arrangement of the motor 12 with its accessories on the free end of the rocker arm 15, the invention accomplishes a pressure relief feature because the rocking movement of the rocker arm 15 in response to the weight of the motor 12 and its accessories will automatically control the pumping pressure, whereby the use of a pressure relief valve has been obviated. Another advantage of this arrangement is seen in that the pumping pressure or the quantity of conveyed paint may easily be increased by simply attaching an additional weight to the free end 14 of the rocker arm 15. For establishing an upper limit however, the invention provides a setscrew 17 which is adjustably secured to the outer end 14 of the rocker arm 15. The setscrew 17 bears against the base 1 and thus limits the downward movement of the motor 12 and thus the extent to which the rollers 9 may squeeze the curved portion of the hose 6.

Referring further to the top portion of FIG. 1, the roller 112 is rotatably secured to the bracket 28 by a bent rod 114. The tubular member 111 for wetting the outer surface of the roller with paint is connected to the bracket 28 by pivoting linkage means 15° which in the shown embodiment form a double scissors linkage. A hairpin spring 117 urges the tubular member 111 against the roller 112. Elastically yielding tubular members 29 and 110 supply the paint into the wetting member 111 whereby a pressure head is established in the tubular members 29 and 110 which also urges the wetting member 111 against the outer surface of the roller 112 as will be described below in more detail with reference to FIG. 4.

In FIGS. 3, 5 and 6 the motor 12 with its accessories such as the shaft 13 and the roller carrier 8 is rigidly secured to the base plate 1 for which purpose the setscrew 17 may engage a threaded hole in the base plate 1.

In FIG. 3 the pinching rollers 9 are movably secured to the roller carrier 8 which comprises longitudinal guide slots 15 extending substantially radially relative to the roller carrier 8. The shafts of the pinching rollers 9 in FIG. 3 bear against compression springs 16 which rest against stop means 18. The pressure of the springs 16 may be adjustable by means well known in the art.

The pressure of the compression springs 16 determines the pumping pressure of the pump which is protected against an overload because when the pumping pressure in the hose 6 exceeds the pressure of the springs 16 the pinching rollers 9 will be lifted off the hose 6 whereby the pump stops pumping.

Incidentally, the curved portion 7 of the support member 3 forms a channel member for the hose 6 as is best seen in FIG. 2 which also illustrates the arrange-
ment of the reshaping rollers 10 in pairs substantially behind the respective pinching roller 9.

Referring now on FIG. 5, the pinching rollers 9 are journaled to the free ends of drag levers 19, the opposite ends 20 of which are pivoted to the roller carrier 8. Compression springs 21 are arranged between the respective drag levers 19 and stop means 22 on the roller carrier 8. Here again the pressure of the springs 21 may be adjustable by well known means. Preferably, the journal shafts of the rollers 9 at the free ends of the levers 19 may be guided in arcuate guide slots 23 extending substantially radially in the roller carrier 8. The guide slots 23 have preferably a curvature with a center in the pivot point at the free end 20 of the respective lever 19.

To save space, only a portion of FIG. 6 is shown to illustrate yet another embodiment for yieldingly supporting the pinching rollers 9 by means of rocker levers 48 connected to the roller carrier 8 by pivot means 49. The rollers 9 are journaled to one end of the rocker arms or levers 48 whereas the opposite end 50 of each arm is connected to a tension spring 51 which in turn is connected to an adjustment screw 53 threaded into a stop member 52 which is rigidly attached to the roller carrier 8. After adjustment of the screw 53 and thus of the tension of the respective spring 51, the screw 53 is secured in the desired position by means of double nuts 55. Stop means 54 may be further provided on the roller carrier 8 for limiting the outward rocking movement of the levers 48.

Referring to FIG. 4 the conduit means 24 may have attached thereto an extension means such as a pipe 122 to which is secured the bracket 28. The pipe 122 is connected to the tubular members 29 and 110 through an intermediate piece of hose 127. The operation of the present apparatus is apparent from the direction of the arrows shown in FIGS. 1 and 4 illustrating the movement of the paint into the hose piece 127 and thence into the tubular members 29 and 110, from there into the wetting member 111 and through the apertures 113 onto the surface of the roller 112.

The pivot linkage 15 which assures a parallel guidance of the wetting member 111 so that it will be uniformly pressed against the surface of the roller 112 along its entire length. The applicator means may be secured to the bracket 28 by a screw and wing nut 120 which facilitates the angular positioning of the applicator means relative to the bracket 28. Although the invention has been described with reference to specific example embodiments, it is to be understood, that it is intended to cover all modification and equivalents within the scope of the appended claims.

What is claimed is:

1. A viscous material applicator, especially for applying paint to surfaces, comprising, in combination, an applicator roller means, a peristaltic pump including a pump frame and a length of hose having an inlet and an outlet, means connecting said applicator roller means to said hose pump outlet, an arcuate guide on said frame having said length of hose extending therealong, motor means, pinching roller means, a motor shaft, a roller carrier driven by said motor shaft, said pinching roller means being attached to said roller carrier for engaging said length of hose to repeatedly squeeze said length of hose against said arcuate guide, hose reshaping roller means attached to said roller carrier for repeatedly reshaping said length of hose following said squeezing whereby the cross-sectional shape of said length of hose is repeatedly varied from said inlet toward said outlet thereof, a base plate fixedly mounting said frame, an elongated rocker arm pivotally mounted at one end on said base plate and having a free end, said rocker arm carrying said motor means and said roller carrier, said rocker arm positioned between the elements carried thereby and said base plate, said rocker arm being swingable about a pivot axis which is in spaced parallel relation to said motor shaft for movement of said motor means and said roller carrier relative to said arcuate guide, and a set screw threadedly engaged in the free end of said rocker arm and engaged with said base plate to limit movement of said motor means and said roller carrier in at least the direction toward said arcuate guide.

2. The applicator according to claim 1, wherein said rocker arm and said motor means and said roller carrier mounted thereon constitute pressure limiting means mounting said pinching roller means for movement in a direction away from said arcuate guide responsive to an increase in the pressure at said outlet to decrease the pressure exerted on said length of hose by said pinching roller means, said set screw abutting the upper surface of said base plate to limit movement of said roller arm toward said base plate.

3. The applicator according to claim 1, wherein said set screw is threadedly inserted into said base plate to secure said motor means and said roller carrier against movement relative to said arcuate guide, and pressure limiting means comprising resilient means yieldingly pressing said pinching rollers against said length of pump hose.

4. The applicator according to claim 3, wherein said resilient pressure limiting means comprises longitudinal, radially extending guide slots in said roller carrier, stop means on said roller carrier, each of said pinching roller means having a shaft, each shaft riding in its respective guide slot, and resilient spring means arranged between said stop means and the respective one of said pinching roller shafts whereby said resilient spring means limit the pressure exerted by said pinching roller means on said length of hose.

5. The applicator according to claim 3, wherein said resilient pressure limiting means comprise a drag lever for each pinching roller, pivot means for journaling one end of each drag lever to said roller carrier, means for journaling the pinching roller means to the opposite end of its respective drag lever, elongated guide slots extending substantially radially in said roller carrier, a guide pin attached to said drag lever for riding in said guide slots, stop means on said roller carrier, and compression spring means secured between said drag lever and the respective stop means, whereby said pinching rollers may yield against said compression spring means.

6. The applicator according to claim 5, wherein said elongated guide slots have a curvature with a center of curvature coinciding with the pivot means of the respective drag lever.

7. The applicator according to claim 3, wherein said resilient pressure limiting means comprise a rocker lever for each pinching roller means, means for pivoting each rocker lever intermediate its ends to the roller carrier, means for journaling the pinching roller means to the respective rocker lever at one end thereof, stop means on said roller carrier, and tension spring means...
secured between said stop means and the other end of
the respective rocker lever.
8. The applicator according to claim 7, further com-
prising adjustment means arranged between said stop
means and said tension spring means for adjusting the
tension of said tension spring means.
9. The applicator according to claim 1, wherein said
means for connecting said applicator roller means to
said hose pump outlet comprise a tubular member with
apertures therein for wetting said applicator roller
means along the outside surface thereof, conduit means
arranged between said outlet and said tubular member,
bracket means connected to the end of said conduit
means, pivoting linkage means connected to said tubu-
lar member and to said bracket means, support means
for rotatably securing the applicator roller means to the
bracket means alongside said tubular member, spring
means operatively connected to said bracket means and
to said pivoting linkage means for pressing the tu-
bular member against the applicator roller means, and
hydraulic pressure means effectively interposed be-
tween the end of the conduit means and said tubular
member for supporting the pressing of the tubular
member by said spring means against the applicator
roller means.
10. The applicator according to claim 9, wherein said
hydraulic pressure means comprise two elastically
yielding bent tubes which connect the end of said con-
duit means to the inside of the tubular member and
which simultaneously press the tubular member against
the applicator roller means in response to the hydraulic
pressure built up by said pump in said conduit means
whereby a pressure head is produced in said bent tubes.
11. The applicator according to claim 9, wherein a
control valve is arranged in said conduit means.
12. The applicator according to claim 10, further com-
prising cleaning means built into said tubular mem-
ber, said cleaning means including a piston movable
back and forth within the tubular member when the lat-
ter is disconnected from said conduit means.
13. The applicator according to claim 9, wherein said
tubular member has a surface member facing said ap-
pli c ator roller means.
14. The applicator according to claim 13, wherein
said surface member has a curved shape.
15. The applicator according to claim 1, wherein said
ap pl i c ator roller means comprises hub means at its
ends, and spring means attached to said hub means,
said spring means including a plurality of relatively thin
pin shaped springs extending substantially tangentially
relative to said hub means and also substantially radia-
ally outwardly relative to said applicator roller means
to the periphery of said applicator roller means, said
spring means yielding inwardly whereby a sliding move-
ment of said applicator roller means is prevented.
16. The applicator according to claim 15, wherein
said hub means comprise hub block means with slots
therein for receiving the inner ends of said spring
means, said spring means having a first bend therein so
that the spring means extend substantially tangentially
relative to the hub and a second bend at their outer end
extending substantially radially outwardly.
17. The applicator according to claim 15, wherein
said applicator roller means comprise bearing bushing
means at each end thereof, and means for rigidly inter-
connecting said hub means to said bearing bushing
means, whereby the rotation of the applicator roller
means is transmitted to the hub means.
18. The applicator according to claim 16, further com-
prising a cover plate attached to said hub block
means for covering said slots.
19. The applicator according to claim 18, wherein
said cover plate is glued to said hub block means.
20. A viscous material applicator, especially for ap-
plying paint to surfaces comprising applicator roller
means, a hose pump including a pump frame and a
length of hose with an inlet and an outlet, means for
connecting said applicator roller means to said hose
pump outlet, means for locating a portion of said length
of hose along part of a circular path in said pump
frame, motor means, pinching roller means, a motor
shaft, a roller carrier driven by said motor shaft, said
pinching roller means being attached to said roller car-
rier for repeatedly squeezing said length of hose along
said circular path, hose reshaping roller means also at-
tached to said roller carrier for repeatedly reshaping
said length of hose following said squeezing whereby
the crosssectional shape of said length of hose is repeat-
edly varied from said inlet end toward said outlet end
thereof, and pressure limiting means arranged for co-
operation with said pinching roller means to limit the
extent of the squeezing movement of said pinching rol-
ler means, said pressure limiting means comprising a
rocker arm, a journal shaft secured to said pump frame,
said rocker arm being journaled to said journal shaft,
and means for attaching said motor means together
with said roller carrier with said pinching roller means
and with said reshaping roller means to said rocker arm
in such a position that the pinching and reshaping roller
means bear against said length of hose along said circu-
lar path whereby the weight of the rocker arm and of
the means attached thereto act as a pressure limit.
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