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(continued on next page)

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(56) Documents Cited:
GB 2355653 A **GB 2294636 A**
GB 2288116 A **GB 2278776 A**
WO 2005/059259 A1

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UK CL (Edition X) **A4N**
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Other:

(54) Abstract Title: **Shower tray with pump**

(57) A shower installation comprises a shower tray (1), in which water is drawn from the shower tray by a peristaltic pump (7) and discharged to drain. In one embodiment, water collects in a sump (4) in the floor (2) of the shower tray, and is withdrawn from the sump by a suction pipe (5) connected to an inlet port (6) of the peristaltic pump.

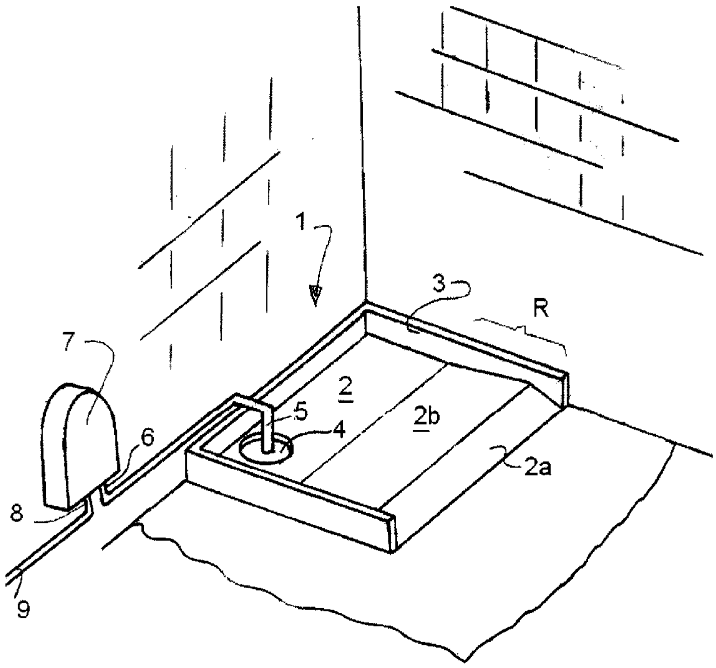

FIG 1

GB 2 425 471 A

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FIG 1

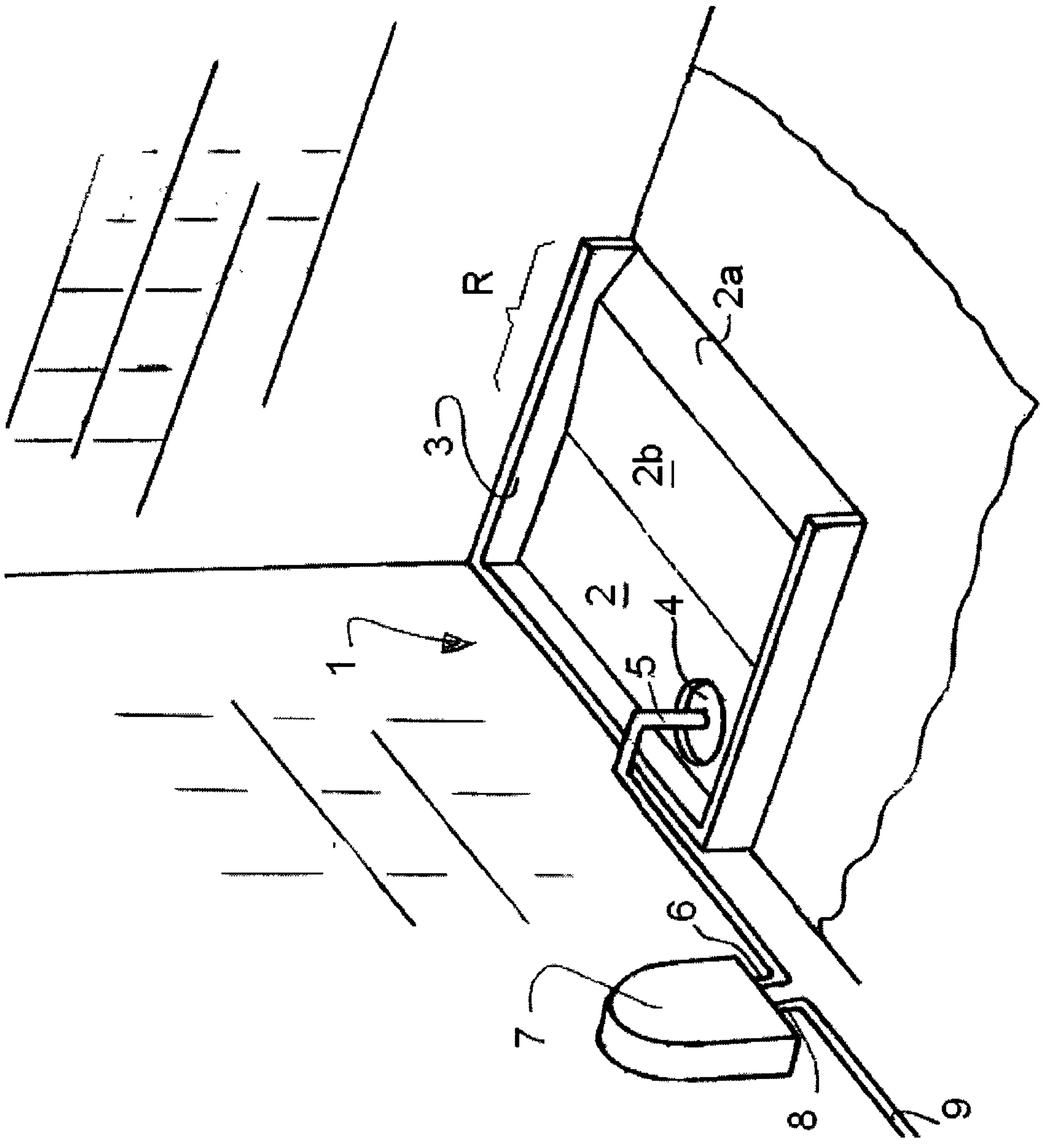


FIG 2

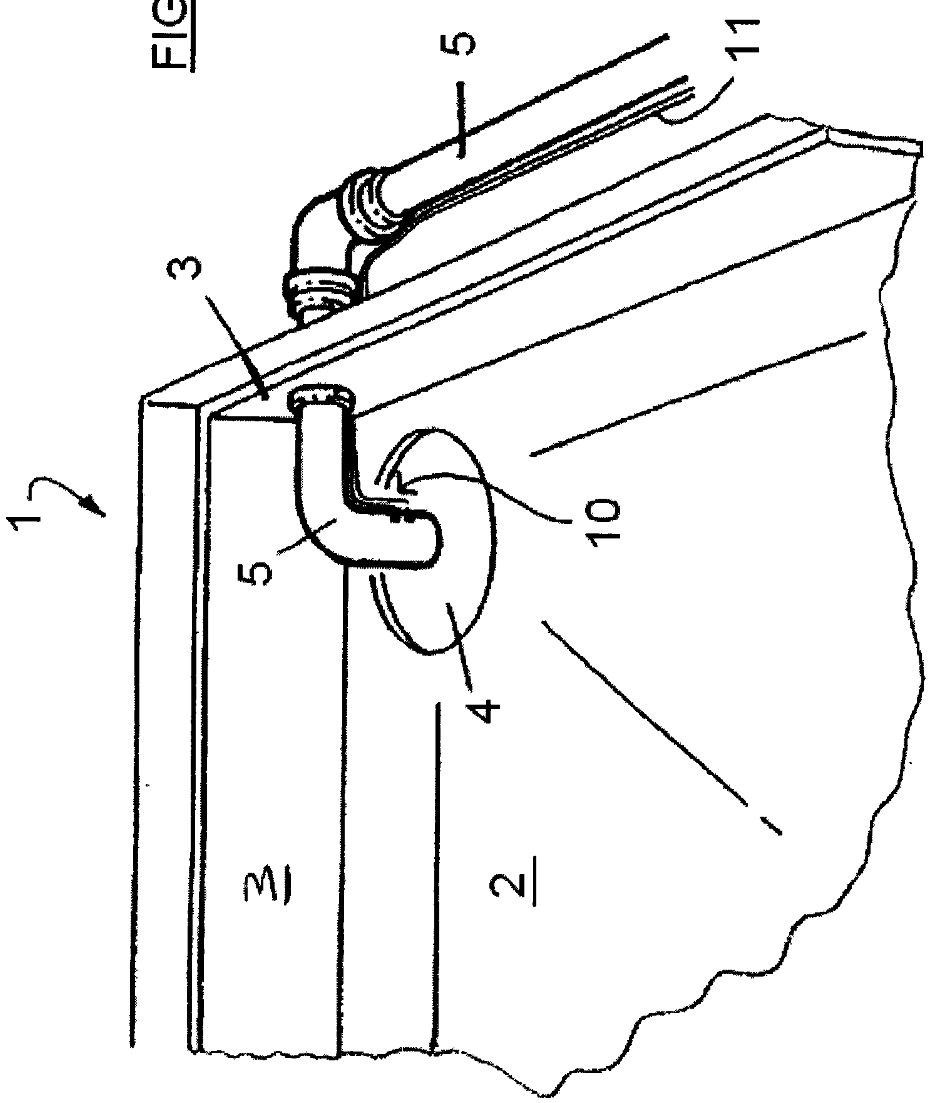
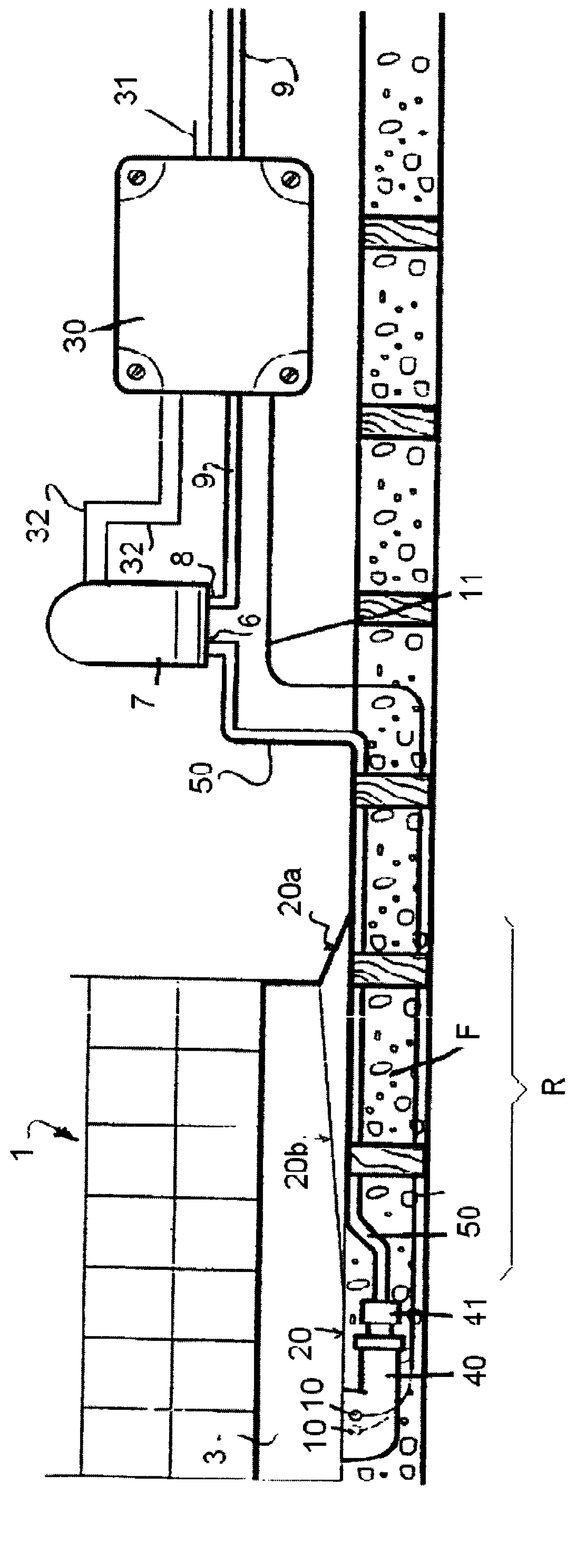


FIG 3



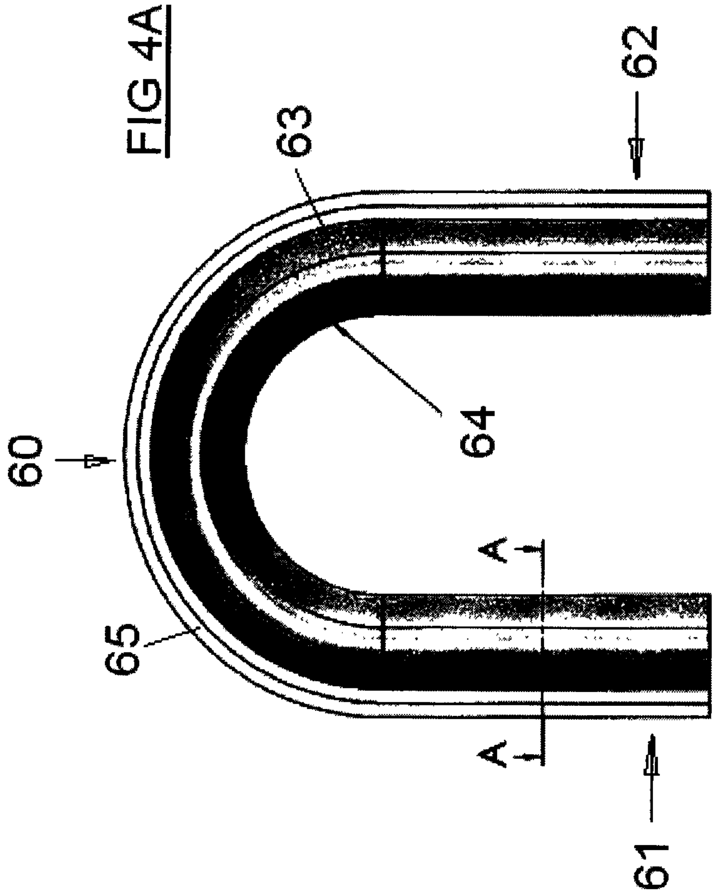


FIG 4A

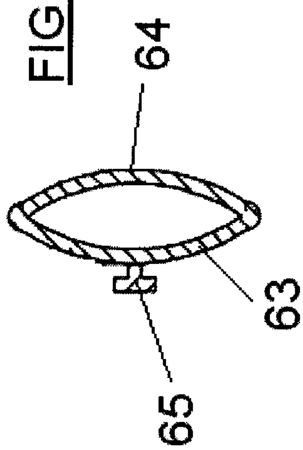


FIG 4B

FIG 5A

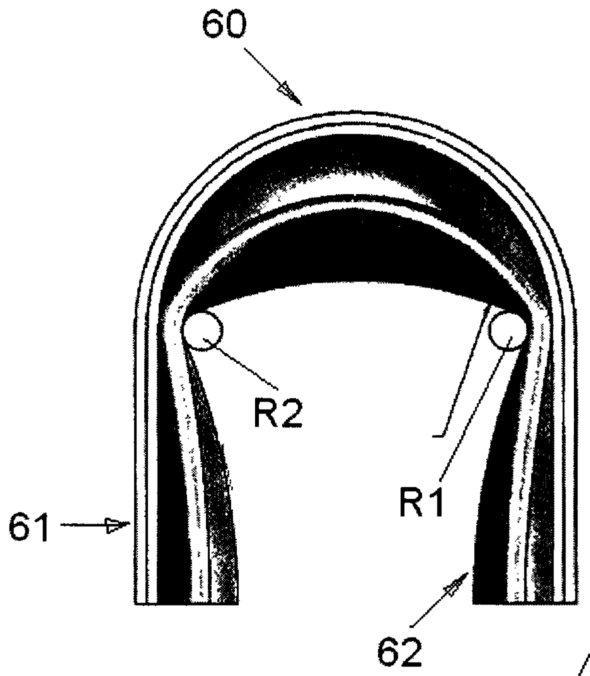


FIG 5B

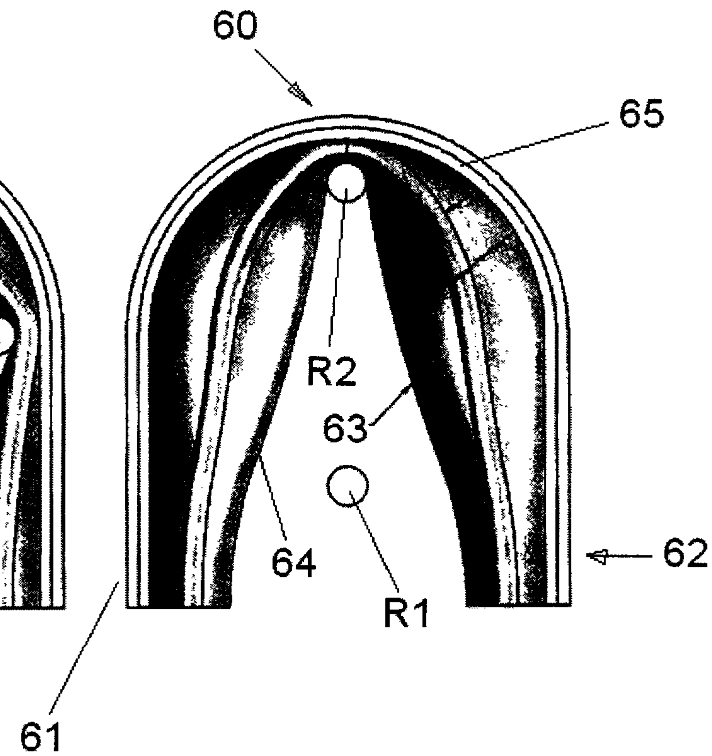
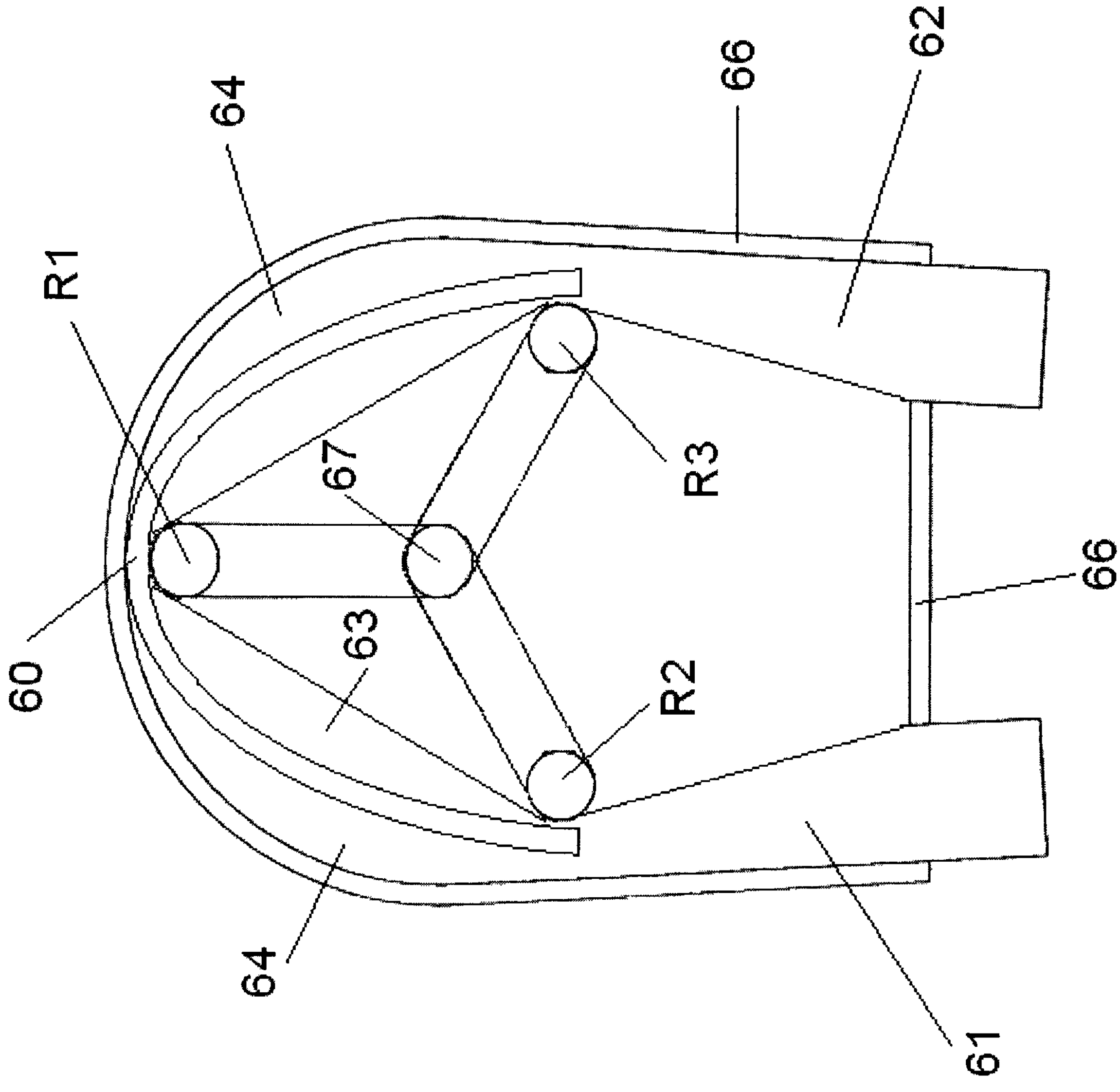


FIG 6



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SHOWER INSTALLATION

The present invention relates to shower installations, and is particularly concerned with shower installations in which waste water from the shower tray is removed using a pump, rather than by gravity.

In many shower installations, the user stands in a shower tray which is raised above the floor level in order to create a space between the shower tray and the floor to accommodate a waste trap and waste pipe for draining the shower tray. This raising of the shower tray above floor level creates a difficulty for the less mobile, such as wheelchair users, to use the shower due to the presence of a step up into the shower tray.

In order to provide a shower installation which is accessible by the less mobile, the height of the shower tray above floor level must be minimised, preferably with only a small ramped threshold separating the shower tray from the outside floor level. The reduced height of the ramped threshold means that only a small volume of water can be contained within the shower tray, and it is therefore imperative to remove water from the shower tray as rapidly as possible to prevent the water from overtopping the threshold. Furthermore, the lowering of the shower tray level reduces the height through which water from the shower tray waste will fall in order to be discharged, and thus draining the shower tray by gravity has proved insufficient to remove water at the required rate. Yet further, in certain types of shower installation, such as level-access showers, there may be insufficient space to install a waste trap and pipe between the shower tray and the floor.

In these type of shower installations, therefore, a pump is installed to draw water from the shower tray and discharge it to waste.

The pump must be able to remove water at a rate compatible with the flow rate of a typical domestic shower installation, namely a flow rate of from 6 to 8 litres per minute, or up to 20 litres per minute in the case of a so-called "power shower" pumped installation. Accordingly, in conventional shower installations with pumped drainage, water is removed using a diaphragm pump or a centrifugal pump.

The diaphragm pump has an enclosed pumping chamber partially defined by a movable diaphragm, with none-returning inlet and outlet valves to allow water to enter and leave the pumping chamber, respectively. Movement of the diaphragm to increase the volume of the pumping chamber closes the outlet valve and draws water into the pumping chamber through the inlet valve. Movement of the diaphragm to reduce the volume of the pumping chamber closes the inlet valve and forces water out through the outlet valve. One particular problem with diaphragm pumps is that they are noisy in operation and produce high levels of suction noise at the inlet (the shower tray drain), particularly when the pump is dealing with mixtures of air and water.

The centrifugal type of pump usually comprises a simple impeller rotating within a casing, with an inlet opening on the impeller axis and an outlet port arranged radially of the impeller. The centrifugal pump is conventionally chosen for its ability to produce flow rates sufficient to deal with domestic shower installations and because of its simple construction with no valves. However, centrifugal pumps are noisy in operation, and they also produce noise at the inlet opening (the shower tray drain) when the pump is dealing with a mixture of air and water.

The noisy operation of conventional shower pumps is particularly disadvantageous when the shower is installed in a multi-occupancy dwelling, such as an apartment block.

The inventor has realised that the problems of motor noise and suction noise can be addressed by using a peristaltic pump to remove water from the shower tray.

Peristaltic pumps comprise a resiliently deformable tube which is pinched at one or more points along its length. The pinch points are moved along the length of the deformable tube, causing a peristaltic action which carries liquid along the tube. Generally the peristaltic tube is arranged in a circular arc, and pinch points are formed by rollers, mounted on a rotor coaxial with the arc, pressing the tube against a generally cylindrical housing.

The common perception of peristaltic pumps is that they are particularly suited for low flow-rate applications, and most particularly as metering pumps. The inventor has devised a peristaltic pump which is particularly capable of providing the required volumetric flow rate for a domestic shower installation, the increased volumetric flow being achieved by making the peristaltic tube non-circular, with its cross-section elongated in the direction of the rotor axis. The pinching action of the rollers on the tube causes the tube cross-section to alter to a more circular shape, increasing the internal volume of the peristaltic tube and thus increasing the pump's flow rate. This cross-sectional change is most pronounced when the pump rotor comprises a pair of diametrically opposed rollers.

The inventor has, however, also recognised that, if the peristaltic pump rotor has only two rollers, the possibility exists that when the pump is not in operation, the rotor can be positioned such that neither roller completely engages the peristaltic tube to occlude it, and thus there is a free flow path through the peristaltic pump. Such a situation can permit water in the pipe between the shower drain and the pump to flow back through the shower drain and into the shower tray, and as such is not acceptable for a domestic installation.

The inventor has overcome this difficulty by providing a peristaltic pump rotor having three equally angularly spaced rollers. While this arrangement sacrifices some of the flow rate increase achieved by the non-circular cross-section of the peristaltic tube, the three-roller arrangement ensures that the peristaltic tube is occluded at at least one location at all times.

According to a first aspect of the invention, there is provided a shower installation comprising a shower tray, in which water is drawn from the shower tray by a peristaltic pump and discharged to drain.

Preferably, the peristaltic pump has a peristaltic tube that has a cross-section which is non-circular in shape, and is elongated in the direction parallel to the rotor axis of the pump.

In a preferred embodiment, the rotor of the peristaltic pump comprises three equally angularly spaced rollers, each roller being engagable with the peristaltic tube to form an occlusion thereof.

Preferably, the shower tray comprises a floor, a sump extending below the level of the floor, and an inlet port of the peristaltic pump is connected to a suction pipe for withdrawing water from the sump. The suction pipe may extend upwardly out of the sump and lead to the inlet port of the peristaltic pump.

Alternatively, an opening may be formed in the sump, and the suction pipe may draw water through the opening and to the inlet port of the peristaltic pump.

Water sensing means may be provided to detect the presence of water in the sump, and a control means may be provided to cause the peristaltic pump to operate when water is detected in the sump. The water sensing means may comprise a pair of electrical contacts positioned so as to be immersed in water when the sump is filled to a predetermined level.

In a shower installation, water is supplied via a shower head, and a control means may be arranged to operate the peristaltic pump when water flows from the shower head.

Embodiments of the present invention will now be explained in detail, by way of example only, with reference to the accompanying drawings, in which:

Figure 1 is a schematic perspective view of a typical shower tray installation according to an embodiment;

Figure 2 illustrates an alternative arrangement for routeing the discharge piping in the shower arrangement of Figure 1;

Figure 3 is a vertical sectional view of an alternative shower installation;

Figure 4A is a side view of a peristaltic tube for use in a peristaltic pump in an embodiment;

Figure 4B is a sectional view in the plane A-A of Figure 4A;

Figures 5A and 5B are side views, respectively showing stages in the deformation of the peristaltic tube of Figure 4A by a peristaltic pump rotor; and

Figure 6 is a schematic drawing showing, in side view, a peristaltic pump for use in the shower installation of an embodiment.

A shower installation is illustrated in Figure 1. The installation comprises a shower tray 1 which in this embodiment is installed in a corner of a room. The shower tray 1 is generally rectangular in plan view, and has a floor 2 and an upstanding side wall 3 extending along three of its sides. The open side of the shower tray allows access to the shower tray via a pair of inclined surfaces 3a and 3b forming a ramp R. The floor 2 of the shower tray 1 is formed with a generally circular depression or sump 4, into which water falling on the inclined surface 3b and the floor 2 will collect. A shower head (not shown) is conventionally mounted to the wall above the shower tray, and a curtain or enclosure may be provided to catch and redirect splashing water into the shower tray 1.

Water is drawn from the sump 4 through a discharge pipe 5, which in this embodiment extends vertically downwardly into the sump 4 to a level approximately 4 to 15mm below the level of the floor 2. The discharge pipe 5 is routed to the inlet port 6 of a peristaltic pump 7. The outlet port 8 of the peristaltic pump 7 is connected by a delivery pipe 9 to the domestic drainage system.

The peristaltic pump 7 is preferably powered by a low voltage electric motor.

The peristaltic pump 7 may be controlled by a water level sensor (not shown) positioned to detect the presence of water in the sump 4.

Alternatively, the peristaltic pump 7 may be controlled on the basis of the supply of water to the shower head. Flow detectors may be provided to detect flow of water to the shower head, and initiate operation of the peristaltic pump 7. The rate of flow detected by the detector may be used to control the speed of operation of the pump, increasing the pumping action when higher flow rates are detected.

In "power shower" installations where water is provided to the shower head by a supply pump, the operation of the peristaltic pump 7 may be controlled on the basis of the operation of the supply pump. For example, the peristaltic pump 7 may be controlled so as to start and stop simultaneously with, or a predetermined interval after, the starting and stopping of the supply pump, respectively.

Figure 2 illustrates an alternative arrangement for the discharge pipe 5 to be led out of the shower tray 1. In this arrangement, the discharge pipe 5 extends upwardly from the sump 4, and then horizontally through the side wall 3 after which the discharge pipe 5 is led to the peristaltic pump 7. Also illustrated in Figure 2 are a pair of water level sensing contacts 10 which are mounted adjacent the lower end of the discharge pipe 5. The sensing contacts 10 are connected by respective wires 11 to a control circuit for the peristaltic pump. When the water level in the sump rises to cover both of the sensor contacts 10, a control input is given to the peristaltic pump control circuit via the connecting wires 11. As an alternative to mounting the water level sensor contacts 10 on the discharge pipe 5, the contacts 10 may be mounted on the shower tray 1, either on the floor 2 or in the sump 4.

To minimise noise caused by the pump sucking up water with large quantities of air, the sensor contacts 10 are preferably positioned such that the end of the discharge pipe 5 is completely immersed, preferably to a depth of at least 5mm and more preferably 10mm, in the water before the circuit is completed and the peristaltic pump 7 is started.

Figure 3 shows an alternative arrangement for the drainage of the shower tray 1. In this arrangement, a conventional trap 40 is positioned beneath the shower tray floor 20, and is connected by a joint 41 to a discharge pipe 50. The trap 40, joint 41 and discharge pipe 50 are embedded beneath the shower tray 1 within the floor F of the building, in order to reduce the height of the shower tray and provide for easy access via the inclined surfaces 20a and 20b forming the ramp R. Water level sensing contacts 10 are provided, in this embodiment, within the trap 40 and below the level of the floor 20 of the shower tray 1. The discharge pipe 50 is led to the inlet port 6 of a peristaltic pump 7, and the outlet port 8 of the peristaltic pump 7 is connected by a delivery pipe 9 to the domestic drainage system, as described in relation to the embodiment of Figure 1.

The control circuitry for the peristaltic pump 7 and the power supply to the level sensor probes 10 are conveniently provided in a single housing 30. A mains voltage input 31 provides power to a transformer and a control circuit provides a low voltage via the wires 11 to the level sensing contacts 10. Typically the voltage at the level sensing contacts is from 3 to 5 V. When trap 40 fills to the extent that the two contacts 10 are immersed, the water within the trap completes a circuit and a control signal is passed through the wires 11 to the control circuitry in the housing 30. Power is supplied to the peristaltic pump 7 via power supply lines 32, causing the pump to operate. When the level within the trap 40 falls below the level of the contacts 10, the control circuitry continues to operate the peristaltic pump 7 for a predetermined interval, and then stops the pump. Typically, the pump continues to operate for an interval of from 30 seconds to two minutes after the contacts 10 are dry.

As an alternative to the electrical contacts 10 for sensing the level of water in the shower tray 1, float switches, capacitive or optical sensors or any other suitable detector may be used.

Figures 4 to 6 illustrate the configuration and operation of the peristaltic tube used in the peristaltic pump. Referring to Figure 4, the peristaltic tube shown in Figure 4A comprises a generally semicircular arcuate top section 60 and a pair of straight entry and exit sections 61 and 62. The cross-section is elongated in the direction of the axis of the semicircular top section, as can be seen from the sectional view in Figure 4B. The peristaltic tube comprises an arcuate outer wall 63 and an inner wall 64. A "T"-shaped rib 65 extends along the length of the peristaltic tube, along the radially outer wall 63 of the top section 60. The rib 65 continues along the outer walls 63 of the entry and exit sections 61 and 62. The rib 65 is engagable with a cooperating formation in a pump housing, in order to anchor the outer wall of the peristaltic tube to the pump housing and prevent the outer wall 63 of the tube from moving radially inwardly.

Figures 5A and 5B show the peristaltic tube in operation in a peristaltic pump in which the pump rotor (not shown) comprises two diametrically opposed rollers R1 and R2. In Figure 5A, the rollers R1 and R2 engage the peristaltic tube at the ends of the arcuate top section 60. The rollers R1 and R2 urge the inner wall 64 of the peristaltic tube outward against the outer wall, which is prevented from outward radial movement by the pump housing (not shown), and a pinch point is formed where the peristaltic tube is occluded. As the rotor turns (clockwise as seen in the figure), the pinch point moves along the peristaltic tube, driving forward liquid contained within the tube towards the exit section 62.

The outward movement of the inner wall 64 at the ends of the top section 60 of the peristaltic tube causes the arched formation of the inner wall 64 of the top section 60 to become flattened, moving the inner wall at the central part of the top section 60 radially inwardly toward the rotor axis. This movement increases the cross-sectional area of the top section 60 of the peristaltic tube, ensuring that an increased volume of liquid is drawn into the tube for pumping. In the illustrated arrangement, manufacturing inaccuracies and wear of the peristaltic tube may result in the peristaltic tube being finally completely occluded by the roller R2 only after the occlusion formed by the roller R1 is released. In this case, for two short intervals during each rotation of the rotor, there is no complete occlusion of the peristaltic tube.

As the pump rotor continues to turn, the rollers R1 and R2 move to the position shown in Figure 5B. In this position, the roller R2 pinches the peristaltic tube at the apex of the top section 60, while the roller R1 is disengaged from the tube. In this position, the inner wall 64 of the peristaltic tube is drawn radially inwardly to increase the cross-section of the tube at the regions of the junctions between the top section 60 and the entry section 61 and the exit section 62, respectively. Rotation of the rotor causes the pinch point to move round the apex of the peristaltic tube, drawing water into the entry section and expelling it from the exit section.

In order to ensure that at least one effective pinch point is maintained at all times, the arrangement shown in Figure 6 is used. In this figure, the peristaltic tube is seen mounted in a pump housing 66, which engages the rib 65 to hold the peristaltic tube in position within the housing 66. The rotor of the peristaltic pump comprises three equally angularly spaced rollers R1, R2 and R3 rotatable about a central axis 67. In the rotor position shown in Figure 6, the roller R1 pinches the tube at the apex of the top section 60, while the rollers R2 and R3 engage the tube at the upper parts of the entry and exit sections 61 and 62, respectively, but do not occlude it. As the rotor rotates (clockwise as seen in the figure) the roller R3 engages and pinches the tube to occlude it while the roller R1 maintains its occlusion and the roller R2 disengages from the tube. The peristaltic tube is pinched either at one point or at two points at all times during each rotor rotation. This arrangement overcomes the difficulty that stopping the rotor may leave the rotor in a position where the peristaltic tube is unsealed, and back flow is therefore avoided. In addition, because the peristaltic tube is always pinched at at least one point, the pump will start (after it has been switched off) with maximum torque, thereby reducing noise during the initial operating stage.

In the preferred embodiment, the pump is driven by a low-voltage DC motor. The peristaltic pump operates equally effectively irrespective of the rotation and direction of the rotor. By selecting the polarity of the current fed to the motor terminals, the rotation direction of the rotor can be selected, to determine which of the two ports of the pump will be the inlet, and which the outlet. The peristaltic pump 7 may therefore be mounted to the left of the shower tray, as shown in Figure 1, with the inlet port 6 being positioned nearer to the shower tray. If the pump 7 has to be mounted to the right of the shower tray, then the direction of the motor current is simply reversed by reversing the polarity of the motor contacts, so that the port nearest to the shower tray functions as the inlet port of the pump. Although the pump is shown in figure 1 mounted with its inlet and outlet ports lowermost, the pump may of course be mounted in any orientation.

Claims:

1. A shower installation comprising a shower tray, a discharge pipe, and a peristaltic pump arranged to draw water from the shower tray through the discharge pipe and discharge it to a drain.

2. A shower installation according to claim 1, wherein the peristaltic pump comprises:

a housing;

a rotor mounted for rotation within the housing about a rotor axis;

an arcuate backing surface coaxial with the rotor axis; and

a peristaltic tube extending along the arcuate backing surface and engagable by the rotor so as to occlude the tube;

wherein the peristaltic tube has a cross-section which is non-circular in shape, and is elongated in the direction parallel to the rotor axis.

3. A shower installation according to claim 2, wherein the rotor of the peristaltic pump comprises three equally angularly spaced rollers, each roller being engagable with the peristaltic tube to form an

occlusion in the lumen of the tube.

4. A shower installation according to any preceding claim, wherein the shower tray comprises a floor, a sump extending below the level of the floor, and wherein an inlet port of the peristaltic pump is connected to a suction pipe for withdrawing water from the sump.

5. A shower installation according to claim 4, wherein the suction pipe extends upwardly out of the sump and to the inlet port of the peristaltic pump.

6. A shower installation according to claim 4, wherein the sump is formed with an opening, and the suction pipe communicates with the opening for drawing water through the opening and to the inlet port of the peristaltic pump.

7. A shower installation according to any of claims 4 to 6, wherein water sensing means are provided to detect the presence of water in the sump, and control means are provided to cause the peristaltic pump to operate when water is detected in the sump.

8. A shower installation according to claim 7, wherein the water sensing means comprises a pair of electrical contacts positioned so as to be immersed in water when the sump is filled to a predetermined level.

9. A shower installation according to any preceding claim, wherein water is supplied to the shower installation via a shower head, and the installation further comprises control means to operate the peristaltic pump when water flows from the shower head.

10. The use of a peristaltic pump to draw water from a shower tray and discharge it to waste.

11. A shower installation kit comprising:

a shower tray;

a discharge pipe connectable to the shower tray; and

a peristaltic pump connectable to the discharge pipe to draw water from the shower tray.

12. A shower pump fitting kit, comprising:

a peristaltic pump;

instructions for connecting the pump to draw water from a shower tray and discharge it to waste.

13. A shower installation substantially as described herein, with reference to the accompanying drawings.

14. A method of draining a shower substantially as herein described with reference to the accompanying drawings.

Amendments to the claims have been filed as follows:

Claims:

1. A shower installation comprising a shower tray, a discharge pipe, and a peristaltic pump arranged to draw water from the shower tray through the discharge pipe and discharge it to a drain.

2. A shower installation according to claim 1, wherein the peristaltic pump comprises:

a housing;

a rotor mounted for rotation within the housing about a rotor axis;

an arcuate backing surface coaxial with the rotor axis; and

a peristaltic tube extending along the arcuate backing surface and engagable by the rotor so as to occlude the tube;

wherein the peristaltic tube has a cross-section which is non-circular in shape, and is elongated in the direction parallel to the rotor axis.

3. A shower installation according to claim 2, wherein the rotor of the peristaltic pump comprises three equally angularly spaced rollers, each roller being engagable with the peristaltic tube to form an

occlusion in the lumen of the tube.

4. A shower installation according to any preceding claim, wherein the shower tray comprises a floor, a sump extending below the level of the floor, and wherein an inlet port of the peristaltic pump is connected to a suction pipe for withdrawing water from the sump.

5. A shower installation according to claim 4, wherein the suction pipe extends upwardly out of the sump and to the inlet port of the peristaltic pump.

6. A shower installation according to claim 4, wherein the sump is formed with an opening, and the suction pipe communicates with the opening for drawing water through the opening and to the inlet port of the peristaltic pump.

7. A shower installation according to any of claims 4 to 6, wherein water sensing means are provided to detect the presence of water in the sump, and control means are provided to cause the peristaltic pump to operate when water is detected in the sump.

8. A shower installation according to claim 7, wherein the water sensing means comprises a pair of electrical contacts positioned so as to be immersed in water when the sump is filled to a predetermined level.

9. A shower installation according to any preceding claim, wherein water is supplied to the shower installation via a shower head, and the installation further comprises control means to operate the peristaltic pump when water flows from the shower head

10. The use of a peristaltic pump to draw water from a shower tray and discharge it to waste.

11. A shower installation kit comprising:

a shower tray;

a discharge pipe connectable to the shower tray; and

a peristaltic pump connectable to the discharge pipe to draw water from the shower tray.

12. A shower pump fitting kit, comprising:

a peristaltic pump; and

means for connecting the pump to a discharge pipe of a shower.

13. A shower installation substantially as described herein, with reference to the accompanying drawings

14 A method of draining a shower substantially as herein described with reference to the accompanying drawings.

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Application No:	GB0606391.1	**Examiner:**	Sarah Harrison
Claims searched:	1-9 and 11	**Date of search:**	27 July 2006

Patents Act 1977: Search Report under Section 17

Documents considered to be relevant:

Category	Relevant to claims	Identity of document and passage or figure of particular relevance
A	-	WO 2005/059259 A1 (XL Pumps Limited)
A	-	GB 2294636 A (Gontar)
A	-	GB 2288116 A (Gontar)
A	-	GB 2278776 A (Gontar)
A	-	GB 2355653 A (Macro Marine Limited)

Categories:

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art
Y	Document indicating lack of inventive step if combined with one or more other documents of same category	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.

Field of Search:

Search of GB, EP, WO & US patent documents classified in the following areas of the UKC^X :

A4N

Worldwide search of patent documents classified in the following areas of the IPC

A47K

The following online and other databases have been used in the preparation of this search report

EPODOC, WPI & JAPIO