United States Patent [19]

Yuen et al.

[11] **3,772,717**

[45] **Nov. 20, 1973**

[54] **INFLATABLE MATTRESSES AND CUSHIONS**

[76] Inventors: **Yat Chuen Yuen; Kin Sun Yuen,** both of 214A Des Voeux Road Central, Hong Kong

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[21] Appl. No.: **114,526**

[52] **U.S. Cl.** **5/349, 5/347**

[51] **Int. Cl.** **A47c 27/08**

[58] **Field of Search** 5/348, 349, 350

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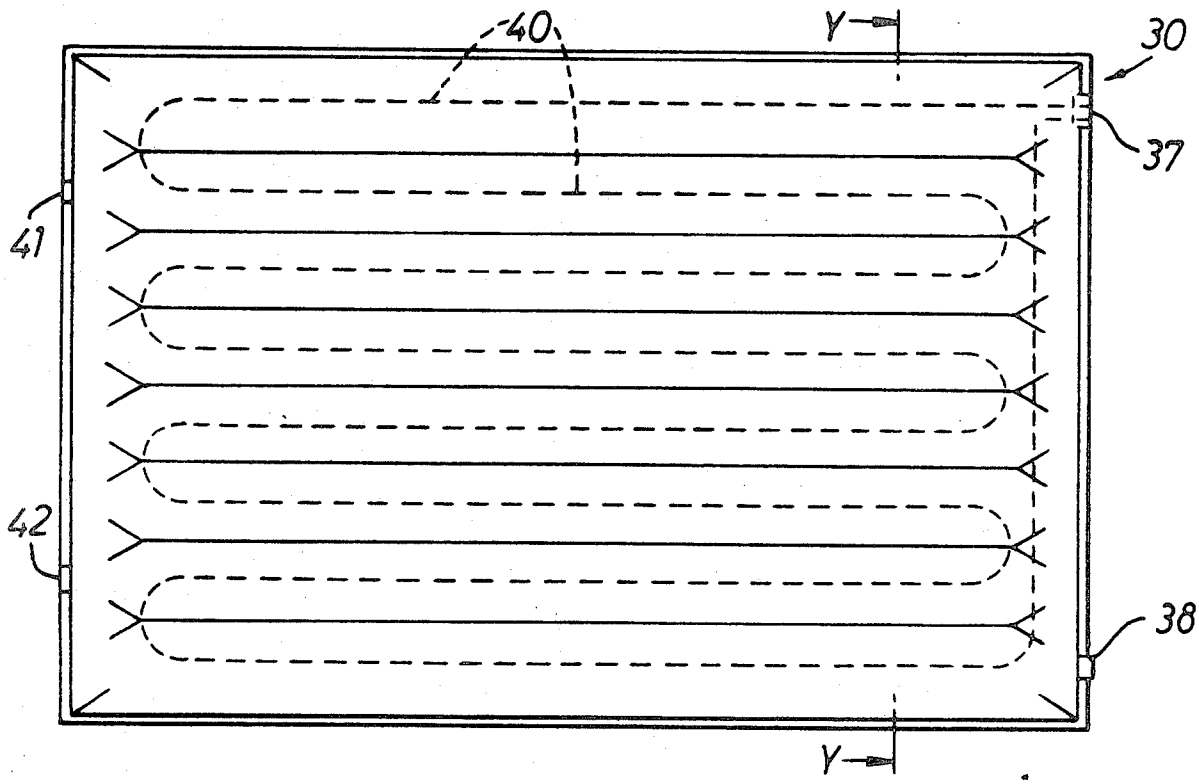
Assistant Examiner—Andrew M. Calvert
Attorney—Oberlin, Maky, Donnelly & Renner

[57] **ABSTRACT**

The invention provides an improved inflatable mattress comprising at least two compartments situated one above the other, at least one of the compartments being internally partitioned, and an aperture in each of the said compartments whereby the said compartments can be separately inflated.

10 Claims, 27 Drawing Figures



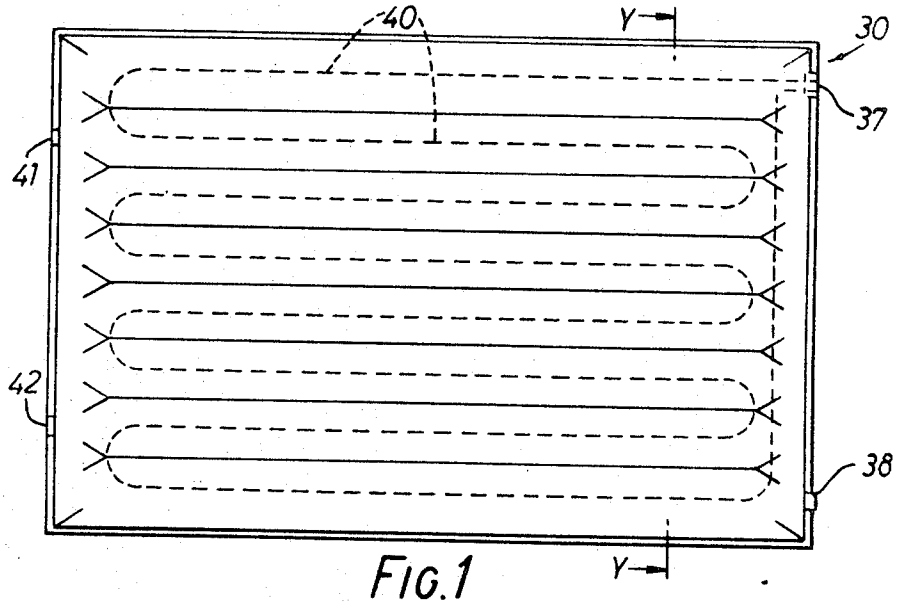


FIG. 1

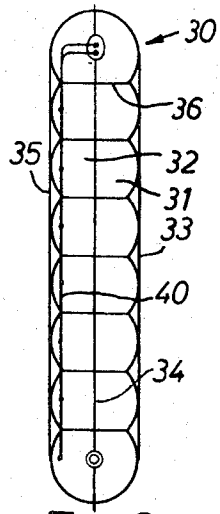


FIG. 2

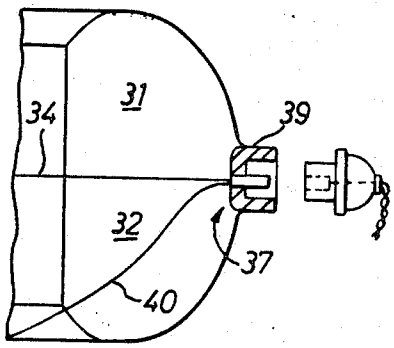


FIG. 3

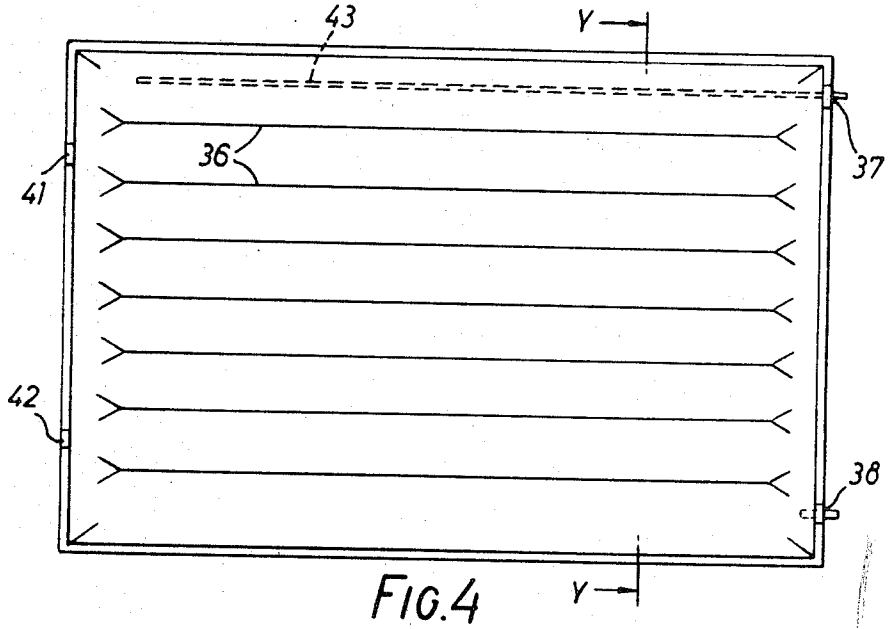


FIG. 4

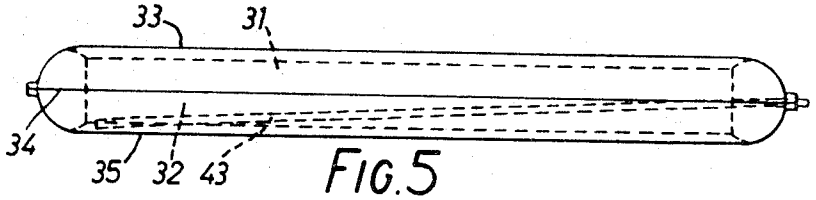


FIG. 5

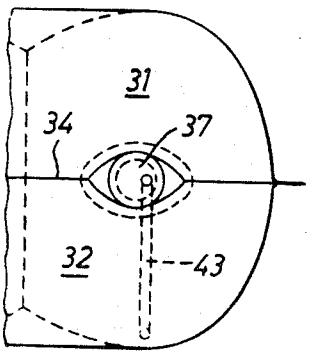


FIG. 6

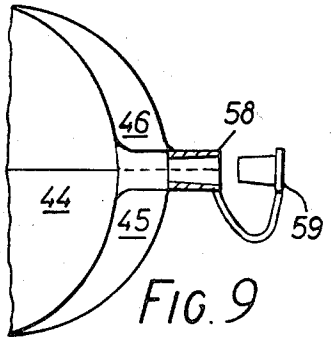


FIG. 9

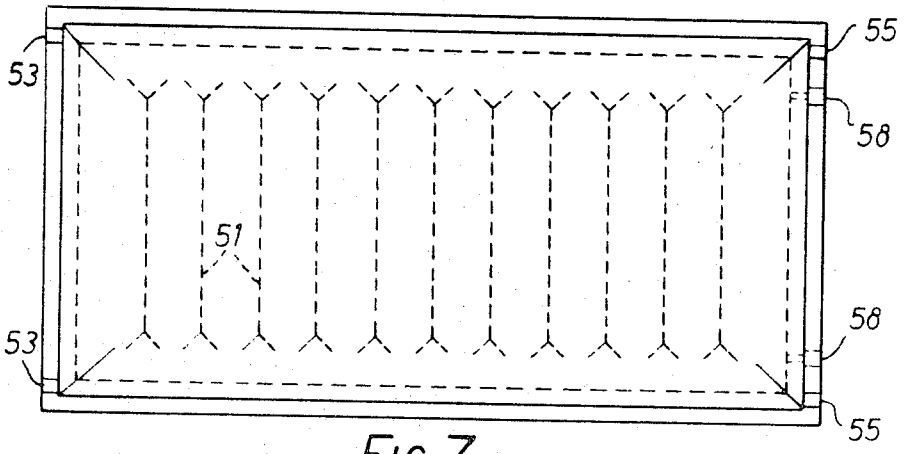


FIG. 7

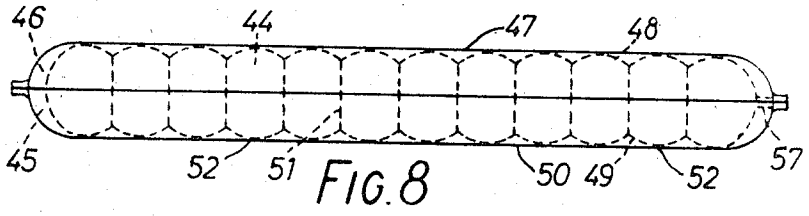


FIG. 8

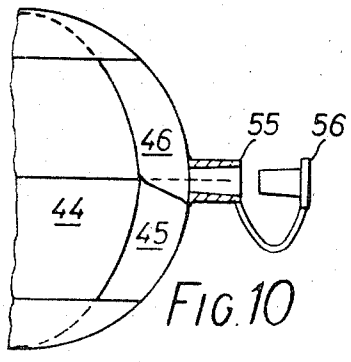


FIG. 10

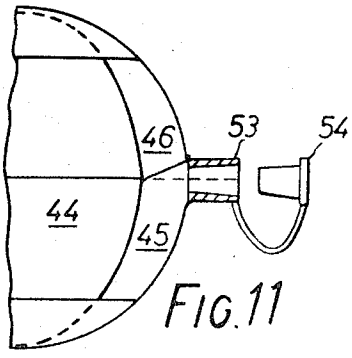


FIG. 11

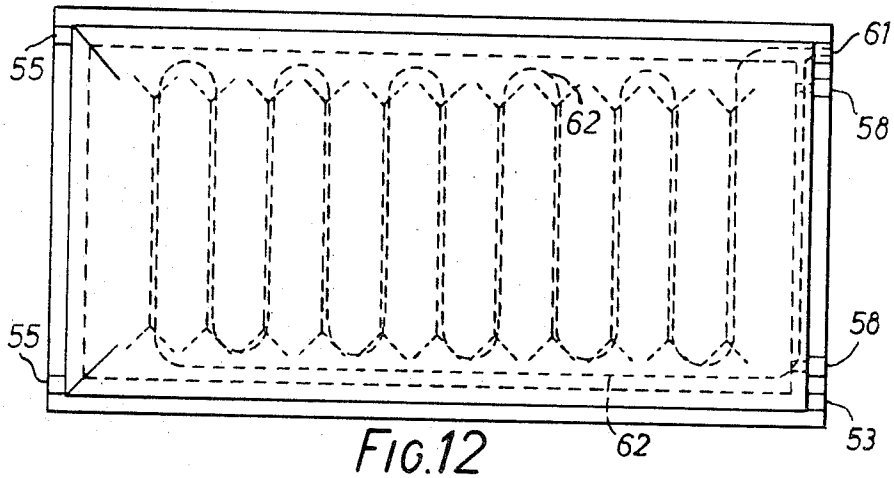


FIG. 12

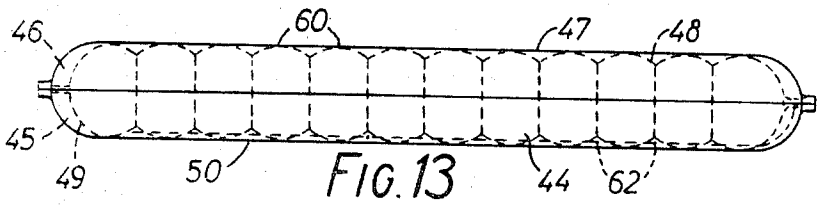
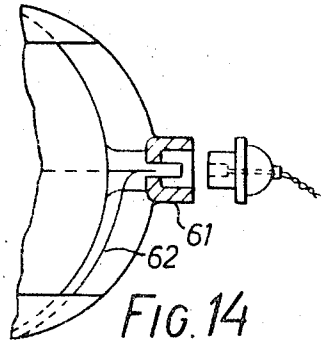


FIG. 13



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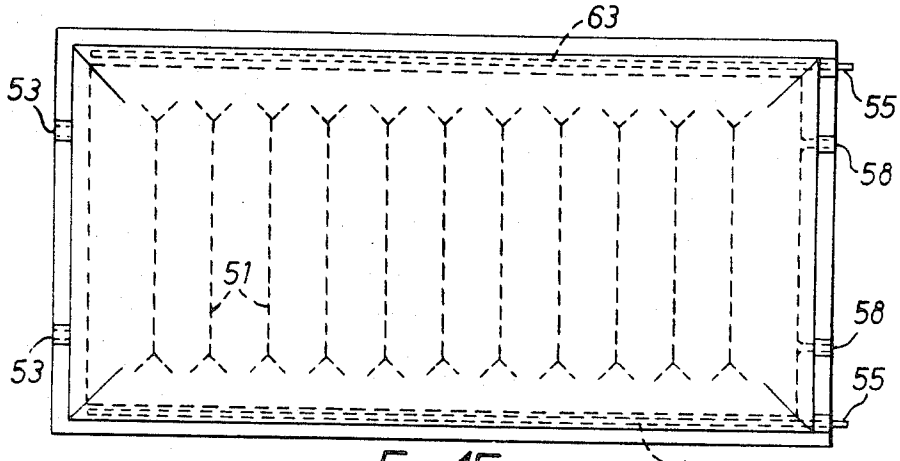


FIG. 15

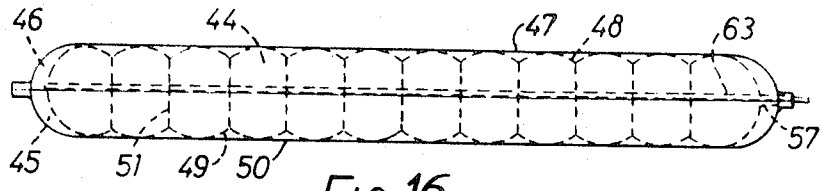


FIG. 16

FIG. 17

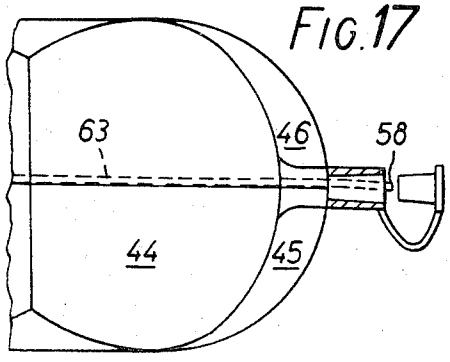
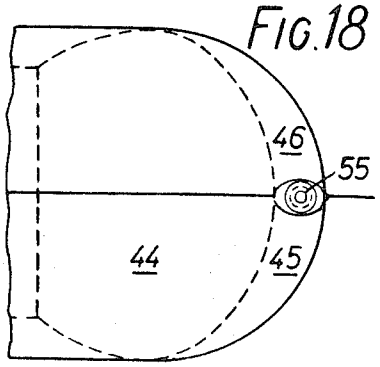


FIG. 18



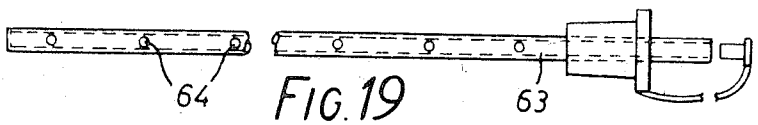


FIG. 19

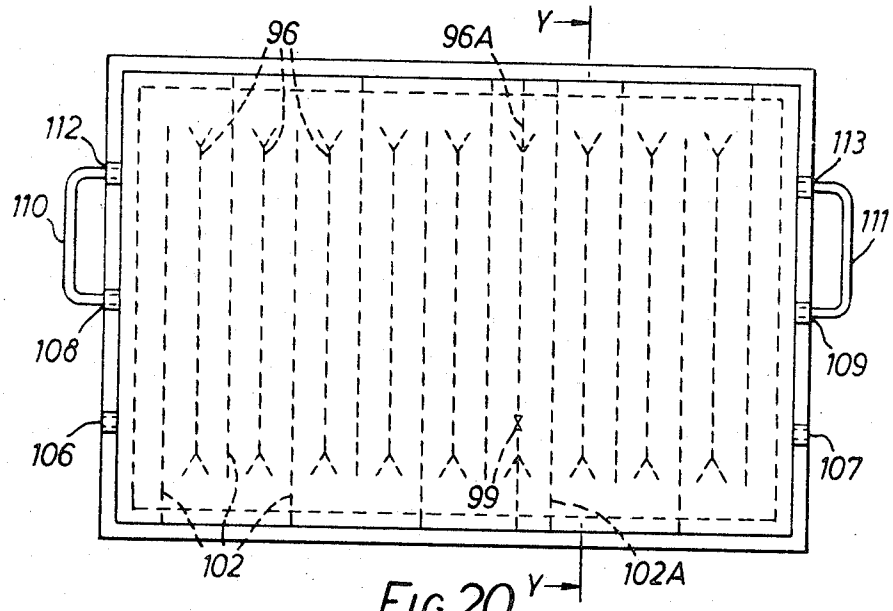


FIG. 20

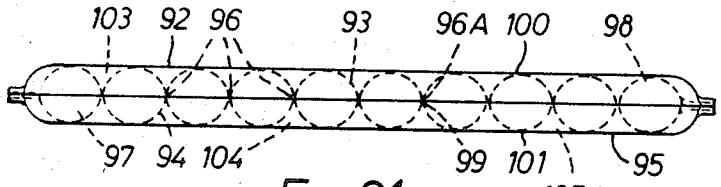


FIG. 21

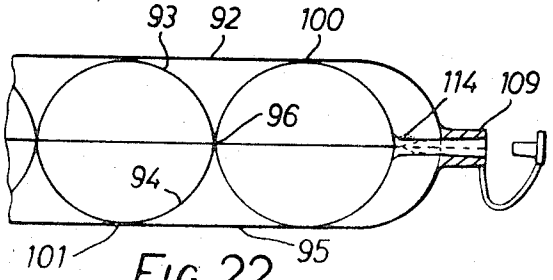


FIG. 22

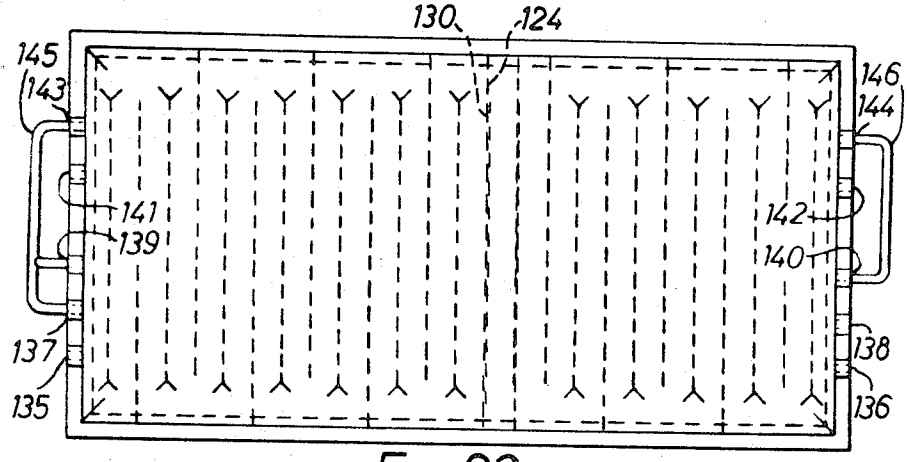


FIG. 23

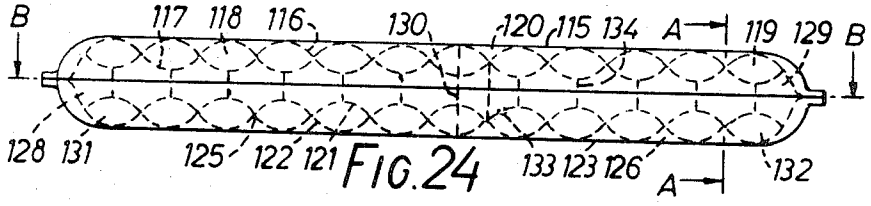


FIG. 24

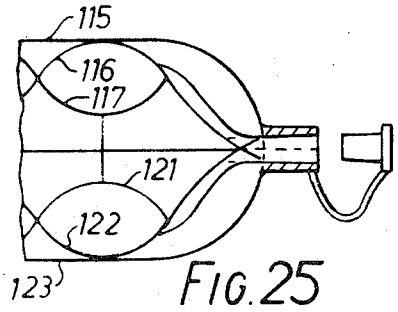


FIG. 25

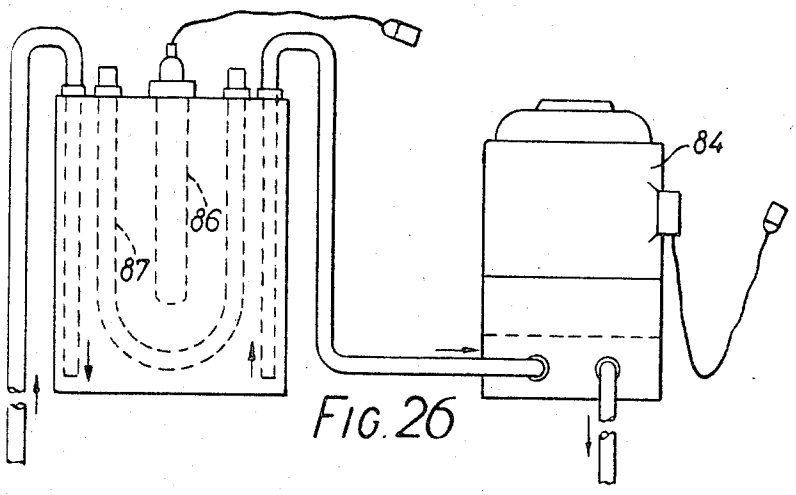


FIG. 26

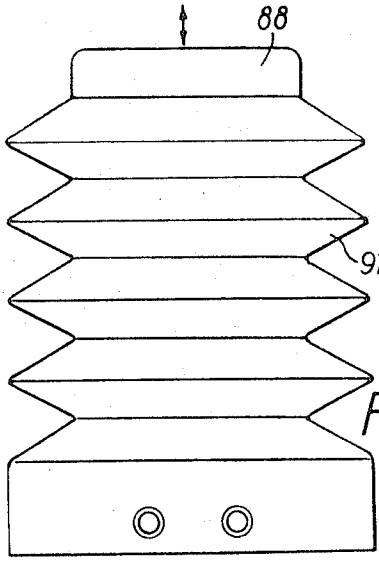


FIG. 27

INFLATABLE MATTRESSES AND CUSHIONS

This invention concerns inflatable mattresses or cushions.

Known inflatable mattresses generally have two compartments situated in side by side relation and each having one aperture whereby the compartment can be inflated. Such mattresses suffer from the disadvantage that accidental deflation of one of the compartments renders the mattress useless or at least very uncomfortable. Also, it is not possible using known inflatable mattresses to apply an even and comfortable heat to the user of the mattress over a considerable period of time since the user will be separated from any heated fluid in the mattress only by the relatively thin flexible wall of the mattress.

The present invention provides an improved mattress having at least two compartments situated one above the other each having an aperture whereby the compartment can be inflated.

A heating wire or a heated fluid in the lower compartment, being separated from the upper surface of the mattress by the upper fluid-filled compartment, will apply heat to the user of the mattress at an even and comfortable rate.

Accidental deflation of one of the compartments of a mattress of the invention will not cause undue discomfort to the user of the mattress provided the other compartment remains inflated.

Also, one of the compartments may be filled with a heated liquid without the mattress losing its resiliency which will be imparted by filling the other compartment with a gas, e.g. air.

In an embodiment of the invention an inflatable mattress comprises upper and lower layers of flexible material sealed together around their perimeters. Partitions are fitted in the interior of the mattress and are secured to the upper and lower layers. In addition to the upper and lower layers, the mattress also has a third central layer positioned between the other two layers and sealed around its perimeter to the perimeters of the said upper and lower layers. The mattress is thus divided into two compartments lying one above the other. Each compartment has two apertures so that the temperature of the mattress may be controlled by circulating heating or cooling fluid or by fitting internally an electric heating wire. Normally the temperature will be controlled only from the lower of the two compartments (i.e. the compartment furthest from the person using the mattress) although the upper compartment may be used for additional temperature control if required. If either compartment is not used for temperature control it may be connected to a pump for applying pulsations to the mattress.

In another embodiment of the invention a mattress similar to that of the previous embodiment but without the central flexible layer, has two extra external layers attached to it, one above the said upper layer of the mattress and the other below the said lower layer. The extra layers are sealed around their perimeters to the seam of the original upper and lower layers thus forming two extra external compartments. The mattress therefore has two compartments lying one above the other and each compartment has two apertures. One or more of these compartments may be temperature controlled by circulating heating or cooling fluid and for this purpose one of more tubes extending into one or more of the compartments may be provided to improve the circulation of the fluid. An electrical heating wire may be fitted inside any of the three compartments and any compartment not involved in the temperature control of the mattress may be connected to a pump for applying pulsations to the mattress.

In yet another embodiment of the invention a mattress is provided similar in construction to that of the previous embodiment except that the central compartment is partitioned by sealing together the upper end lower layers at the locations previously occupied by the partitions. The central compartment is therefore effectively partitioned as before except that at one of the above-mentioned locations the upper and lower layers are sealed together right across the mattress dividing the central compartment into two smaller compartments which communicate with each other only through a one-way (non-return) valve. In a similar manner the lower compartment is divided into two smaller non-communicating compartments. The mattress therefore has a total of five compartments, four smaller compartments lying beneath the top compartment. Each of the smaller compartments has one aperture and the top compartment has two apertures. In a preferred arrangement each of the two central compartments is connected to the upper compartment by means of a pipe. In operation the bottom two compartments are normally inflated with air and one of the two central compartments is filled with liquid at any desired temperature. When a person lies on the mattress, liquid flows from the filled central compartment through the upper compartment and slowly into the second central compartment from where it can be returned to the first central compartment through the one-way valve. A heating wire may be fitted internally of any of the compartments. Heating or cooling fluid may also be circulated through the mattress as in previous embodiments and a pump for applying pulsations to the mattress may be attached to any of the compartments.

In yet a further embodiment of the invention a matress has five horizontal compartments lying one above the other. The bottom four of these compartments are each further divided into two compartments so that the mattress has a total of nine compartments. As in the previous embodiment it can be arranged that when a person lies on the mattress, liquid contained in two of the compartments will flow through a third compartment and into a fourth compartment. Provision is also made for the liquid to be returned to the first compartment after the mattress has been used. The other compartments of the mattress are normally inflated with air during use.

As in previous embodiments this mattress may be connected to fluid circulating means for temperature control. It may also be connected to a pump for applying pulsations to the mattress. A heating wire may be fitted internally of the mattress.

Further features of the invention will become apparent from the following particular description with reference to and as illustrated by the drawings in which:

FIG. 1 is a plan view of a first mattress according to the invention;

FIG. 2 is the section marked Y—Y on FIG. 1.

FIG. 3 is a side view of the power socket mounted on the mattress shown in FIG. 1.

FIG. 4 is a plan view of a second mattress according to the invention.

FIG. 5 is an elevation of the mattress shown in FIG. 4.

FIG. 6 is an end view of part of the mattress illustrated in FIG. 4 showing the tube mounting.

FIG. 7 is a plan view of a third mattress according to the invention.

FIG. 8 is an elevation of the mattress shown in FIG. 7.

FIG. 9 is a side view of the aperture marked 58 on FIG. 7.

FIG. 10 is a side view of the aperture marked 55 on FIG. 7.

FIG. 11 is a side view of the aperture marked 53 on FIG. 7.

FIG. 12 is a plan view of a fourth mattress according to the invention.

FIG. 13 is an elevation of the mattress shown in FIG. 12.

FIG. 14 is a side view of the power socket marked on FIG. 12.

FIG. 15 is a plan view of a fifth mattress according to the invention.

FIG. 16 is an elevation of the mattress shown in FIG. 15.

FIG. 17 is a side view of the aperture marked 58 on FIG. 15.

FIG. 18 is an end view of part of the mattress shown in FIG. 15 showing the aperture marked 55.

FIG. 19 is a side view of the pipe marked 63 on FIG. 15.

FIG. 20 is a plan view of a sixth mattress according to the invention.

FIG. 21 is an elevation of the mattress shown in FIG. 20.

FIG. 22 is a side view of the aperture 109 shown on FIG. 20.

FIG. 23 is a plan view of the seventh mattress according to the invention.

FIG. 24 is the elevation of the mattress shown in FIG. 23.

FIG. 25 is a side view of an aperture of the mattress shown in FIG. 23.

FIG. 26 is an elevation of temperature regulating and fluid circulating apparatus suitable for use with mattresses according to the invention.

FIG. 27 is an elevation of a pump suitable for use with mattresses according to the invention.

FIGS. 1 to 3 illustrate an embodiment of the invention in which a mattress 30 having two compartments 31 and 32 is formed of three rectangular layers 33, 34 and 35 of flexible material sealed around their perimeters. Partitions 36 extend longitudinally through both the compartments 31 and 32. The lower compartment 32 has two apertures 37 and 38. The aperture 37 is fitted with an electric power socket 39 to which is attached a heating wire 40 which extends throughout the lower compartment. The aperture 38 is used to fill the compartment 32 with any suitable fluid and when the mattress is in use it may be attached to a pump such as that illustrated in FIG. 27 to apply pulsations to the mattress. The upper compartment 31 also has two apertures 41 and 42 which may be used to circulate heating or cooling fluid or may be connected to a pump to apply pulsations to the mattress.

FIGS. 4 to 6 illustrate an embodiment similar to that of FIGS. 1 to 3 differing only in that the heating wire is replaced by a fluid inlet pipe 43. Temperature control is therefore effected by fluid circulation rather than by electrical heating. The reference numerals in FIGS. 4 to 6 correspond to those used in FIGS. 1 to 3.

FIGS. 7 to 11 illustrate a mattress according to the invention having three compartments 44, 45 and 46. The mattress comprises four layers 47, 48, 49 and 50 sealed together around their perimeters to form the three compartments. The central compartment 44 has partitions 51 attached to its upper and lower layers 48 and 49. The lowest layer 50 of the mattress is also attached to the layer 49 along the crests 52 formed between the partitions 51 in the central compartment 44. The lower compartment 45 has two apertures 53 each provided with stoppers 54 (FIG. 11). Similarly the upper compartment 46 has two apertures 55 with stoppers 56 (FIG. 10). The central compartment 44 communicates with the outside of the mattress through necks 57 which pass between the upper and lower compartments to apertures 58 provided with stoppers 59 (FIG. 9). The temperature of the mattress may be controlled by circulating heating or cooling fluid through one or more of the compartments 44, 45 and 46. The pump for applying pulsations to the mattress may be connected to any of the compartments not involved in temperature control.

FIGS. 12 to 14 illustrate a mattress similar in construction to that of FIGS. 7 to 11. The reference numerals used in FIGS. 7 to 11 apply to corresponding parts of this embodiment. The difference between this and the previous embodiment are as follows: (a) the top layer 47 of the mattress is attached to the crests 60 of the layer 48, (b) the apertures 53 and 55 are situated at different ends of the mattress, (c) an electric power socket 61 is fitted to one of the apertures 53, and (d) a heating wire 62 extends throughout the lower compartment 45 from the power socket 61. Apart from the heating of the lower compartment 45 by the wire 62, the operation of this embodiment is the same as for the previous embodiment.

FIGS. 15 to 19 illustrate an embodiment similar to that of FIGS. 12 to 14 except that the heating wire is omitted and fluid circulating tubes 63 extend through the apertures 55 into the upper compartment 46. Each of the tubes 63 has apertures 64 along its length to ensure even distribution of the circulating fluid.

The embodiments illustrated in FIGS. 15 to 19 and FIGS. 12 to 14 may be combined to form a mattress according to the invention in which both the upper and lower compartments, 46 and 45, are temperature controlled, one by circulating fluid and the other by a heating wire.

FIGS. 20 to 22 illustrate another mattress according to the invention. This mattress is formed, as in previous embodiments, by sealing together four rectangular layers of flexible material 92, 93, 94 and 95. The two central layers 93 and 94 are sealed together along the lines 96 which correspond to the partitions of previous embodiments. One of the seals 96, marked 96A in the drawings, extends right across the central compartment defined by the layers 93 and 94 thus effectively dividing it into two smaller compartments. These compartments are shown at 97 and 98 in the drawings. A one-way valve 99 is situated between the two compartments 97 and 98 so that, under certain circumstances liquid can flow from one to the other. The seals 96 extend only partially across the mattress so that liquid is free to flow throughout the compartments 97 and 98.

The top and bottom layers of the mattress 92 and 95 are sealed to the layers 93 and 94 along the crests 100 and 101 between the seals 96. This sealing of the top and bottom layers is effected along the lines indicated at 102 on FIG. 20 so that liquid passing through the top compartment 103 (defined by layers 92 and 93) runs in zig-zag fashion from one end of the mattress to the other. Along the line 102A, the layers 94 and 95 are sealed together for the full width of the mattress thus forming two compartments 104 and 105.

The mattress has therefore a total of five compartments 97, 98, 103, 104 and 105 each having at least one aperture through which fluid can enter or leave the compartment. Compartments 104 and 105 have apertures 106 and 107 respectively. Compartments 97 and 98 have apertures 108 and 109 respectively which are connected through pipes 110 and 111 to apertures 112 and 113 in the compartment 103. The pipes 110 and 111 extend into the interiors of compartments 97 and 98 respectively, terminating in each case near the bottom wall of the compartment. The aperture 109 has a restriction similar to that indicated at 114 on FIG. 22. This allows liquid to flow only relatively slowly through the pipe 111 from the compartment 103 to compartment 98.

A preferred method of operating the mattress is as follows. First the compartment 97 is substantially filled with water through the aperture 108 by temporarily disconnecting the pipe 110. Compartments 104 and 105 are then fully inflated with air and compartments 103 and 98 (connected by the pipe 111) are partially inflated with air by temporarily disconnecting pipe 110 or 111. When a person lies on the mattress, the pressure in compartment 97 will increase and the water therein will begin to flow readily through the pipe 110 and into compartment 103. The one-way valve 99 prevents the water from flowing directly into the compartment 98. Once inside the compartment 103, the liquid flows in zig-zag fashion along the troughs formed by the seals 96 to the other end of the mattress where it passes through the pipe 111 and into the compartment 98. The restriction 114 in the aperture 109 may be of any suitable size but it is normally desirable for it to be of such size that the water will flow for several hours. After use the compartment 97 can be refilled by allowing the water in the compartment 98 to flow back through the one-way valve 99.

It is possible by this method to control the temperature of the person lying on the mattress for a considerable period. In a hot climate, cold water is used which cools the body of the user of the mattress as it flows through the compartment 103. Of course in a cool climate, hot water may be used.

The mattress may be provided with a heating wire (not shown) extending through the compartments 104 and 105. When it is required to use the heating wire it is found convenient to inflate all the compartments with air and invert the mattress.

As in the previous embodiments it is possible to arrange for temperature controlled fluid to circulate in the mattress from an external source. Also, a pump for applying pulsations to the mattress may be connected to one or more of the compartments.

FIGS. 23 and 25 illustrate yet another mattress according to the invention. Layers 115, 116 and 117 are sealed together in a similar manner to the layers 92, 93 and 94 of the previous embodiment, compartments 118, 119 and 120 corresponding to compartments 97, 98 and 103 of that embodiment. The layers 115, 116 and 117 comprise the upper half of the mattress. The lower half of the mattress is identical to the upper half, except for a few features which will be explained later and comprises layers 121, 122 and 123. These layers are sealed together in the same manner as layers 115, 116 and 117 except that layers 122 and 123 are sealed right across the width of the mattress along the line 124 thus dividing lowest compartment into two separate smaller compartments 125 and 126. There is a further compartment formed between the two halves of the mattress and this compartment is also divided into two separate smaller compartments 128 and 129 by a partition 130.

The mattress therefore has nine compartments shown at 118, 119, 120, 125, 126, 128, 129, 131 and 132. A one-way valve 133 connects compartment 129 with compartment 131 so that liquid can pass from one to the other when desired. Stays 134 help to retain the shape of the mattress when it is inflated.

Each of the compartments has at least one aperture through which fluid can be introduced or withdrawn, compartments 125 and 126 have apertures 135 and 136 respectively. Similarly compartments 131 and 132 have apertures 137 and 138 and compartments 128 and 129 have apertures 139 and 140. Compartments 118 and 119 have apertures 141 and 142 and compartment 120 has apertures 143 and 144. Tubing 145 connects together the apertures 137, 139 and 143 so that liquid can flow from compartments 131 and 128 into compartment 120 and vice versa. Tubing 146 connects apertures 144 and 140 so that liquid can flow from compartment 120 into compartment 129 and vice versa.

In a preferred method of operation compartments 118, 119, 125, 126 and 132 are fully inflated with air, compartments 120, 128 and 129 are partially inflated with air and compartment 131 is substantially filled with water. Compartment 128 is also partially filled with water. The tubes 146 and 145 which extend into the compartments 128, 131 and 129 terminate near the bottom of the said compartments.

When a person lies on the mattress, liquid is expelled from compartments 128 and 131, through the tubing 145 and into compartment 120 through which it flows in zig-zag fashion, finally passing through the tube 146 into the compartment 129. The rate at which the liquid flows from one compartment to the other is predetermined by providing restrictions in one or more of the apertures 137,139,143,144 and 140. These restrictions are similar to that illustrated at FIG. 22 of the previous embodiment and referenced 114. Preferably it is arranged so that the liquid takes several hours to flow through compartment 120. After use, the liquid can be returned from compartment 129 to compartments 128 and 131 by siphonic action or through the one-way valve 133. The surface of the mattress 115 can be maintained at a comfortable temperature for a period of some hours by choosing a suitable temperature for the liquid initially in compartments 128 and 131; or by regulating the size of the restriction in, for example, aperture 140.

As in the previous embodiment heating or cooling fluid may be circulated in the mattress from an external source. A pump for applying pulsations to the mattress

may also be connected to one or more of the compartments if desired.

The mattress described in the above embodiments may be made from any suitable material provided it is flexible and impermeable to the fluids being used in the mattress. Suitable materials include rubber, plastics such as PVC and the like. The layers of the mattress may be attached to each other by welding or by adhesive or in any other convenient way provided that the fluid used in the mattress cannot escape through the joint.

FIG. **26** illustrates a fluid temperature controlling and circulating system suitable for use with mattresses according to the invention. A pump **84** circulates the fluid in the direction indicated by the arrows. The circulating fluid passes through a temperature control compartment which contains for this purpose an electrically powered heating element **86** and a pipe **87** for connection to a cooling system.

FIG. **27** illustrates a reciprocating pump **88** suitable for attachment to mattresses according to the invention. The pump has an input pipe and an output pipe. In operation, both the input pipe and the output pipe will be attached to a mattress and the reciprocating motion of the bellows **91** of the pump will apply pulsations to the mattress. The use of such a pump in conjunction with mattresses according to the invention is often found desirable since pulsation of the mattress can have a pleasant or soothing effect on the user of the mattress.

It will be apparent to those skilled in the art that other embodiments may be constructed which lie within the spirit and scope of the present invention.

We claim:

1. An inflatable mattress comprising:

a. first, second, third and fourth layers of flexible and impermeable material sealed along their peripheries to form upper, middle and lower compartments;

b. transverse connections between said second and third layers partitioning the middle compartment, certain of said connections extending only partially across said compartment to permit fluid flow therepast;

c. transverse seals connecting at least one of said first and second layers and said third and fourth layers respectively at locations between said connections in the middle compartment, whereby the one of said second and third layers connected assumes a zig-zag configuration on inflation, certain of said seals extending only partially across said compartment to permit fluid flow therepast, and

d. filling openings permitting the supply of fluid to all of said compartments, such that the compartments can be pressurized to different pressures.

2. The inflatable mattress of claim **1** in which transverse seals connect both said first and second layers and said third and fourth layers, respectively.

3. The mattress according to claim **1**, wherein said connections in the middle chamber are constituted by partitions.

4. The mattress according to claim **1**, wherein said connections in the middle chamber are constituted by seals.

5. The mattress according to claim **1**, further including means for heating fluid in the middle compartment.

6. The mattress according to claim **1**, wherein one of said connections fully divides the middle compartment into two chambers and means are provided to connect each of said chambers via said filling openings to the upper compartment whereby, on use of the mattress, heating or cooling liquid can be forced by the user's weight from the first chamber through the upper compartment to the second chamber, said connecting means including a constriction to slow down liquid flow and prolong the heating or cooling effect.

7. The mattress according to claim **6**, wherein one of said seals fully divides the lower compartment into two independently inflatable chambers.

8. The mattress according to claim **6** further including a one-way valve interconnecting said chambers.

9. An inflatable mattress comprising:

a. a plurality of layers of flexible and impermeable material defining an upper compartment situated above at least two lower compartments, the upper compartment being internally partitioned;

b. tubing connecting the upper compartment with the lower compartments such that liquid can flow from one lower compartment, through the upper compartment and into the other lower compartment when the first of said lower compartments is filled with liquid and the second is empty, and

c. a constriction in the fluid path between the first lower compartment and the upper compartment to prevent over-rapid fluid flow between the compartments.

10. The mattress according to claim **9**, including a one-way valve interconnecting said lower compartments.

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