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## (54) IMPROVEMENTS IN OR RELATING TO PERISTALTIC PUMPS

(71) I, FRANK ILES, a British Subject of "Loscombe", Four Lanes, Redruth, Cornwall, TR16 6LP., do hereby declare the invention for which I pray that a patent may be granted to me and the method by which it is to be performed to be particularly described in and by the following statement:-

This invention relates to pumps.

According to the present invention there is provided a peristaltic pump comprising a body having an open mouthed chamber, a rotary member mounted in the body for rotation in the chamber about an axis, a cartridge comprising a housing having a bore, a flexible walled tube extending through the housing with at least a part of a convolution of the tube encircling the bore and means for releasably mounting the cartridge in the chamber through the open mouth thereof so that the rotary member is received in the bore and so that, in use, the rotary member traverses the convolution and, by depressing the tube, causes a flow of fluid therein.

According to an aspect of the invention there is provided a peristaltic pump comprising body means having an open mouthed chamber, a rotary member mounted in the body for rotation in the chamber and a cartridge releasably mountable in the chamber through the open mouth thereof, the cartridge comprising a housing having a bore for receiving the rotary member when the cartridge is mounted in the chamber, a flexible walled tube extending through the housing with at least part of a convolution of the tube encircling the bore so that, in use, the rotary member traverses the convolution and, by depressing the tube, causes a flow of fluid therein, the tube having an integral rib extending lengthwise thereof which narrows in cross-section to a neck adjacent the tube and the housing being formed with a recess encircling the bore of

similar width to the neck so that the rib is trapped in the recess to hold the tube in the bore.

The housing to either side of the recess may be formed by two parts secured together.

Preferably the integral rib on the tube has

a dovetail section to engage in the recess with the narrow end of the section adjacent the tube located in the mouth of the recess.

In any of the above arrangements an aperture may extend through the wall of the housing to the bore through which the tube extends into and out of the housing.

Again in any of the above arrangements the bore may be frusto-conical.

The following is a description of two specific embodiments of the invention, reference being made to the accompanying drawings in which:

Figure 1 is a partly sectioned diagrammatic view of the peristaltic pump having a cartridge through which a feed tube extends;

Figure 2 is a similar view to Figure 1 showing the pump and cartridge separated;

Figure 3 is a view looking in the direction of the arrow 3 on Figure 1;

Figure 4 shows part of the cartridge during its assembly;

Figure 5 shows a modified form of pump and cartridge;

Figure 6 is a section through an alternative construction of cartridge;

Figure 7 is a perspective view of a further pump construction; and

Figure 8 is a diagrammatic view of part of the pump of Figure 7 showing a locking mechanism for the cartridge.

Referring firstly to Figures 1 to 4 of the drawings, there is shown a peristaltic pump comprising a main housing 10 having a circular socket 11 in which the cartridge 12 is mounted. The pump has an electric drive motor 13 having an output shaft 14 which is

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supported in a bearing 15 and extends coaxially into the socket 11.

Referring firstly to Figures 1 to 4 of the drawings, there is shown a peristaltic pump comprising a main housing 10 having a circular socket 11 in which the cartridge 12 is mounted. The pump has an electric drive motor 13 having an output shaft 14 which is supported in a baring 15 and extends coaxially into the socket 11.

A disc 16 is mounted on the shaft 14 in the socket, the disc having an inclined peripheral flange 17 and two shafts 18 are mounted at diametrically spaced locations around the disc on the inclined portion so that the shafts converge towards the axis of the shaft 14. Cylindrical rollers 19 are rotatably mounted on the shafts 18.

As indicated earlier, a cartridge 12 is mounted in the socket 11 in the housing. The cartridge has a frusto-conical bore 20 in a housing, which is formed in two parts 21, 22 located end-to-end along the bore. A dovetail section groove 23 is formed around the bore 20 at the joint between the two parts 21, 22 of the cartridge. There is a radial opening 25 through the wall of the cartridge at the bottom thereof and a silicon rubber tube 24 forming part of a blood supply system has a portion extending through the opening 25 into the cartridge and formed into a convolution 26 encircling the bore of the cartridge. The tube 24 is formed with a dovetailed section rib 27 extending along the length thereof which is trapped in the dovetail section groove 23 in the cartridge to hold the tube in place in the bore 20. Figure 4 of the drawings shows the assembly of the cartridge, the dovetail section rib 27 being trapped in the groove 23 as the two parts 21 and 22 are brought together and then secured together.

Referring again to Figure 1 of the drawings, the cartridge 12 is located in the socket 11 and is locked in place by means not shown. The rollers 19 rotate about axes generally parallel to the frusto-conical bore 20 in the cartridge and are set up during manufacture of the pump to flatten fully the tube 24 where they engage the tube. Thus as the disc 16 rotates the rollers 19 one after the other displace fluid along the tube to produce a continuous flow of fluid along the tube.

Figure 5 of the drawings illustrates a modification to the above construction in which the disc 16 carries only a single roller 19 and the ends of the convolution 26 of the tube 24 are overlapped, entering and exiting from the cartridge through openings 25a, 25b spaced around the cartridge. As the single roller 19 reaches the end of the convolution 26 of the bottom of the cartridge it comes again into contact with the beginning of the convolution. Thus the fluid being pumped is prevented from passing back around the convolution and is continually forced through the tube.

Figure 6 of the drawings shows an alternative construction of cartridge which is generally similar to that described above and like parts have been allotted the same reference numerals. The two parts 21, 22 of the cartridge are formed from clear plastics mouldings and have an outer encircling grooves 28 for locking the cartridge in the socket in the pump housing as described below.

Referring now to Figure 7 of the drawings, there is shown an alternative form of pump housing which is again generally similar to that described with reference to Figures 1 and 2 above. In the arrangement shown in Figure 8 the end of the shaft 14 projecting into the socket 11 carries an enlarged boss 30 having an outwardly projecting flange 31 adjacent the bottom of the socket. The two rollers 19 are partially buried in the boss 30 and flange 31 so that only portions of the rollers project outwardly to engage the tube in the cartridge. The rollers are formed from molybdenum disulphide filled nylon.

The motor driving the shaft of the pump has a speed indicator 32 and a control 33 for varying the speed of the motor and thereby the flow rate of fluid through the tube.

Referring now to Figure 9 a clamping arrangement for securing the cartridge shown in Figure 7 in the socket 11 of the pump housing shown in Figure 8 is provided comprising a pair of elongate stainless steel pins 34 which extend downwardly on either side of the socket 11. The pins break into the socket through openings 35 to engage in the groove 28 in the cartridge and thereby lock the cartridge in the socket. The pins are mounted in the housing for movement outwardly of the socket and are biassed inwardly by leaf springs 36 mounted on the 110 housing. The upper end of both pins are conical and a locking bar 37 is mounted towards the upper end of the housing having two downwardly extending abutments 38 each having an inclined lower face 39 to 115 engage and drive the upper ends of the pins 34 inwardly so that the pins project into the socket 11. The abutments 38 are encircled by compression springs 40 which bias the locking bar 37 upwardly and the bar engages under a cam 41 mounted on a shaft 42 to which a knob 43 on the front face of the housing is attached. The shaft 42 also operates an on-off switch for the motor drive for the pump and is arranged so that in one position the locking pins 34 are released so that a cartridge can be inserted in or removed from the pump and the motor is off, a second position in which the locking bar 37 is driven downwardly to lock the pins 130

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34 and thereby hold the cartridge in place in the socket with the motor remaining off and a third position in which the locking pins 34 are locked and the motor is switched on.

It will be understood that many modifications may be made to the above described embodiments without departing from the scope of the invention. For example, the tube 24 may be formed with a rib of different section reducing to a neck adjacent the tube and the groove 23 is then formed with a corresponding cross-section having a mouth at the bore of similar width to the neck to trap and hold the rib in place in the groove.

Also the shaft 14 may be arranged to be adjustable axially to vary the extent to which the rollers 19 compress the tube 24 and thereby vary the fluid flow rate along the tube for a given pump speed. WHAT I CLAIM IS:-

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1. A peristaltic pump comprising a body having an open mouthed chamber, a rotary member mounted in the body for rotation in the chamber about an axis, a cartridge comprising a housing having a bore, a flexible walled tube extending through the housing with at least a part of a convolution of the tube encircling the bore and means for releasably mounting the cartridge in the chamber through the open mouth thereof so that the rotary member is received in the bore and so that, in use, the rotary member traverses the convolution and, by depressing the tube, causes a flow of fluid therein.

2. A peristaltic pump comprising body means having an open mouthed chamber, a rotary member mounted in the body for rotation in the chamber, and a cartridge releasably mountable in the chamber through the open mouth thereof, the cartridge comprising a housing having a bore for receiving the rotary member when the cartridge is mounted in the chamber, a flexible walled tube extending through the housing with at least part of a convolution of the tube encircling the bore so that, in use, the rotary member traverses the convolution and, by depressing the tube, causes a flow of fluid therein, the tube having an integral rib extending lengthwise thereof which narrows in cross-section to a neck adjacent the tube and the housing being formed with a recess encircling the bore of similar width to the neck so that the rib is trapped in the recess to hold the tube in the bore.

A pump as claimed in claim 2 when the housing to either side of the recess formed by two parts secured together.

4. A pump as claimed in claim 2 or claim 3 wherein the integral rib on the tube has a dovetail section to engage in the recess with the narrow end of the section adjacent the tube located in the mouth of the recess.

5. A pump as claimed in any one of the claims 2 to 4 wherein an aperture extends through the wall of the housing to the bore through which the tube extends into and out of the housing.

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6. A pump as claimed in any one of claims 2 to 5 wherein the bore is frustoconical.

7. A pump as claimed in any one of claims 2 to 6 wherein the rotary member is rotatable about the axis of the bore and has at least one eccentrically mounted element thereon for engaging and pressing the wall of the tube.

8. A pump as claimed in claim 7 wherein each element comprises a roller rotatably mounted on the rotary member to rotate about an axis eccentric to the axis of the rotary member.

9. A pump as claimed in claim 7 or 8 wherein the rotary member comprises a shaft and a radially extending carrier on which the or each element for engaging the tube is mounted.

10. A pump as claimed in claim 7 to 9 in the case where the bore in the housing is frusto-conical, when the or each element for engaging the tube extends parallel to the bore.

11. A pump as claimed in claim 8 each roller being mounted to rotate about an axis convergent with the axis of the rotary member.

12. A pump as claimed in any one of claims 2 to 11 further comprising clamping means for holding the cartridge in the chamber.

13. A pump as claimed in claim 12 wherein the encircling wall of the chamber has openings on opposite sides thereof and a pair of pins extends through the body means on either side of the chamber and are resiliently biased so that the side portions of the pins project into the chamber through the openings, the cartridge being provided with an encircling groove to receive the projecting portions of the pins and releasable clamping means being provided for holding the pins with said portions projecting through the openings into the groove in the cartridge to hold the cartridge in place in the chamber.

A pump as claimed in claim 13 or in a single manual control is provided which, in one position, releases the clamping means, in a second position clamps the clamping means and in a third position both clamps the clamping means and energises the motor for the rotary member.

15. A cartridge for a peristaltic pump 125 substantially as described with reference to and as illustrated in Figure 1 to 4 of the accompanying drawings or Figure 1 to 4 as modified by Figure 5.

16. A peristaltic pump substantially as 130

described with reference to and as illustrated in Figures 1 to 4 of the accompanying

drawings or Figures 1 to 4 of the accompanying drawings or Figures 1 to 4 as modified by Figure 5.

17. A cartridge for a peristaltic pump substantially as described with reference to and as illustrated in Figure 6 of the accompanying drawings.

panying drawings.

18. A peristaltic pump substantially as described with reference to and as illustrated in Figures 7 and 8 of the accompanying drawings.

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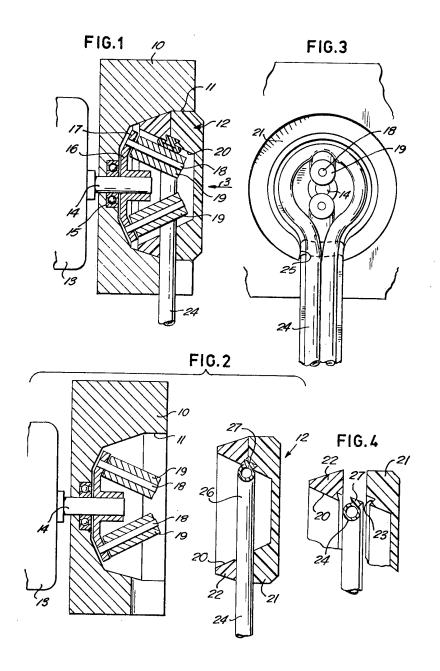
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COMPLETE SPECIFICATION

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Sheet 1



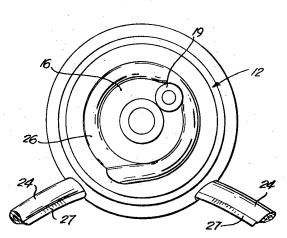
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COMPLETE SPECIFICATION

3 SHEETS

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FIG.5



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COMPLETE SPECIFICATION

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Sheet 3

FIG.7

