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REINFORCED COMPRESSIBLE FLUID TRANSPORTING TUBE

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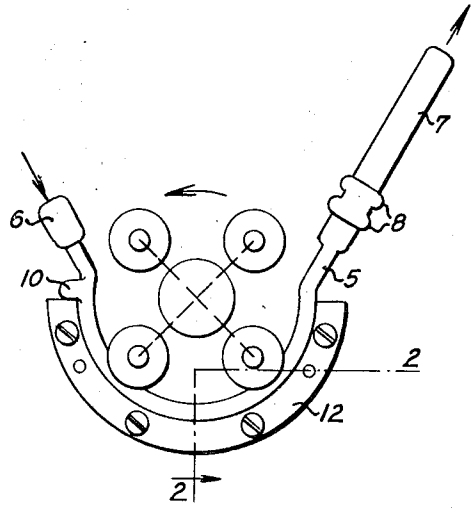


FIG. 1

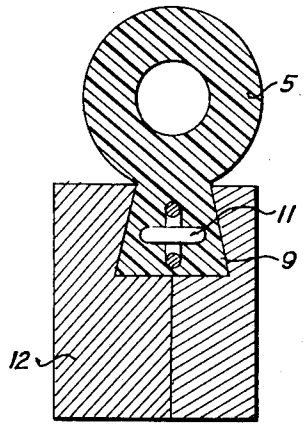


FIG. 2

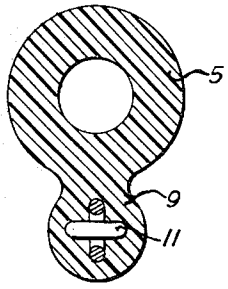


FIG. 4

FIG. 3

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REINFORCED COMPRESSIBLE FLUID TRANSPORTING TUBE

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ABSTRACT OF THE DISCLOSURE

This invention is directed to an arcuate compressible fluid transporting tube having a reinforcing rib attached on one side with a chain embedded therein and especially adapted as a part of an infusion pump having impeller rollers to drive fluid through the tube.

This invention relates to new and useful improvements in fluid pumps of the compressed tube type and particularly seeks to provide a novel fluid transporting tube therefor.

In my Pat. 3,384,080, granted May 21, 1968, there is disclosed and claimed a portable self-contained infusion device employing a mechanical clock-driven fluid pump of the type to which this invention generally relates.

Such pumps usually employ a rotary element provided around its periphery with a plurality of impeller rollers which are successively brought into compressing engagement with a fluid carrying or transporting tube supported by a base or anvil containing an arcuate portion concentric with the path of travel of the rollers.

When these types of pumps are employed in infusion systems for injecting liquid chemo-therapeutic agents into a living body at a low volumetric rate over prolonged periods of time, it is essential that the compressible fluid transporting tube be restrained against bodily axial movement and against either axial compression or elongation in order to assure proper and accurate operation of the pump.

Therefore, an object of this invention is to provide a novel fluid transporting tube which is capable of being maintained in operative position with respect to the compression rollers of a pump without becoming axially distorted or displaced as a result of prolonged operation of the pump.

Another object of this invention is to provide a tube of the character stated which includes an internally reinforced, radially projecting, longitudinally extending, clamping or attaching rib.

Another object of this invention is to provide a tube of the character stated in which the rib reinforcement is a flexible element made from a material less compressible than the material of the tube.

With these and other objects, the nature of the invention will be more fully understood by reference to the drawings, the accompanying detailed description and the appended claims.

In the drawings:

FIG. 1 is a top plan view of the arcuate base or anvil of a compressible tube fluid pump with the fluid transporting tube of this invention clamped in operative position, the impeller rollers and their supporting rotor being schematically indicated;

FIG. 2 is an enlarged transverse section taken along line 2—2 of FIG. 1;

FIG. 3 is a plan view of a fluid transporting tube constructed in accordance with this invention; and

FIG. 4 is an enlarged transverse section taken along line 4—4 of FIG. 3.

Referring to the drawings in detail, the invention as illustrated is embodied in a tube **5**, formed from any suitable plastic or soft material, e.g., silicone rubber, compatible with the fluid to be pumped, provided at one end **6** with a thickened wall portion for connection to a fluid supply and provided at its other end **7** with a similarly thickened wall portion for connection with a catheter or other receiver.

The tube end **7** is provided with a pair of spaced parallel transverse fins **8, 8** which define a grommet for retaining that end of the tube in its proper position within the supporting structure of the pump.

A radially projecting longitudinally extending clamping or attaching rib **9** is formed on the outside of the tube **5** and is provided with an enlarged abutment **10** at the end corresponding to the fluid intake end of the tube.

An internal reinforcing element **11** extends along the full length of the rib **9** and is molded integral therewith. In the illustrated embodiment of the invention the reinforcing element **11** is a metal chain which prevents the rib **9** and the associated tube **5** from becoming stretched or otherwise distorted when in operative position in the pump.

It will be appreciated that other reinforcing materials, such as braided wire or braided cord similar to fishing line, may be used instead of the chain.

In the form shown the tube **5** and the reinforced rib **9** are precurved in a single plane to permit ready insertion of the rib into the receiving and clamping groove of a two-piece anvil or base segment **12** of the pump as shown in FIGS. 1 and 2 of the drawings.

When installed in this manner it will be noted that the abutment **10** of the rib **9** contacts the associated end of the segment **12**, thus assuring proper location of the fluid transporting tube as a whole and preventing axial displacement thereof in the direction of fluid flow when the pump is in operation. Since the rib reinforcement **11** is relatively incompressible, clamping of the segment parts about the rib **9** is much more positive than it would be if the rib were not so reinforced. Additionally, since the reinforcement **11** is not stretchable when subjected to the normal operating forces of the pump and is formed integrally with the rib **9**, the rib will not stretch. Consequently undesirable stretching, bunching or other unwanted distortion of the tube **5** during operation of the pump is prevented.

The effectiveness of the abutment **10** may be enhanced by a solid metal ball or core **13** covered thereby and secured to the adjacent end of the chain **11**. The diameter of the ball **13** should be slightly greater than the width of the receiving and clamping groove in the segment **12** to prevent the abutment **10** from being forced into the groove during operation of the pump.

Obviously the principles of this invention are applicable to any use where it is desired to securely hold a distortable plastic tube in position such as in a compressible tube fluid pump in which a plurality of fluid transporting tubes are arranged in spaced parallel relation in a single plane and are progressively compressed by impeller rollers movable through an orbital path containing a straight line portion overlying the plane of the tubes.

It is, of course, to be understood that various details of arrangements and proportions of parts may be modified within the scope of the appended claims.

I claim:

1. A fluid transporting tube adapted to be secured to a positioning clamp and including a compressible tubular body provided with a radially projecting attaching rib extending longitudinally along at least a portion of the length thereof, an enlarged abutment located at that end of said rib nearest to the fluid intake end of said tube, a flexible, nonstretchable metal chain enclosed by said rib

and formed integral therewith, and a solid internal core positioned within said abutment and attached to the adjacent end of said chain.

2. In a portable self-contained infusion pump having an arcuate base supporting a compressible tube, a driven rotary element concentric with said base, a plurality of impeller rollers operatively carried on the periphery of said rotary element that are brought into compressing engagement with said tube during rotary element rotation; the improvement in combination therewith comprising a radially projecting rib integrally attached to and extending longitudinally along at least a portion of the length of said tube, and a reinforcing member enclosed within, formed integral with, and extending along substantially the full length of said attaching rib.

3. The pump of claim 2 in which the attaching rib is provided with an enlarged abutment located at that end thereof nearest to the fluid intake end of said tube and in which the reinforcing element is flexible and nonstretchable.

4. The pump of claim 3 in which said reinforcing element is a metal chain.

5. The pump of claim 4 additionally including a solid internal core positioned within said abutment and attached to the adjacent end of said chain.

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