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(54) Fabric with helical support

(57) There is disclosed a fluid delivery device (1, 1a) having an inlet for fluid (2) and two sheets of woven, knitted or non-woven fibres arranged as a double layer. The double layer comprises one or more fluid delivery regions (4, 4a) in which the sheets are held apart by a helical support (6, 6a) to define an internal cavity within the double layer. The device (1, 1a) is arranged such that, in use, fluid from the inlet (2, 2a) passes into the regions (4, 4a) and permeates out of the device through one or both of the sheets.

Also disclosed is a fabric comprising two sheets as a double layer. The double layer comprises a plurality of regions in which the sheets are held apart by a helical support to define an internal cavity within the double layer.

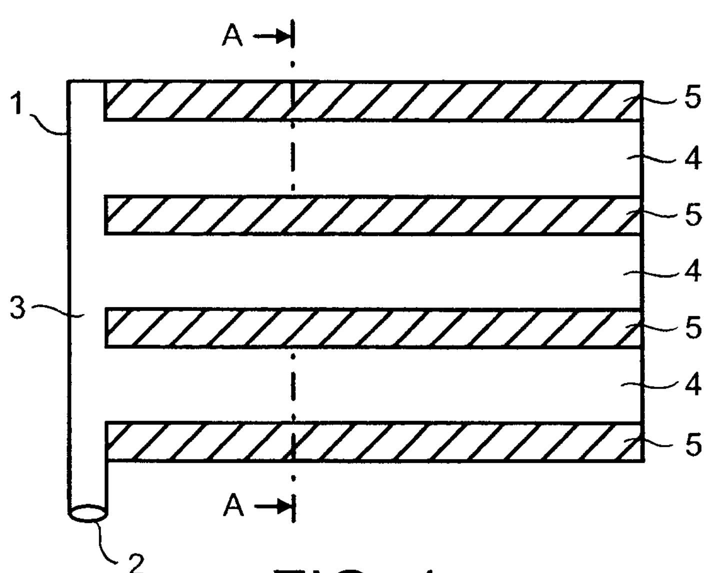

FIG. 1

Description

[0001] This invention relates to a fluid delivery device, to a garment comprising the device and to a method of delivering fluid using the device. It also relates to an air space fabric having a helical support and a mattress having a helical support.

[0002] The controlled delivery of fluids is important in many technical fields. For example, temperature regulation by air conditioning is based on the delivery of air of a predetermined temperature into a room. Also, many chemical reactions require the delivery of gas into a reaction vessel and it is often desirable to have the gas provided as a fine dispersion of small bubbles into a liquid reaction mixture in order to maximise the rate of the reaction.

[0003] It is known that large enclosed spaces, such as exist in factories, can be heated by blowing hot air into an extended tube of fabric located near to their ceilings. The hot air permeates through the fabric and thereby heats the surrounding air inside the enclosed space. Since the body of fabric into which the hot air is blown is large and tubular, there is no direction of the hot air towards a particular location. Indeed, the very purpose of the arrangement is to ensure that hot air is emitted in all directions to give uniform heating of the surroundings.

[0004] GB-A-2146114 describes the use of cool air to regulate the temperature of a vehicle seat. The air is provided to the inside of a seat having an apparently conventional seat cover with a relatively high gas permeability of 200 to 1000 $cm^3/cm^2/s$. The cavity for the air is provided by a rigid frame structure which makes this system inflexible and relevant only to this specific type of application. Also, this high level of porosity makes even distribution of the cool air over the whole of the seat cover practically impossible.

[0005] EP-A-0840072 relates to gas delivery devices based on double layer textile fabrics in which a gas is introduced between the layers and permeates out of one or both of the layers. The devices rely on the porosity of the fabric and the rate of flow of the gas being adjusted to cause inflation of at least parts of the space between the sheets of the double layer.

[0006] The devices described in EP-A-0840072 have the disadvantage that the pressure of the gas and the porosity of the fabric need to be carefully regulated to avoid over- or under-inflation of the device. Also, at relatively low inflation pressures, articles placed on a device can cause the double layers of the sheet to collapse back together and thus prevent effective gas flow around the article.

[0007] The present invention aims to alleviate the difficulties associated with the prior art devices and achieves this aim by using a specific type of support in a fluid delivery device.

[0008] Accordingly, the present invention provides a fluid delivery device comprising an inlet for fluid and two sheets of woven, knitted or non-woven fibres arranged as a double layer, wherein the double layer comprises one or more fluid delivery regions in which the sheets are held apart by a helical support to define an internal cavity within the double layer, the device being arranged such that, in use, fluid from the inlet passes into the regions and permeates out of the device through one or both of the sheets.

[0009] The helical supports used in the device of the present invention impart a number of advantages to the device. They reduce the tendency for the sheets of the double layer to collapse onto one another when a relatively heavy article is placed on the device. They also keep the sheets apart, in the vicinity of the support and this means that the fluid delivery region or regions do not need to be inflated. Thus, relatively low fluid pressures can be used with the device of the invention. A further advantage is that the device is strengthened but retains a degree of flexibility, particularly remaining bendable out of the plane of the double layer. The helical support is preferably of resiliently deformable material although the helical shape itself will impart a degree of flexibility. In one embodiment the helical support is made of a plastics material, for example an acetyl resin plastic. The helical support may have a filament which is of a "ribbon" shape (having a flat surface) which provides more comfort and is effective in increasing pressure resistance.

[0010] Furthermore, the device has other textile features including extensibility, durability to laundering or sterilising, conformability and ease of cutting to shape.

[0011] The sheets of the double layer may be of woven, knitted or non-woven fibres but are preferably woven. The terms woven, knitted or non-woven, as used herein, cover all methods of constructing an article from fibres, threads or yarn. Preferably, the sheets are woven as one fabric. The fibres may be of ceramic material, which is particularly appropriate when the device is used in a high temperature environment (e.g., greater than 250°C) but are preferably of organic polymeric material such as polyamides (e.g., nylon), aramids (e.g., Kevlar^R), polypropylene, polyester, acrylics (e.g., polyacrylate or polymethacrylate), cellulose or any other material which may be produced as a fibre. The fabric preferably has a weight of from 50 to 300 g/m^2.

[0012] The sheets may be made by conventional means well-known in the art. They may be formed as a roll of fabric which is subsequently cut to the desired lengths. The double layer arrangement of the sheets may be achieved by forming each sheet separately and then joining them by, for example, stitching, sealing, heat fusing or using an adhesive, at suitable places along the length of the double layer sheet. Alternatively, the two sheets may be formed and joined together simultaneously by conventional double layer weaving or double layer knitting methods.

[0013] The device of the invention preferably comprises an ordered arrangement of fluid delivery regions e.

g., a plurality of regions which are substantially tubular and are arranged substantially parallel to each other, across the fabric sheet. This type of arrangement has the advantage that the fabric is relatively easy to produce and that the device can be rolled up for storage purposes.

[0014] The fluid delivery regions are preferably separated from each other by areas of the double layer in which the sheets are joined together. This provides a series of separate fluid delivery regions, each of which resembles a tube when internally supported by the helical support. The sheets may be joined together either when the fabric is formed (e.g., by knitting or weaving as a single layer) or after the fabric has been formed (e.g., by treating the regions to be joined with an adhesive).

[0015] At least one of the sheets has at least a portion which is fluid permeable. The permeability of the sheet is chiefly due to the pores between the fibres (e.g., in the threads) which make up the sheet. Preferably, the permeability is within the range from 0.1 to 10,000 $dm^3/m^2/s$, more preferably 1 to 1,000 $dm^3/m^2/s$. Typically, the whole of the sheet, where not adhered to the other sheet in the double layer, will be fluid permeable. However, when used in the device of the invention, the sheet may be treated or joined to the other sheet such that only a portion of it is gas permeable. The degree of permeability of the sheet after it has been formed may be suitable for many applications and it may not therefore require further treatment. However, if the permeability of the sheet needs to be reduced for a given application, this can be achieved by treating the sheet such that a proportion of the pores between the fibres become partially or completely blocked. Blocking of the pores in this way may be carried out by methods which are well-known in the art such as treatment with an aqueous dispersion of a polymer (e.g., PVC, polyacrylate or polyurethane) or transfer coating with an impermeable polymer film.

[0016] In one embodiment of the invention in which both sheets of the double layer fabric in the device are permeable to fluid, the device may comprise a series of two or more superimposed double layers which are stacked such that the fluid delivery regions in one part of the double layer overlap the areas in which the sheets are joined together in an adjacent double layer. In this way, the device can be made such that when viewed in cross-section perpendicular to the plane of the double layer, a helical support is always present. Such an arrangement is advantageous if the device forms all or part of a garment which is required to provide the wearer with protection against attack (e.g., by a sharp object). The overlapping double layers may be part of the same continuous sheet (i.e., overlapped on itself) or they may be separate sheets connected to the same or different fluid inlets.

[0017] In an alternative embodiment of the invention in which the double layers do not overlap, one of the sheets may be fluid permeable and the other may be substantially impermeable. Such an arrangement has the advantage of allowing fluid to be delivered from all (or part) of one face of the double layer sheet only. The ability to direct fluid in this way is a clear advantage of the invention. The sheet which is substantially impermeable may be formed initially in the same way as the fluid permeable sheet and subsequently treated with a material which renders the sheet substantially impermeable. Treatments to render the sheet impermeable include, for example, coating the sheet with an impervious coating of a polymer (such as a film of polyurethane, polyethylene or polypropylene) which may be applied to the sheet using an adhesive either directly or indirectly by transfer from a release paper. Alternatively, the substantially impermeable sheet may be formed separately from the permeable sheet and may be made substantially impermeable by increasing the density of the fibres in the fabric and/or reducing the size of the pores.

[0018] The device comprises an inlet for fluid which directs fluid to the region or regions between the sheets. Fluid may be supplied by any means of providing fluid at a pressure greater than atmospheric pressure such as a compressor or a cylinder of pressurised gas. If the device has more than one fluid delivery region, the inlet may comprise a manifold arrangement for directing fluid from a single supply to each of the fluid-delivery regions of the device.

[0019] The device of the invention is particularly useful in clothing which is intended to regulate air flow and the temperature of air, around parts of the body. Therefore, the present invention also provides a garment comprising the device of the invention. The garment may be a jacket or a bodysuit, such as a flying suit, and may provide the wearer with a degree of protection against sharp objects and/or projectiles. The garment can also provide the wearer with some protection against impact or friction. Clearly, the choice of materials for the double layer and the helical support will dictate the protective properties of the garment in this regard. A garment comprising the device of the invention also has the advantage that the sheets of the double layer do not simply collapse on themselves in the event of a failure of the gas supply and the wearer is therefore left with a degree of circulation of air. The device may also be used in, for example, insulation garments (e.g., underwater wear or gloves). It may also provide an air gap for shoes or back packs or the like.

[0020] An embodiment of the invention which is particularly suitable for use in a garment comprises fluid delivery regions which are connected to the inlet for fluid and fluid delivery regions which remain unconnected or connected to fluid at reduced pressure. Where the device of the invention comprises an ordered arrangement of a plurality of substantially parallel fluid delivery regions, this can be achieved by connecting only alternate fluid delivery regions to the inlet for fluid, for example. By keeping fluid delivery regions unconnected in this way, fluid (e.g., air) may be allowed to circulate away from the skin of the wearer of the garment and this can be useful in the event of a failure of the fluid flow.

[0021] An alternative embodiment of the invention particularly suitable for use in a garment has an impermeable or reduced permeability coating on one of the sheets which is discontinuous such that the device still permits the flow of fluid through the two sheets. Such a device may be produced by coating one of the sheets (i.e., on one face of the double layer only) over the fluid delivery regions, such that the fluid is delivered predominantly or only from one face of the double layer, and leaving the areas between the fluid delivery regions uncoated so that fluid can permeate through these areas. Alternatively, the whole of one face of the double layer fabric can be coated and then parts of the coated layer can be removed to leave a single layer of fabric as the area between the fluid delivery regions. Thus, the wearer of the garment is again provided with a degree of "breathability" in the garment in the event of a failure of the fluid flow. This embodiment of the invention may involve a series of overlapping double layers.

[0022] The nature of the fluid which is delivered by the device will depend on its intended use. The fluid may be a liquid or a liquid/gas mixture but is preferably a gas. For example, in the case of the garments mentioned above, the gas will, typically, be air. Generally, the gas may consist of a single element or compound or may comprise a mixture of two or more elements or compounds. Reactive gases (such as hydrogen or the halogens) may be used, for example where the device is used to deliver a gas into the liquid phase of a chemical reaction. Alternatively, the device may be used to supply relatively inert gases (such as argon and the other noble gases, carbon dioxide or nitrogen) to provide an inert gas atmosphere. The device may also be used in the aeration of water, for example. Gases might also be delivered to plants to control their growth or their ripening e.g., carbon dioxide which can speed up the growth rate of plants such as tomatoes.

[0023] In another application, the device of the invention may be used in a spurge system for the scrubbing of air. Soiled air is pumped into the device by way of the fluid inlet, with the device being present within a tank of aqueous cleansing solution. The air permeates out of the device as a fine dispersion of bubbles enabling efficient cleansing of the air by the cleansing solution.

[0024] The device may also be used to regulate the temperature of an article or a region by a method which comprises delivering gas of a predetermined temperature. For this application, the gas is preferably air. A particular application of the device is in maintaining comestible products (such as packaged or unpackaged foodstuffs) at a temperature below room temperature (e.g., -10 to 10°C). Conventionally, the transport of comestible products within a food processing or packaging facility, for example on a conveyor belt, has caused difficulties since it has been necessary either to transport the products quickly through an area which is at room temperature (which may be undesirable as regards the perishability of the product) or to keep the whole of the area at a reduced temperature (which is undesirable for an area in which people need to work). The device of the present invention overcomes these problems since it allows cold air to be supplied directly to the product and its immediate surroundings and therefore need not significantly affect the environment outside this zone. Since the device of the invention can be made light and flexible, it may itself form the conveyor belt on which the food is transported. The device of the invention is particularly advantageous for this application because the helical supports allow the flow of air (or other gas) to be maintained when a heavy article is placed on the device or when the device is bent or kinked. Alternatively, one or more than one of the devices of the invention can be disposed above a conventional conveyor belt to direct cold air at the product. The device or devices may also be disposed above or below a conveyor belt which allows air to pass through it by, for example, being made from a chain-type arrangement. The device has the advantage of greatly reducing the tendency for moisture from the surrounding warmer air to condense onto the foodstuff or its packaging.

[0025] The device of the invention may be used in other areas in the food industry. For example, it may be used as a support for foodstuffs in display areas (e.g., display cabinets). It may also be used for the rapid chilling or freezing of foodstuffs, for example, by supplying cooled gas (e.g., air); such an arrangement has the advantage of being able to supply the cooling effect directly to where it is needed. It may also be used in trays used in the transit of food, or shelves in storage rooms to provide rapid cooling of cooked foods etc.

[0026] Examples of other applications in which the device of the invention may be useful are in ventilated seats (e.g., for transport vehicles, such as cars, lorries or trains), blankets for providing a heating or cooling effect, articles for the healing of wounds, hot or cold treatment of joints, and incontinence bedding or clothing. Furthermore, the device of the invention may also be used in other agriculture applications (for example, in undersoil irrigation, aeration of soil or grain in silos, providing localised warm air to plants or to provide a microclimate for mushrooms), or to provide an under tarmac or temporary road surface, or to provide an insulation gap for walls, or as a low water drag hull covering in boats.

[0027] The device of the invention may be partially connected to a source of reduced pressure. By connecting parts of the device to a source of fluid at a pressure above atmospheric pressure and other parts of the device to a source of reduced pressure, the fluid can be recirculated (or otherwise recycled) using the device. For example, where the device of the invention comprises a plurality of fluid delivery regions, alternate regions may be connected to a source of fluid and to the source of reduced pressure, respectively. Thus, the general direction of fluid flow is from one fluid delivery region, over the surface of the device, to a neighbouring region. The helical supports prevent the regions which are connected to the source of reduced pressure from collapsing.

[0028] The device of the invention may also be wholly connected to a source of reduced pressure. This allows the device to be used as a filter, in certain applications, by inserting the device into a liquid containing solid particles and applying the reduced pressure to the device such that only the liquid is drawn through the device with the solid being unable to pass through the sheets of the double layer. The helical supports again prevent collapse of the regions which are under reduced pressure.

[0029] The device of the invention may also be used in applications where a forced supply of fluid to the device is not required. In these applications, therefore, an inlet for fluid is not needed. Thus, in another embodiment, the invention provides a fabric comprising two sheets of woven, knitted or non-woven fibres arranged as a double layer wherein the double layer comprises a plurality of regions in which the sheets are held apart by a helical support to define an internal cavity within the double layer. Conventionally, spacer fabrics are generally used to keep two surfaces apart whilst providing a degree of thermal insulation and, preferably, air flow in the region between the surfaces. In one embodiment of the invention, the fabric of the invention allows fluid to flow into the regions in which the sheets are held apart by the helical supports (e.g., by keeping the ends of the regions, at the edge of the fabric, open) and, preferably, to permeate through one or both of the sheets. The fabric is preferably knitted. However, in an embodiment in which fluid is not allowed to permeate through one or both of the sheets, the fabric may be in the form of an air space fabric or the like having a helical support. The invention may provide a significantly higher crush resistance than conventional spacer fabrics and be light in weight.

[0030] In the embodiment in which a fluid inlet is not needed, the sheets and helical support may take the optional or preferred forms mentioned above. Furthermore, in order to maximise freedom of air access to the skin when used as bedding, clothing or the like, the fabric may have a high percentage of fluid relative to solid material (fibres and helical supports), for example of the order of 95% to 5% by volume. Typically, the thickness of the fabric without an inlet may be between 0.5 to 1cm in such embodiments, but any suitable thickness could be used.

[0031] This device may be used in many of the applications mentioned above, for example in garments. In the embodiment in which fluid is not allowed to permeate either of the sheets, it is particularly useful for insulation garments, such as underwater wear or gloves, or to provide an insulation gap for walls, or in loft insulation. An especially high insulation effect could be provided if a vacuum is created within a structure which has an impermeable coating on both faces and sealed edges. An effect similar to that found in vacuum flasks and can be achieved in garments for example, if a reflective surface is provided on the inner face, for example if it is aluminised. In the embodiment in which a vacuum is provided a coating provided may be a nitrile coating to prevent a reduction in the vacuum. However, when used to provide an air gap for shoes or back packs or the like, an impermeable coating would not be required over the whole of the device.

[0032] In a preferred embodiment of the invention, the device is formed from two sheets of fabric with alternate bands of the sheets being joined together (for example, by being woven, sealed or adhered to each other) and being unconnected, across the direction of production of the fabric. Helical supports are put into the fluid delivery regions to provide a structure which resembles a series of connected parallel tubes and the regions in which the sheets are unattached are connected to an inlet for fluid at one edge of the sheet and are sealed at the opposite edge (again, for example, by being woven, heat sealed or adhered to each other).

[0033] According to a further aspect of the present invention, there is provided a mattress comprising two sheets arranged as a double layer, wherein the double layer comprises a plurality of regions in which the sheets are held apart by a rotatable helical support lying substantially in the plane of the sheets to define an internal cavity within the double layer. Whilst the sheets may be formed of any material they are preferably of woven, knitted or non-woven fibres. This embodiment is particularly useful to prevent or reduce bed sores or the like as the rotatable supports provide a constantly movable surface when activated. A foam layer may be provided on top of the double layer. The supports may be activated by any mechanism, one example being a switch connected to a rack and pinion arrangement. The supports are preferably coated with a friction-reducing substance, for example PTFE and preferably adjacent supports are formed in opposition orientations ("S" or "Z" forms) to each adjacent support to prevent significant movement of a patient relative to the mattress. The device differs from existing bed-sore prevention devices in that the movement is on such a small scale that injured patients would not suffer aggravation of injury. The mattress may be provided with a fluid inlet from which fluid may pass into the regions and permeates out, although this is not essential.

[0034] Preferred embodiments of the invention will now be described, by way of example only, with reference to the accompanying drawings wherein:

Figure 1 shows a device according to the invention;

Figure 2 illustrates a helical support which may be used in the device of the invention;

Figure 3 is a perspective view, in cross-section, showing the arrangement of fluid delivery regions in a device of the invention;

Figure 4 depicts a device of the invention in which the double layers overlap;

Figure 5 shows a device according to the invention which is a modification of the device of Figures 1 and 3; and

Figure 6 (a) and (b) show possible opposite orientations of the helical support.

[0035] Referring to Figure 1, fluid delivery device 1 comprises an inlet for fluid 2 which directs fluid via manifold 3 to fluid delivery regions 4. The fluid delivery regions 4 are formed as part of a sheet of double layer fabric which comprises joined areas 5 in which the two layers of the fabric are attached (or woven together) as a single sheet and unjoined areas which constitute fluid delivery regions 4. Connection between manifold 3 and regions 4 can be via direct connection of manifold 3 to each of regions 4 or by way of intermediate connecting tubes (not shown in the figure).

[0036] The fabric used to make the double layer can be of any fibres (e.g., polyamide, such as nylon or polyaramid, or polyester) depending on the use to which the device 1 is to be put. If parts of the fabric are desired to be impermeable to the fluid, then these parts can be treated with a coating.

[0037] The ends of the fluid delivery regions 4 which are furthermost from the manifold 3 are sealed. Thus, when fluid (e.g., gas) is introduced through inlet 2 and passes through manifold 3 and into fluid delivery regions 4, it exits from device 1 by passing out of the permeable sheet or sheets which form the boundaries of regions 4.

[0038] Regions 4 are supported by helical supports (not shown in the figure) and a suitable helical support 6 is shown in Figure 2. Helical support 6 may be a coiled spring of resiliently deformable material (such as metal, for example).

[0039] Figure 3 is a perspective view showing a cross-section along line A-A of Figure 1 and shows how helical supports 6 reinforce fluid delivery regions 4. In this figure, the lower sheet 8 of the double layer has applied to it an impermeable layer 7, although it could equally be permeable like the upper sheet 9. Helical supports 6 maintain regions 4 in a substantially tubular form.

[0040] Figure 4 is a perspective view, from the same angle and for the same cross-section as Figure 3, illustrating an embodiment of the invention in which the device 1 contains overlapping double layer fabrics 10, 11. In this embodiment of the invention, the sheets are permeable where the two fabrics 8, 9 meet (the fabrics 10, 11 may be different fabrics or different parts of the same fabric). With this overlapping arrangement, helical supports 6 strengthen the device 1 and can provide a barrier to penetration of the device 1 across the whole of its width and length.

[0041] In Figure 5, a modification of the device of Figures 1 and 3 is shown. In the device 1a of Figure 5, fluid delivery regions 4a, supported by helical supports 6a, have an impermeable layer 7a applied to their lower sheet 8a. Impermeable layer 7a can be applied throughout the length of fluid delivery regions 4a or to only parts of the fluid delivery regions 4a and may be applied to all of the fluid delivery regions 4a or only to some of them. By coating fluid delivery regions 4a with impermeable layer 7a, fluid permeates only out of upper sheet 9a of fluid delivery regions 4a and thus fluid is delivered from one face only of device 1a i.e., the uppermost face as shown in the Figure. Fluid delivery regions 4a are separated by joined areas 5a in which the two layers of the fabric are woven as a single sheet (or otherwise joined together). Unlike the device shown in Figures 1 and 3, joined areas 5a do not have an impermeable layer applied thereto and, therefore, they retain their permeability to fluid. The permeability of joined areas 5a makes the device 1a shown in Figure 5 particularly advantageous for use as part of a garment. Using the device 1a in a garment means that fluid (e.g., gas) can be directed at the wearer of the garment from one face of the device 1a only (i.e., the uppermost face as shown in the Figure), avoiding wasteful flow of fluid away from the wearer as a result of impermeable coating 7a, and, in the event of an interruption in the fluid flow (e.g., because of a pump failure), the permeability of joined areas 5a allows warm air and moisture to circulate around and away from the wearer's skin. Sections of the coated layer 7a could be cut away to increase the natural breathability of the product, if desired.

[0042] The devices 1, 1a shown in Figures 1, 3 and 5 are suitable for use as other fabrics of the invention if constructed without inlet 2 and manifold 3 shown in Figure 1. When the devices are used as such fabrics, the ends of the fluid delivery regions 4 which are furthermost from the manifold 3 are preferably left open (i.e., they are not sealed).

[0043] The above arrangements can be used in a mattress to prevent or diminish bed sores or the like if the helical supports 6 and 6a are rotatable to provide a constantly moving surface on which a patient lies. The helical supports 6, 6a lie substantially in the same plane as the sheets as shown in, for example Figure 3. A rack and pinion mechanism may be used to rotate the supports 6 or 6a. To prevent a patient being caused to be moved up or down a mattress comprising such a device, each helical support is in an opposite orientation to its adjacent helical supports. These orientations are shown in Figure 6 in which Figure 6 (a) shows the "Z" form and Figure 6 (b) shows the "S" form. In this embodiment a friction-reducing coating is on the helical supports 6 or 6 (a) in order that they can continue to rotate even whilst under the weight of a patient.

Claims

1. Fluid delivery device comprising an inlet for fluid and two sheets of woven, knitted or non-woven fibres arranged as a double layer, wherein the double layer comprises one or more fluid delivery regions

in which the sheets are held apart by a helical support to define an internal cavity within the double layer, the device being arranged such that, in use, fluid from the inlet passes into the regions and permeates out of the device through one or both of the sheets.

2. Device as claimed in claim 1, wherein the sheets comprise a fabric of woven fibres.

3. Device as claimed in claim 1 or claim 2, wherein the two sheets are woven as one fabric.

4. Device as claimed in any one of claims 1 to 3, which comprises a plurality of fluid delivery regions which are substantially tubular and are arranged substantially parallel to each other.

5. Device as claimed in claim 4, wherein the fluid delivery regions are separated from each other by areas of double layer in which the sheets are joined together.

6. Device as claimed in any one of claims 1 to 5, wherein the helical support is of resiliently deformable material.

7. Device as claimed in claim 5 or claim 6, which comprises two or more double layers stacked together.

8. Device as claimed in claim 7, wherein the double layers are stacked such that the fluid delivery regions in one double layer overlap the areas in which the sheets are joined together in an adjacent double layer.

9. Device as claimed in any one of claims 1 to 8, wherein one of the sheets of one or more of the fluid delivery regions is impermeable to fluid.

10. Device as claimed in claim 9, wherein one sheet of each fluid delivery region is impermeable to fluid, with all of the impermeable sheets being on the same side of the double layer, and the areas between the regions are permeable to fluid.

11. Garment comprising the device of any one of claims 1 to 10.

12. Method of delivering fluid comprising providing the fluid from a device according to any one of claims 1 to 10.

13. Method as claimed in claim 12, wherein the fluid is a gas of a predetermined temperature such that it regulates the temperature of its surroundings.

14. Method as claimed in claim 13, wherein the gas is at a temperature below room temperature.

15. Method as claimed in any one of claims 12 to 14, wherein the gas is delivered to a comestible product.

16. Fabric comprising two sheets of woven, knitted or non-woven fibres arranged as a double layer, wherein the double layer comprises a plurality of regions in which the sheets are held apart by a helical support to define an internal cavity within the double layer.

17. A fabric according to claim 16, wherein at least a portion of the sheets is permeable to fluid.

18. A fabric according to claim 16, wherein both of the sheets are impermeable to fluid.

19. A fabric according to claim 18, wherein a vacuum is provided in the internal cavity.

20. A mattress comprising two sheets arranged as a double layer, wherein the double layer comprises a plurality of regions in which the sheets are held apart by a rotatable helical support lying substantially in the plane of the sheets to define an internal cavity within the double layer.

21. A mattress according to claim 20, wherein the helical support is coated with a friction-reducing substance.

22. A mattress according to claim 20 or 21, wherein each helical support is formed in an opposite orientation to an adjacent helical support.

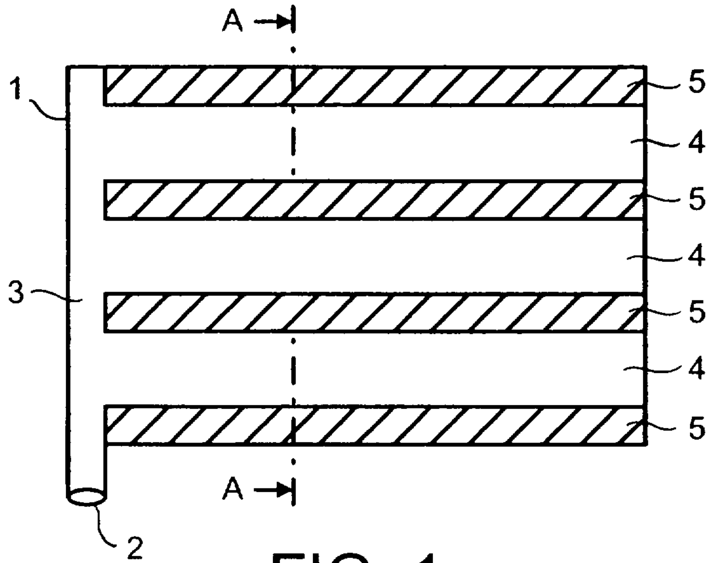

FIG. 1

FIG. 2

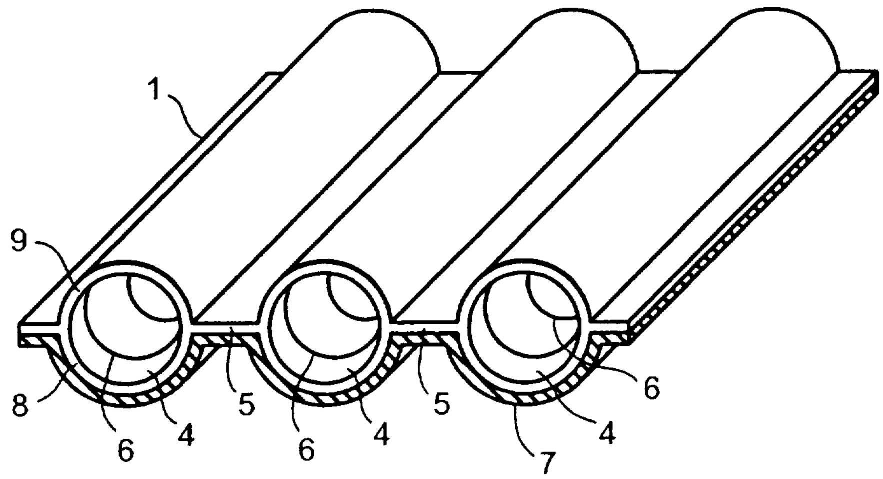

FIG. 3

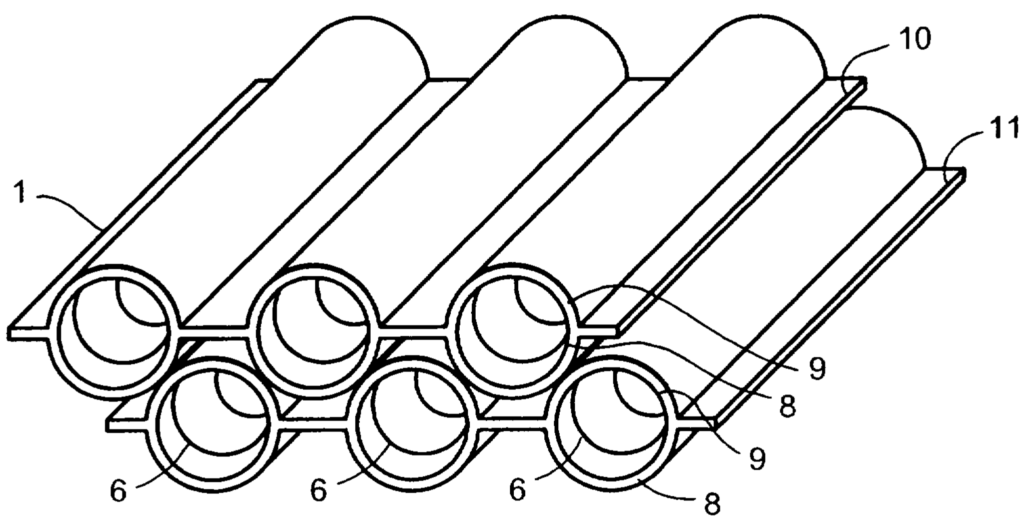

FIG. 4

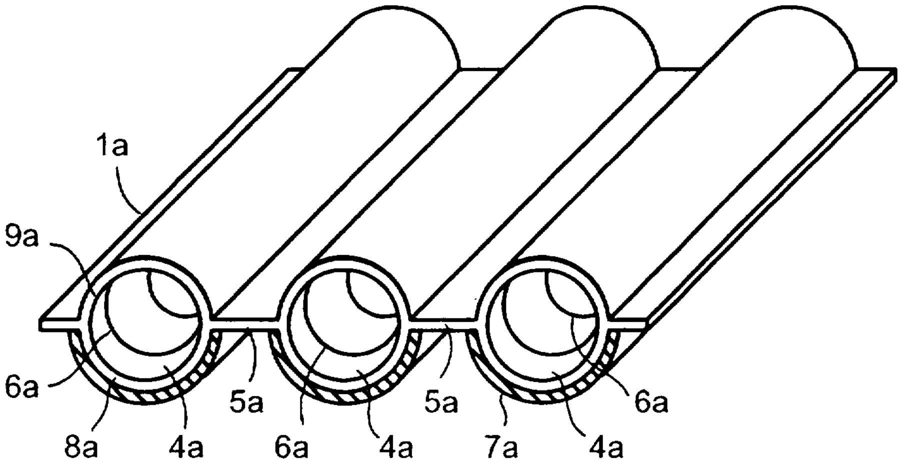

FIG. 5

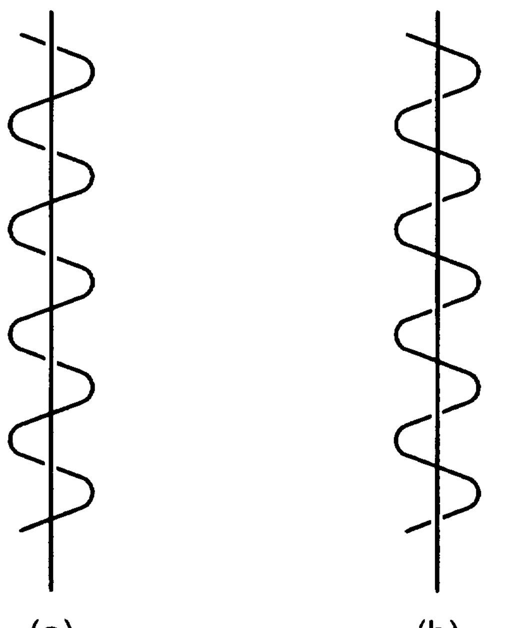

FIG. 6

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EUROPEAN SEARCH REPORT

Application Number
EP 99 30 9484

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Place of search	Date of completion of the search	Examiner
THE HAGUE	7 January 2000	Gonzalez-Granda, C

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