(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 200 448**
A2

(12) EUROPEAN PATENT APPLICATION

(21) Application number: 86302972.4

(22) Date of filing: 21.04.86

(51) Int. Cl.⁴: F 04 B 43/12

(30) Priority: 24.04.85 GB 8510382

(43) Date of publication of application:
05.11.86 Bulletin 86/45

(84) Designated Contracting States:
AT BE CH DE FR GB IT LI LU NL SE

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(54) Peristaltic pump.

(57) There is disclosed a peristaltic pump comprising a substantially rectilinear pinch-deformable tube having an axial direction and tube deforming means extending axially of said tube and movable perpendicularly to said axial direction so as to engage said tube and deform it peristaltically at positions successively displaced in one direction therealong.

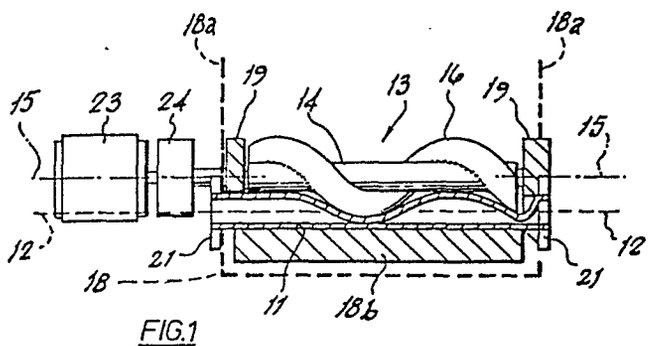

FIG.1

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PERISTALTIC PUMP

This invention relates to peristaltic pumps.

Such pumps essentially comprise a deformable tube and means producing a pinch-like deformation of the tube which travels along the tube forcing the contents of the tube from one end to the other. Peristaltic pumps are used in situations where corrosive liquids or abrasive particles in suspensions or slurries might damage the works of ordinary pumps, or where, conversely, such ordinary pumps might damage particles in suspensions to be pumped, for example corpuscles in blood in heart bypass or dialysis machines.

In the usual form of such pumps, the deformable tube is bent around a major arc of a circle. Rollers or sliding shoes mounted on a wheel on a shaft extending axially of the circle revolve about the axis of the circle in contact with the radially inner part of the tube thereby pinching the tube against an outer containing rim. The shaft is connectible to a motor, usually an electric motor, often through a reduction gear arrangement, the whole being mounted in a supporting framework.

A disadvantage of this arrangement is its sheer

bulk, much of which is comprised by the motor and the supporting framework. Moreover, to connect the arrangement in a pipeline, elbow connectors have to be used which add further to the bulk and complexity of the arrangements and are potential blockage regions where solids can accumulate on account of differential rates of flow at different positions radially of the arc of the elbow.

The present invention provides a peristaltic pump which avoids these problems by making the pump assembly itself smaller by a novel layout, and also by reducing the size of motor required for given back pressure and throughput requirement, as well as simplifying installation and eliminating potential blockage regions.

The invention comprises a peristaltic pump comprising a substantially rectilinear pinch-deformable tube having an axial direction and tube deforming means extending axially of said tube and movable perpendicularly to said axial direction so as to engage said tube and deform it peristaltically at axial positions successively displaced in one direction therealong.

Said tube deforming means may comprise a rotary

member having an axis of rotation substantially parallel to said axial direction. Said rotary member may comprise tube engaging means disposed helically on said rotary member.

Said tube engaging means may comprise a continuous helical thread, smooth and rounded so as to be able to engage said tube with low friction to avoid substantial wear or damage.

Said helically disposed tube engaging means may otherwise comprise a series of rotary cam like members. A flexible pressure member may be disposed between said tube and said cam-like members, flexing to deform said tube under the action of said cam-like members.

Said tube and said tube deforming means may be disposed in a lubricant bath.

The pump may comprise an electric motor connected to move said tube deforming means.

Embodiments of a peristaltic pump according to the invention will now be described with reference to the accompanying drawings, in which:-

Figure 1 is a sectional elevation of one embodiment,

and Figure 2 is a sectional elevation of another embodiment.

The peristaltic pump illustrated in Figures 1 and 2 comprises a substantially rectilinear pinch - deformable tube 11 having an axial direction indicated by the broken line 12 and tube deforming means 13 extending axially of said tube 11 and movable perpendicularly to said axial direction so as to engage said tube 11 and deform it peristaltically at positions successively displaced in one direction therealong.

Said tube deforming means 13 comprise a rotary member 14 having an axis of rotation (indicated by broken line 15) substantially parallel to said axial direction 12. Said rotary member 14 in each case comprises tube engaging means 16 disposed helically on said rotary member 14.

Figure 1 illustrates said helically disposed tube engaging means 16 comprising a continuous helical thread, smooth and rounded so as to be able to engage

said tube 11 with low friction to avoid substantial wear or damage.

Figure 2 illustrates said helically disposed tube engaging means 16 comprising a series of cam-like members 16a, 16b, ... A flexible pressure member 17, for example, a strip of spring steel, is disposed between said tube 11 and said cam-like members 16a, 16b, ... and flexes to deform said tube 11 under the action of said cam-like members.

It will be recognised that in either case a pinch-deformation, or peristaltic wave, is propagated in one direction along the tube 11. Reversing the direction of rotation of the rotary member 14, of course, propagates the peristaltic wave in the opposite direction so that the pump is reversible.

The tube 11 and tube deforming means 13 are disposed in a lubricant bath 18. End walls 18a of the bath 18 include bearings 19 for the rotary member 14 and pipe connectors 21 for attachment of inlet and outlet pipes to the tube 11. The bath 18 is rigidly constructed and includes a lengthwise containing wall 18b against which the tube deforming means 13 pinch deform the tube 11.

An electric motor 23 is mounted on the outside of the bath 18 connected directly or through a gearbox 24 to the rotary member 14.

The pumps illustrated in Figures 1 and 2 have a small axial cross-section as compared to conventional peristaltic pumps of equivalent bore in which the deformable tube is bent around a major arc of a circle. This means at once that they can be used in confined spaces such for example as bore holes or in underground pipe line installations or in nests of pipes. A peristaltic pump according to the invention can be located underground in a pipe line installation much more easily than can a conventional peristaltic pump.

In a pipe line installation, the flow is straight through and does not have to pass through elbow joints connecting the pump to the pipe ends, which can be potential blocking regions due to deposition of solids at the bends. In any event, the resistance to flow is less because of the straight-through configuration. Furthermore, because the point of application of pinching force to the pipe 11 is close to the axis of the rotary member 14, instead of being at outer radius as in conventional peristaltic pumps, less driving torque is required, so the motor can be correspondingly smaller, for a given back pressure and

throughput requirement.

The length of the tube 11 and the pitch of the helical arrangement can be so chosen that there is always at least one pinched part of the tube 11 to prevent return flow.

Peristaltic pumps according to the invention may be produced in a wide range of sizes from very large for heavy industrial and civil engineering applications to miniature. At either extreme, clearly, the saving in bulk and power requirements offers considerable advantages over conventional peristaltic pumps.

CLAIMS

1. A peristaltic pump comprising a substantially rectilinear pinch-deformable tube having an axial direction and tube deforming means extending axially of said tube and movable perpendicularly to said axial direction so as to engage said tube and deform it peristaltically at positions successively displaced in one direction therealong.

2. A pump according to claim 1, said tube deforming means comprising a rotary member having an axis of rotation substantially parallel to said axial direction.

3. A pump according to claim 2, said rotary member comprising tube engaging means disposed helically on said rotary member.

4. A pump according to claim 3, said helically disposed tube engaging means comprising a continuous helical thread smooth and rounded so as to be able to engage said tube with low friction to avoid substantial wear or damage.

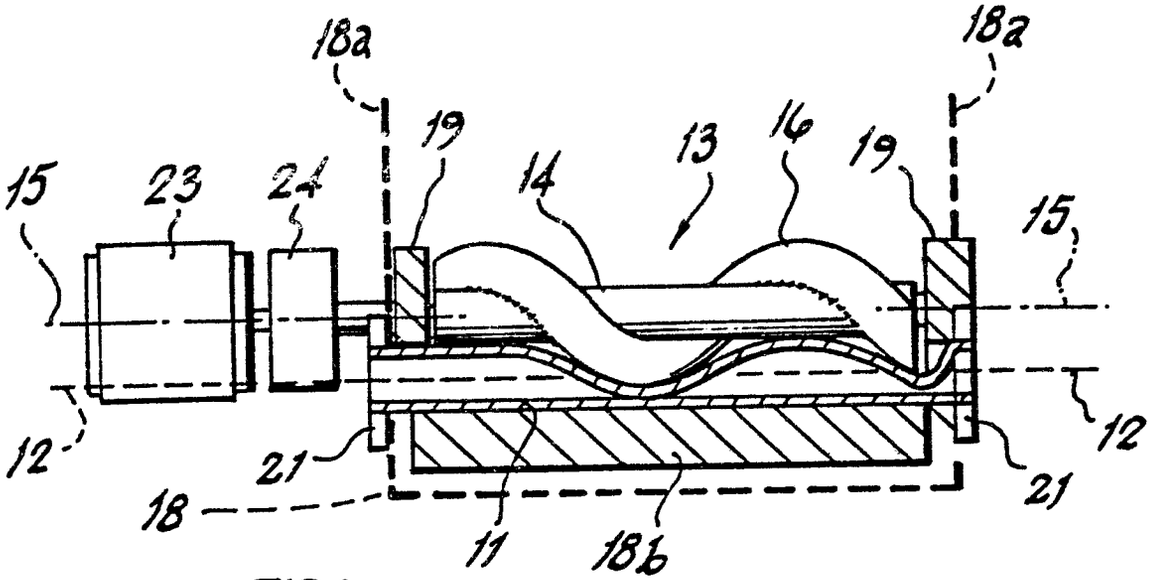
5. A pump according to claim 3, said helically disposed tube engaging means comprising a series of rotary cam-like members.

6. A pump according to claim 5 comprising a flexible pressure member disposed between said tube and said cam-like members and flexing to deform said tube under the action of said cam-like members.

7. A pump according to any one of claims 1 to 6, said tube and said tube deforming means being disposed in a lubricant bath.

8. A pump according to any one of claims 1 to 7 comprising a motor connected to move said tube deforming means.

9. A pump substantially as hereinbefore described with reference to the accompanying drawings.


18a
18a
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12
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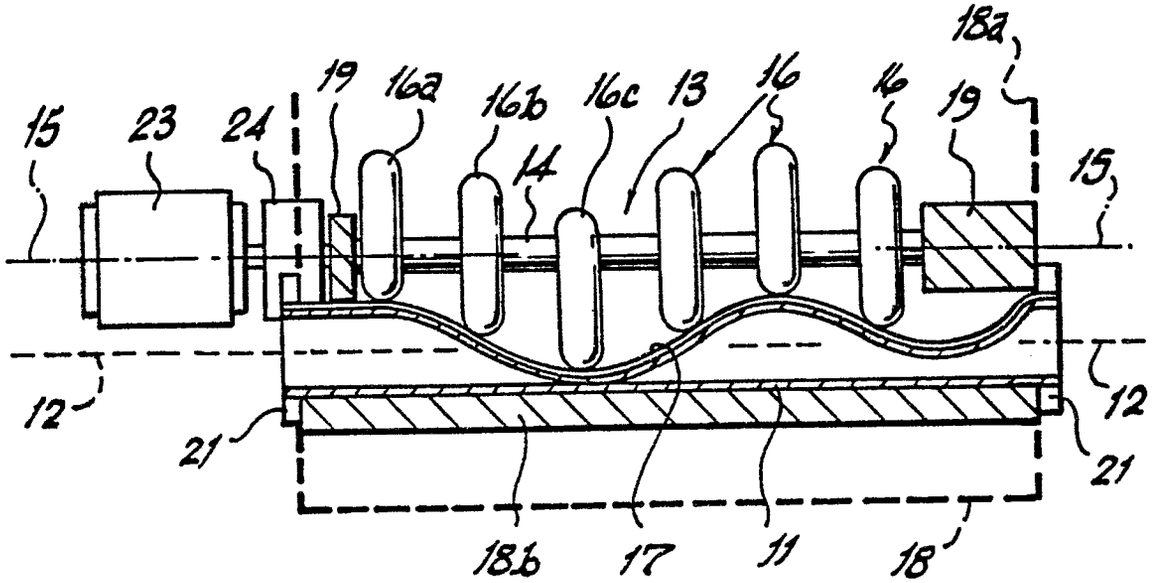
21
18
11
18b

FIG.1


18a
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16a
16b
16c
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21
18b
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FIG.2