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RESILIENT PUMP TUBE ASSEMBLY

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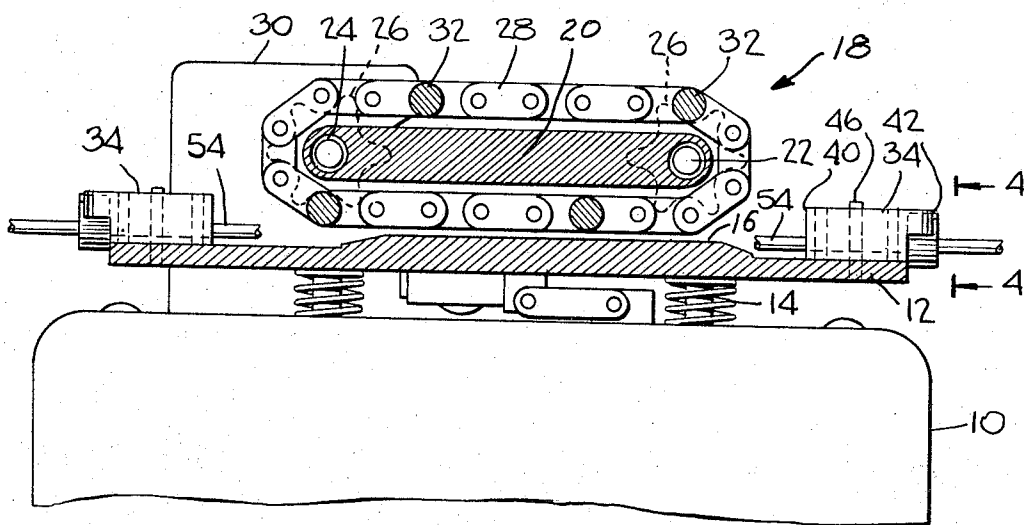


Fig. 1.

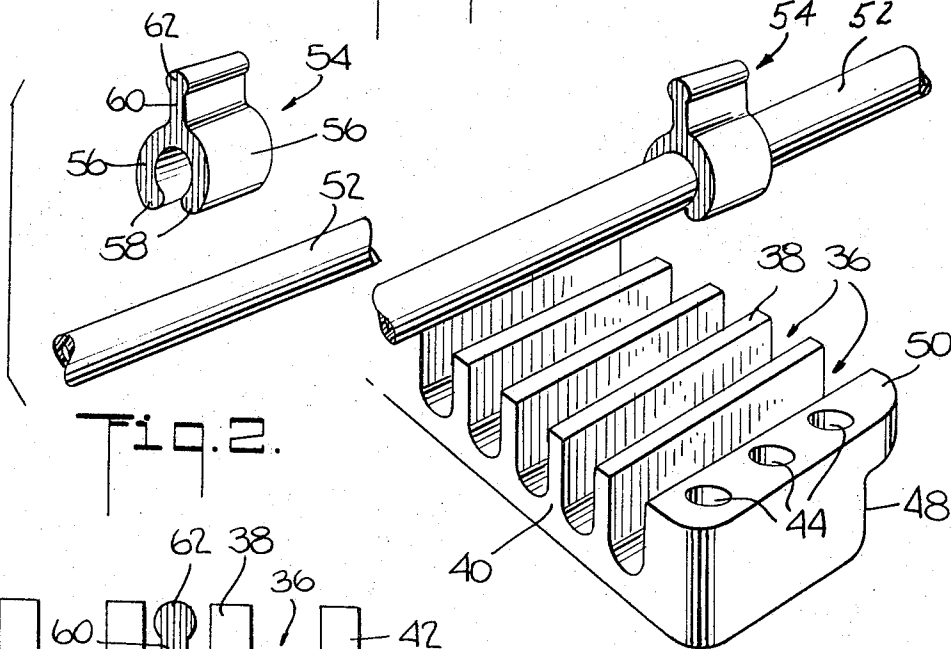


Fig. 2.

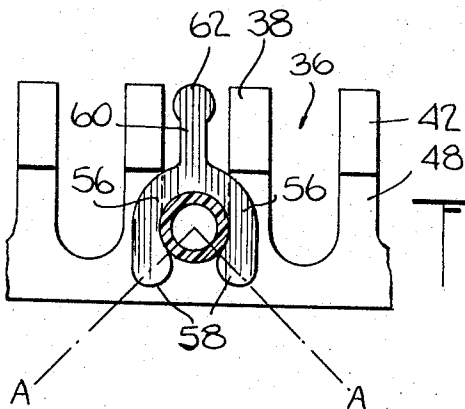


Fig. 4.

Fig. 3.

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RESILIENT PUMP TUBE ASSEMBLY

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ABSTRACT OF THE DISCLOSURE

This invention relates to a peristaltic pump wherein a plurality of resiliently compressible tubes are progressively compressed along their lengths by a series of rollers which engage said tubes and move longitudinally thereof. The invention relates to the mounting of the tubes on a platen against which the tubes are compressed.

This application relates to conduit assemblies and, more particularly, to a resilient tube assembly for a roller operated pump, which is especially adapted for use with an automatic analysis apparatus.

In automatic analysis apparatuses of the type shown in U.S. Patent No. 2,797,149, issued June 25, 1957, a sample liquid is transmitted through the apparatus in the form of a fluid stream at a predetermined volumetric flow rate. Fluid streams of various processing liquids are also concurrently transmitted through the apparatus at predetermined volumetric flow rates. These volumetrically proportioned fluid streams are concurrently pumped by a proportioning pump which may advantageously be of the type shown in U.S. Patent No. 2,935,028, issued May 3, 1960. In this proportioning pump, a plurality of resiliently flexible tubes are concurrently occluded progressively along their lengths by rollers, thereby advancing the fluids within the tubes. A plurality of rollers are utilized serially, to provide a substantially smooth flow of fluids through the tubes. The ratios of the volumetric flows are determined by the ratios of the inner diameters of the tubes which are respectively utilized. Preferably the tubes are provided with a standard outer diameter.

The tubes are held taut, in parallel, spaced apart relation, above a platen and below the rollers by a pair of spaced apart positioning blocks having slots into which the tubes are respectively disposed. These blocks may be removably mounted directly to the pump as shown in U.S. 2,935,028, or they may be mounted to panels which are removably mounted on the pump as shown in U.S. Patent 3,167,307. In each case, each of the tubes is held taut by means of two collars, which are fixed to the tubes and are each disposed in abutment with the outer, mutually distal sides of the positioning blocks. These prior art collars are customarily molded as split rings, having only a small gap in their annulus. Each ring is manually spread open to enlarge the split to permit the transverse entrance of the tube therethrough. Adhesive is disposed on the inner surface of the ring, the tube is transversely inserted through the split, and the ring is closed around the tube.

It is an object of this invention to provide an improved collar which may be rapidly attached to a pump tube.

It is another object of this invention to provide a collar which is adaptable to automated assembly to a pump tube.

It is still another object of this invention to provide a collar which may be snapped onto a pump tube.

It is yet another object of this invention to provide a collar and pump tube assembly which may be readily positioned in, and removed from the pump positioning blocks.

A feature of this invention is the provision of a collar

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for a pump tube which is substantially Y shaped in cross-section, the arms of the Y being bulbous at their distal ends and adapted to snap around the pump tube, the leg also bulbous at its distal end and adapted to be gripped manually or by a dispensing apparatus.

These and other objects, features and advantages of the invention will be more fully understood from the following description of the invention considered in conjunction with the accompanying drawings, wherein:

FIG. 1 is a front view in elevation, partly in cross-section, of a proportioning pump having a pump tube mounted for operation;

FIG. 2 is a perspective view showing a collar prior to installation on a pump tube;

FIG. 3 is a perspective view showing a collar and tube assembly prior to installation in a positioning block; and

FIG. 4 is a side cross-sectional view in elevation, taken along line 4-4 of FIG. 1, showing the collar and tube assembly installed in a positioning block.

Turning now to the drawings, FIG. 1 illustrates a proportioning pump which is similar to the pump of U.S. 2,935,028. The pump base 10 has a platen 12 resiliently mounted thereon by means of compression springs 14 which encircle pins which are fixed to the platen and pass loosely into the base. The platen has a thickened central portion 16. A tube compressing mechanism 18 is mounted to the base 10 by a suitable hinge assembly and a handle and catch, all not shown here. A frame plate 20, carries a pair of shafts 22 and 24 to which are fixed a plurality of sprocket wheels 26, which wheels engage a pair of endless sprocket chains 28, and which chains are disposed around the frame plate. The shaft 24 may be flexibly coupled to a motor 30 mounted to the base 10 to drive the chains 28 by the sprocket wheels fixed thereto. A plurality of rollers 32 are carried by and between the chains 28. As each roller 32 is carried under the frame plate it is parallel to and closely spaced from the upper surface of the thickened portion 16 of the platen 12.

One of two positioning blocks 34 is removably mounted to each of two thinner side portions of the platen 12, respectively. Each block 34 has a plurality of slots 36 extending into its upper surface 38, from its roller proximate side 40 to its roller distal side 42, each having a rounded bottom surface. A plurality of holes 44 are provided through the front and rear portions to respectively receive front and rear mounting pins 46 which are fixed to the platen 12. Each pin 46 may be disposed through any one of the holes 44 in the block, thereby permitting changes in the spacing between the two blocks 34. Each of the blocks has an undercut 48 in the lower portion of the roller distal side 42, forming an upper extending portion 50.

Each pump tube 52 is made of a resilient, flexible material, such as polyvinyl chloride sold under the trademark "Tygon." The outer diameter of the tube is made equal to the inner width of the slots 36, so that the tube may be disposed therein without distortion. The inner diameter of the tube is determined by the volumetric flow rate to be provided by the particular tube.

Each collar 54 is made with a Y-shaped cross-section. The collars may advantageously be extruded in long lengths and then cut into individual collars. The collar is made of a resilient, flexible material, which may also be "Tygon." The arms 56 of the Y are formed with a semi-circular curvature, with slightly bulbous distal portions 58. The medial portions of the arms have an inner diametrical spacing equal to the outer diameter of the tube. The inner chordal spacing between the bulbous portions is less than the outer diameter of the tube, but large enough to permit the arms to be snapped around the tube, and to hold

the collar to the tube. The arcuate spacing between the bulbous ends 56 may advantageously be made of 90°, taken on radial lines drawn from the center of the tube to the centers of the bulbous ends.

The leg 60 of the collar is also formed with a bulbous distal portion or end bead 62. The leg may be manually grasped, without a tendency to compress the arms 56, when snapping the collar over the tube. The bulbous end portion may be used to slidably hold a plurality of collars in a mechanical dispenser for individual dispensation in the manner of staples in a stapling machine. The bulbous end may also be used to fixedly hold each of two collars upright in a groove in an assembly jig at a predetermined spacing therebetween, so that a tube may be snapped into and secured to two collars 54 with a predetermined spacing therebetween.

Prior to the collar being snapped onto a tube, a suitable solvent or adhesive, as previously described, is applied to either of the mating surfaces of the collar or the tube. The collar is snapped on, the tube being grasped between the arms 56, and the solvent allowed to dry. The tube may then be conveniently positioned in a slot 36 in the block 34 by grasping the leg 60 of the collar and flexing the collar under the upper extending portion 50 of the block while inserting the tube into a slot 36. The axial length of the collar may be made longer than the length of the extending portion 50 to make convenient this positioning, and also the converse removal operation.

The outside diameter of the collar is made larger than the diameter of the slot 36, and as seen in FIG. 4, the bulbous end portions 58 serve a twofold function of providing rounded camming surfaces for initially engaging the tube as the collar is snapped thereon, and of providing a maximum bearing surface for the collar in abutment with the sidewall 48 of the block 34.

While I have shown and described the preferred embodiment of the invention, it will be understood that the invention may be embodied otherwise than as herein specifically illustrated or described, and that certain changes in the form and arrangement of parts and in the specific manner of practicing the invention may be made without departing from the underlying idea or principles of this invention within the scope of the appended claims.

What I claim is:

1. A resilient collar and tube assembly comprising: a tube having a given outer diameter and made of a resilient material; and two longitudinally spaced apart members, each having a leg portion and two arm portions with a common junction to form a substantially Y-shaped cross-section, and made of a resilient material; said arm por-

tions having a mutual annular curvature, an inner diametrical spacing between said arm portions substantially equal to said given outer diameter of said tube, and junction remote ends having an inner chordal spacing therebetween which is less than said given outer diameter of said tube; and said tube being disposed between and adhered to said arm portions.

2. A resilient collar and tube assembly comprising: a tube having a given outer diameter and made of a resilient material; and two longitudinally spaced apart members, each having a leg portion and two arm portions with a common junction to form a substantially Y-shaped cross-section, and made of a resilient material; said arm portions having a mutual annular curvature, an inner diametrical spacing between said arm portions substantially equal to said given outer diameter of said tube, and junction remote bulbous ends having an inner chordal spacing therebetween which is less than said given outer diameter of said tube; and said tube being disposed between and adhered to said bulbous arm portions and resiliently grasped thereby.

3. A resilient collar and tube assembly comprising: a tube having a given outer diameter and made of a resilient material; and two longitudinally spaced apart members, each having a leg portion and two arm portions with a common junction to form a substantially Y-shaped cross-section, and made of a resilient material; said arm portions having a mutual annular curvature, an inner diametrical spacing between said arm portions substantially equal to said given outer diameter of said tube, and junction remote bulbous ends having an inner chordal spacing therebetween which is less than said given outer diameter of said tube; and said tube being fixedly disposed between and adhered to said bulbous arm portions and resiliently grasped thereby.

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