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A4M M1B1 M1B4 M1B5 M1B7 M1D3 M1D4

(56) Documents Cited
GB 2149655 A **GB 1350110 A** **WO 97/19619 A1**
DE 003937214 A **US 5394577 A** **US 4347633 A**
US 4280487 A

(58) Field of Search
UK CL (Edition R) **A4M**
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(54) Abstract Title
Alternating pressure mattress with foam upper layer.

(57) An alternating pressure mattress is provided with an upper visco-elastic foam layer to reduce the pressure variation felt by a patient lying on the mattress. The foam layer may extend into gaps between the cells making up the mattress. A foam layer may also be provided beneath the cells so that the mattress has a more conventional appearance.

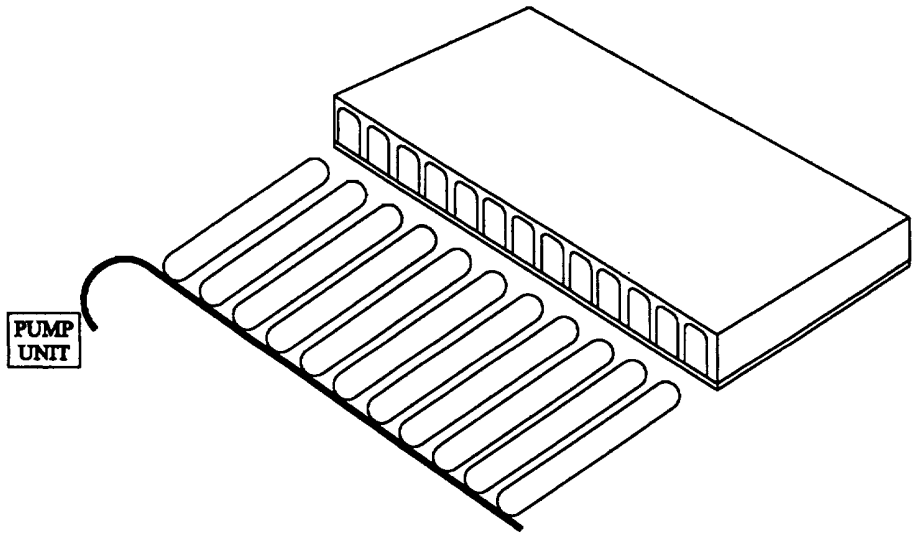


FIG. 3

GB 2 346 553 A

At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

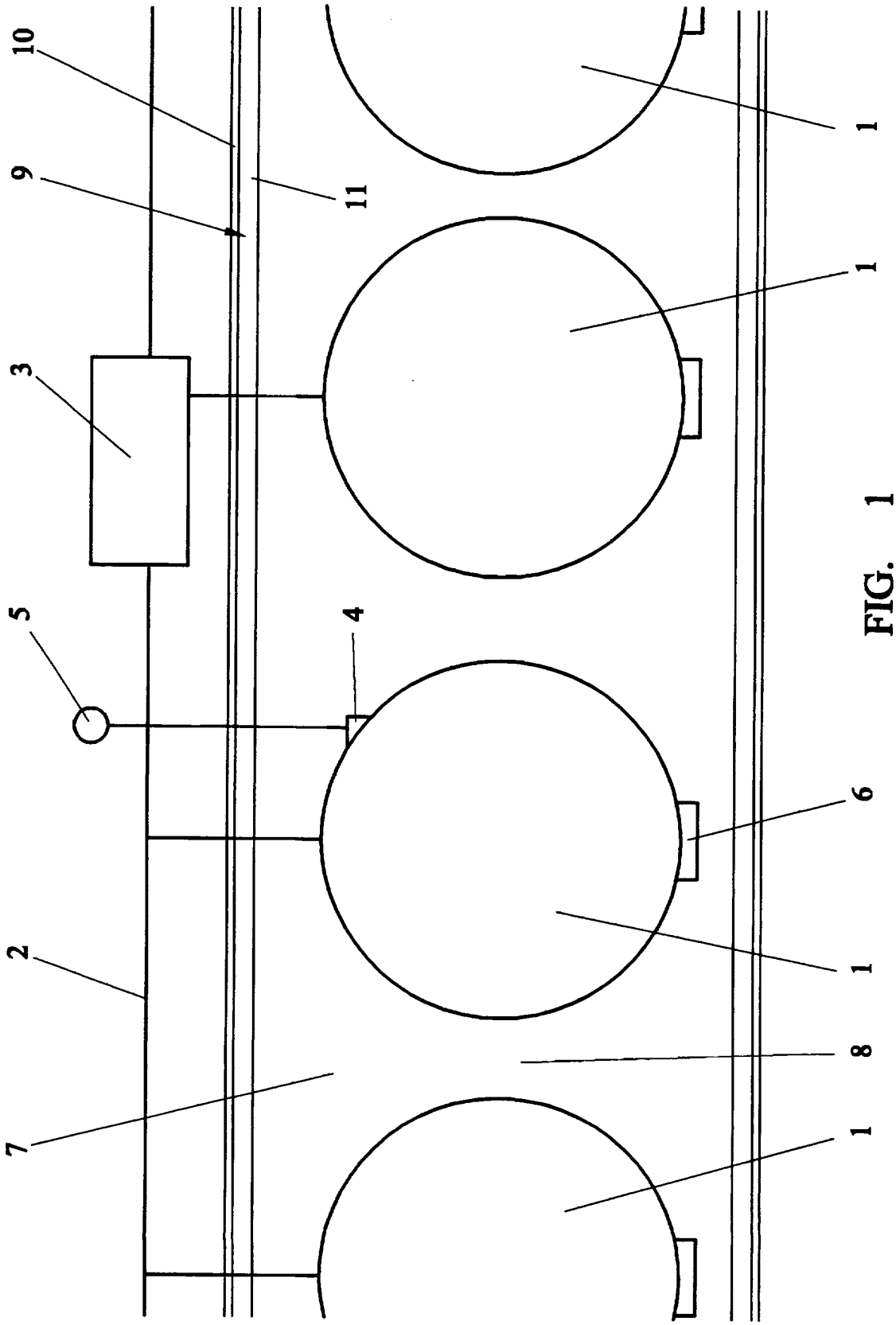


FIG. 1

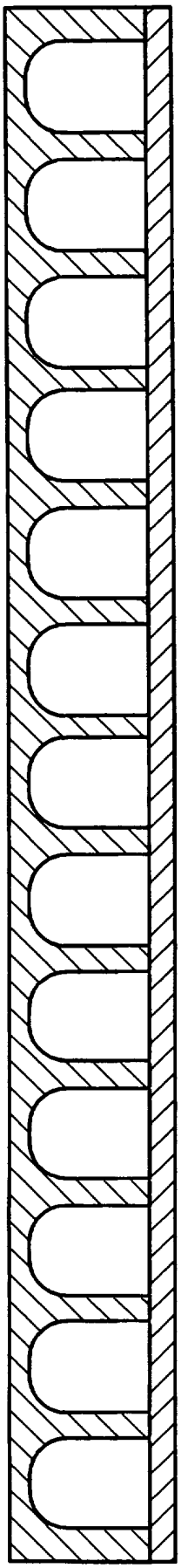


FIG. 2

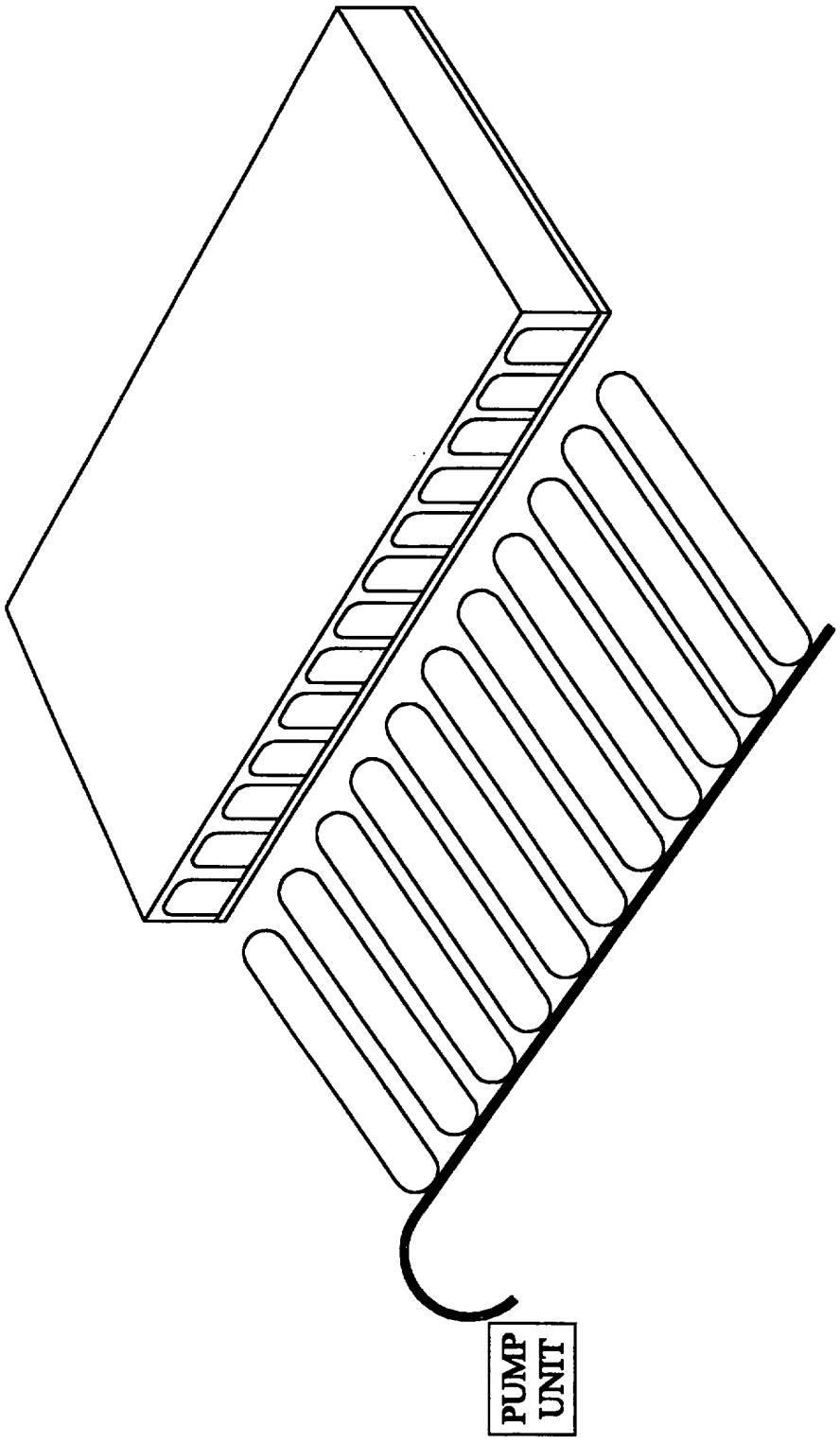


FIG. 3

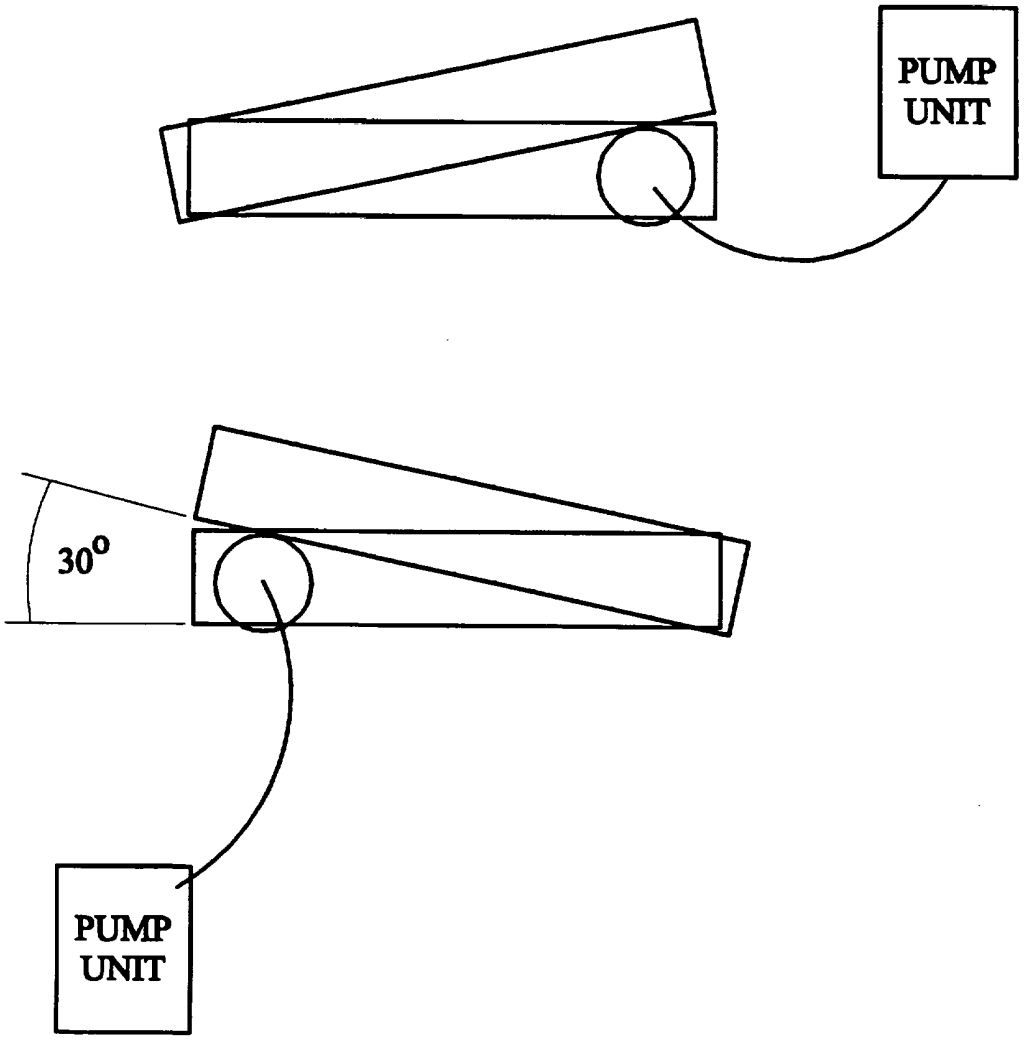


FIG. 4

A MATTRESS

The present invention relates to a mattress for retarding the development of ulcers. More particularly, but not exclusively, the present invention relates to a mattress comprising a plurality of inflatable bladders covered by a visco elastic foam layer.

The development of pressure ulcers by bed bound patients is a well known problem. In hospitals the nursing staff tend to turn patients typically every two or three hours to inhibit the development of such ulcers. This is time consuming and can occasionally result in injury to the nursing staff.

Dynamic air flotation mattresses are well known in the field of ulcer reduction. Such mattresses comprise a series of transverse air filled tubes which provide a flotation base beneath the patient. A control unit inflates and deflates these tubes to ensure that the pressure points beneath the patient alter continuously. Since no one point under the patient is continuously exposed to pressure from the mattress ulcer formation is inhibited. Such mattresses are used for patients at high risk of decubitus ulcer development or tissue damage.

However, such flotation mattresses can create a feeling of obvious motion. Coherent patients with good sensations can feel this motion and instantly and immediately dislike the feeling.

Accordingly, a first aspect of the present invention provides a mattress for assisting in the treatment of ulcers comprising:

a plurality of inflatable bladders defining a support surface for supporting a patient;

a control system for supplying pressurised air to the bladders for selective inflation and deflation of the bladders; and

a visco elastic foam layer covering at least a portion of the support surface.

The visco elastic layer reduces the motion feeling increasing patient comfort and reducing peak pressures generated by the bladders. The visco elastic layer therefore acts like a damper or shock absorber and absorbs the energy output from the inflated core. Also, the visco elastic layer allows greater patient conformity i.e. allows the distribution of patient load over a wider surface area.

In addition, the inflatable bladder of known flotation mattresses are made from materials having very little stretch. Such material result in localised contact areas between the patient and the mattress resulting in a localised pressure being applied to the skin of the patient. Whilst the points of contact between the mattress and the patient vary as the bladders inflate and deflate this can still result in decubitus ulcer formation. The visco elastic foam layer of the mattress according to the invention disperses the pressure between patient and mattress over a wide area, inhibiting peak pressure build up.

Also, the mattress according to the invention is suitable for use by low risk to critical care patients. By maintaining the inflation bladders at a constant pressure the mattress functions as a standard visco elastic foam mattress suitable for use by low risk patients. By varying the pressure in the inflation bladders the mattress becomes suitable for use by critical care patients i.e. it acts as an alternating pressure therapy unit.

Preferably, the inflatable bladders are separated by visco elastic foam walls. Such walls absorb the horizontal forces being exerted on the sides of the inflatable bladder walls when the patient is on the mattress. This results in a more gradual reduction in pressure on the patient as the pressure in the inflatable bladders is varied, increasing patient comfort.

The foam can be temperature and/or pressure sensitive. This allows the foam to mould itself around the patient and thereby increases patient comfort and pressure reduction.

The foam can be breathable and preferably open celled. This reduces moisture build-up within the foam and ensures a cool and airy microclimate under the patient.

The inflatable bladders can be positioned within the visco elastic foam mattress. The mattress has the appearance of a standard mattress rather than a floatation device. This has a significant patient perception advantage.

The mattress can be coated in a poly-urethane cover, preferably a thermoplastic cover. This prevents entry of fluids and bacteria into the foam layer. This enables cleaning or washing down to be performed by infection control/hospital cleaning staff, rather than being taken off site.

Preferably the cover is impermeable to fluids but permeable to vapours. This maintains breathability between the patient and the mattress preventing a moist microclimate developing beneath the patient which would lead to skin tissue breakdown.

Preferably the control system comprises a rapid deflation valve for deflating the bladders. This enables the mattress to be rapidly deflated, for example, it is required to apply CPR to the patient.

The mattress can further comprise a pressure sensor for monitoring the pressure in at least one inflatable bladder. This enables the control system to maintain the correct pressure within the bladders. Preferably, the pressure sensor generates an alarm signal if the pressure in the bladder drops.

Preferably the control system can be programmed to inflate and deflate the bladders on a plurality of different cycles.

In a further aspect of the invention there is provided a mattress for assisting in the treatment of ulcers comprising:

a plurality of inflatable bladders defining a support surface for supporting a patient;

a control system for supplying pressured air to the bladders for selective inflation and deflation of the bladders; and

a visco elastic foam shell adapted to absorb pressure so reducing the pressure between patient and mattress.

The present invention will now be described by way of example only, and not in any limitative sense, with reference to the accompanying drawing in which:

Figure 1 shows in cross section, a first embodiment of a mattress according to the invention;

Figure 2 shows, in cross section, a second embodiment of a mattress according to the invention.

Figure 3 shows, in perspective view the second embodiment of the invention with the air bladders removed.

Figure 4 shows, in cross section, a rotational therapy base which may optionally be used with a mattress according to the invention.

The mattress shown in Figure 1 comprises a series of inflatable bladders (1) each in the form of a tube. The tubes, in combination, define a support surface for supporting a patient.

The inflatable bladders (1) are manufactured from high stretch hydrophobic polyurethane material . The stretch in the material ensures full patient conformity and reduces shear forces on the skin tissue. These shear forces are a key contribution to skin breakdown.

In an alternative embodiment the inflatable bladders (1) are manufactured from a nylon material with a thermoplastic polyurethane coating. Such a coating has microscopic holes which allow some air loss from the bladders during use thereby reducing mattress temperature and assisting the healing of open wounds.

Typically the bladders are approximately 90 cm in length and 14cm in diameter. This depends upon mattress size and clinical/patient requirements.

The inflatable bladders (1) are connected via air lines (2) to a control system (3). The control system (3) selectively supplies pressurised air to the bladders (1) to control their inflation and deflation.

In use the control system inflates and deflates each tube (1) independently. Typically AB or ABC alternating cycles are used. In an AB alternating cycle each tube (1) is inflated and deflated out of phase with its neighbour. In an ABC cycle tubes A and B inflate whilst C deflates, then B and C inflate whilst A deflates and so on. Cycle time is typically of the order 6 minutes for high risk patients, 10 to 15 minutes for medium risk patients and 15 to 21 minutes for low risk patients. Such cycles ensure that the points of contact between the patient and mattress vary slowly over time.

The maximum and minimum air pressures in the air bladders (1) during each cycle can be varied by programming the control system (3). This is to allow for patients of different weights.

Each bladder can be easily and immediately removed and exchanged if damaged or punctured. The pressure feedback sensor system (4) in the pump unit sounds an alarm and activates a visual alarm if a pressure drop due to tube damage is detected by the sensor.

The pressure control system can be programmed with different cycles depending on the patient weight. If the feedback pressure sensor system detects from pressure measurement that the incorrect patient weight has been entered the visual alarm will be activated. If this is not corrected then the audible alarm will be activated.

The bladder system comprises two rapid deflation valves for rapid deflation of the mattress tubing. When opened these allow deflation of the mattress within approximately ten seconds.

In this embodiment the bladders (1) are embedded within a visco elastic foam shell (7). The foam shell is pressure sensitive. The foam typically has an uncompressed density of between 58 kg and 62 kg, a hardness of 80-120 N at 20°C, and is fire retardant. The foam is open celled and breathable.

The foam (7) extends in walls (8) between the air bladders (1). For this type of foam the walls (8) are optimally between 10 and 20mms thick. Such walls (8) slowly absorb the forces exerted by the inflatable bladders (1) thereby reducing peak pressures of the patient mattress/patient interface. This results in a more gradual reduction in pressure beneath the patient enhancing patient comfort and reducing the alternating flotation feel of the bladder system. If this layer is less than 10mm thick the layer will compress too easily and the comfort aspect will be lost. If the layer is thicker than 20mm then the benefit of the inflatable bladders (1) is lost.

The foam (7) is sealed within a plastic polyurethane multi-stretch cover (9). The cover (9) is made from coated polyurethane coating (10) on a polyester weave (11). The cover (9) is constructed from a plurality of layers to ensure impermeability to fluids but rapid vapour permeability. This allows moisture within the foam (7) to escape through the cover (9).

The coating (10)and base weave (11) are designed to have, as close as possible, equal stretch coefficients. This reduces the shear forces between the coating (10) and the base weave (11) which prevents the separation of these layers.

The coating layer (10) can be washed down by hospital cleaning staff or laundered or autoclaved on site. There is

no need for the mattress to be decontaminated by a specialist technique. This considerably reduces maintenance costs.

The base weave layer (11) typically has a weight of between 125 and 150 g/m^2. The coating (10) typically has a weight of approximately $100g/m^2$.

Shown in figure 2 is a further embodiment of a mattress according to the invention, shown in cross section. In this embodiment the foam layer (7) comprises two parts. The first part comprises a plurality of recess into which the open bladders are inserted. The second part of the foam layer is in the form of a sheet which is attached to the first part as shown to cover the recesses.

This mattress comprises a plurality (typically 13) of inflatable bladders and also at least one static tube in the head section of the mattress. The static tube is designed to keep the head section under the pillow stable . Inflation/deflation of this area is uncomfortable for the patient.

Figure 3 shows the mattress of figure 2 with the air bladders removed.

Shown in figure 4, in cross section is a rotational therapy base which may optionally be used to rotate the bed from one side to another. The rotational therapy base comprises a plurality of bladders which can, when selectively inflated or deflated pivot the mattress about its long axis as shown.

Claims:

1. A mattress for assisting in the treatment of ulcers comprising:

a plurality of inflatable bladders defining a support surface for supporting a patient;

a control system for supplying pressurised air to the bladders for selective inflation and deflation of the bladders; and

a visco elastic foam layer covering at least a portion of the support surface.

2. A mattress as claimed in claim 1, wherein the foam is pressure and/or temperature sensitive.

3. A mattress as claimed in either of claims 1 or 2 wherein the inflatable bladders are separated by visco elastic foam walls.

4. A mattress as claimed in either of claims 1 to 3, wherein the foam is breathable.

5. A mattress as claimed in any one of claims 1 to 4, wherein the inflatable bladders
are positioned within the visco elastic foam mattress.

6. A mattress as claimed in any one of claims 1 to 5, wherein the mattress is coated in a polyurethane cover, preferably a thermoplastic cover.

7. A mattress as claimed in claim 6, wherein the cover is adapted to be impermeable to fluids but permeable to vapours.

8. A mattress as claimed in any one of claims 1 to 7, wherein the control system comprises at least one rapid deflation valve for deflating the bladders.

9. A mattress as claimed in any one of claims 1 to 8, further comprising a pressure sensor for monitoring the pressure in at least one inflatable bladder.

10. A mattress as claimed in any one of claims 1 to 9, wherein the control system can be programmed to inflate and deflate the bladders in a plurality of different cycles.

11. A mattress for assisting in the treatment of ulcers comprising:

a plurality of inflatable bladders defining a support surface for supporting a patient;

a control system for supplying pressured air to the bladders for selective inflation and deflation of the bladders; and

a visco elastic foam shell adapted to absorb pressure so reducing the pressure between patient and mattress.

12. A mattress substantially as hereinbefore described.

13. A mattress substantially as hereinbefore described with reference to the drawings.

Application No: GB 0010401.8 **Examiner:** Matthew Jefferson
Claims searched: 1 to 13 **Date of search:** 7 July 2000

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.R): A4M

Int Cl (Ed.7): A47C 27/18; A61G 7/057.

Other: Online: EPODOC, WPI.

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
X	GB 2149655 A	(SEIKEN CO. LTD.) See claims 1 and 2, and figures 1 to 25.	1 to 4 & 6 to 11.
X	GB 1350110 A	(LAPIDUS) See page 2, lines 45 to 67, and figures 4 to 6.	1, 2, 4 & 6 to 11.
X	WO 97/19619 A1	(SLEEP OPTIONS, INC.) See in particular pages 21 to 24, and figures 1 and 2.	1, 2 & 6 to 11.
X	US 5394577 A	(JAMES ET AL.) See claim 1 and figures.	1, 2 & 6 to 11.
X	US 4347633 A	(GAMMONS ET AL.) See column 2, line 49 to column 3, line 6 and figures.	1, 2, 4 & 6 to 11.
X	US 4280487 A	(JACKSON) See column 3, lines 36 to 52 and figures.	1, 2, 4 & 6 to 11.
X	DE 3937214 A1	(KUEHNEGGER) See column 5, lines 36 to 52 and figures 14 and 15.	1 to 3 & 5 to 11.

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.