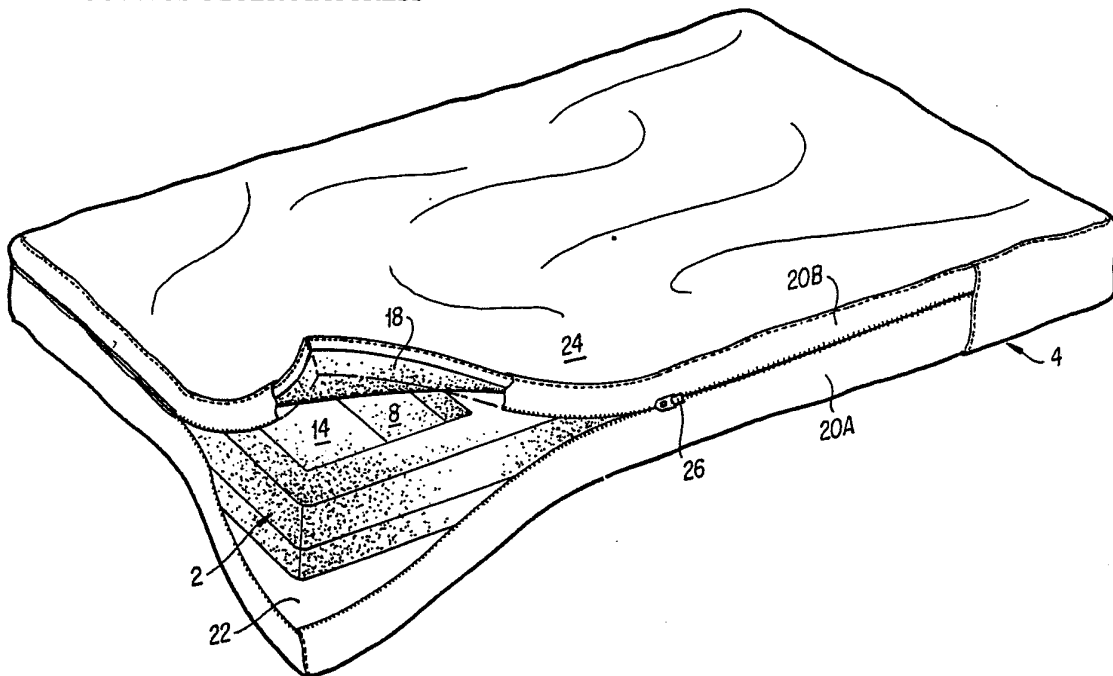




INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

<p>(51) International Patent Classification⁴ : A47C 27/15, A61G 7/04</p>	<p>A1</p>	<p>(11) International Publication Number: WO 87/ 06442 (43) International Publication Date: 5 November 1987 (05.11.87)</p>
<p>(21) International Application Number: PCT/US87/00946 (22) International Filing Date: 30 April 1987 (30.04.87) (31) Priority Application Number: 857,977 (32) Priority Date: 1 May 1986 (01.05.86) (33) Priority Country: US (71) Applicant: COMFORTEX, INC. [US/US]; 420 Main Street, Winona, MN 55987 (US). (72) Inventor: MURPHY, Michael ; 1209 Willow, LaCrescent, MN 55945 (US). (74) Agents: POUS, Robert, T. et al.; Oblon, Fisher, Spivak, McClelland & Maier, 1755 South Jefferson Davis Highway, Crystal Square Five - Suite 400, Arlington, VA 22202 (US).</p>		<p>(81) Designated States: AT (European patent), BE (European patent), CH (European patent), DE (European patent), FR (European patent), GB (European patent), IT (European patent), JP, LU (European patent), NL (European patent), SE (European patent). Published <i>With international search report.</i></p>

(54) Title: DECUBITUS ULCER MATTRESS



(57) Abstract

A mattress consists of a foam body (2) having recesses (8) at positions corresponding to the locations of protruding portions of a patient lying on the mattress. Foam blocks (14, 16) can be selectively placed in portions of the recesses (8). An encasement member (4) encases the foam body (2) and includes a top foam sheet (18). A bloused waterproof, non-shearing, flame retardant and antibacterial top sheet (24) forms a portion of the encasement member (4) covering the foam sheet (18). A zipper (26) in the encasement member (4) enhances air circulation into and out of the mattress.

FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AT Austria	FR France	ML Mali
AU Australia	GA Gabon	MR Mauritania
BB Barbados	GB United Kingdom	MW Malawi
BE Belgium	HU Hungary	NL Netherlands
BG Bulgaria	IT Italy	NO Norway
BJ Benin	JP Japan	RO Romania
BR Brazil	KP Democratic People's Republic of Korea	SD Sudan
CF Central African Republic	KR Republic of Korea	SE Sweden
CG Congo	LI Liechtenstein	SN Senegal
CH Switzerland	LK Sri Lanka	SU Soviet Union
CM Cameroon	LU Luxembourg	TD Chad
DE Germany, Federal Republic of	MC Monaco	TG Togo
DK Denmark	MG Madagascar	US United States of America
FI Finland		

Description"Decubitus Ulcer Mattress"Technical Field

5 The present invention relates to a mattress having utility in the prevention and treatment of decubitus ulcers and other tissue damage aggravated by pressure, and/or heat, and/or shearing.

Background Art

10 Decubitus ulcers are caused by the reduction or lack of blood to skin and muscle tissue. The deprived cells quickly die and sores form. These sores often become open wounds which can spread throughout the body's soft tissue and finally expose bone mass. Predisposing conditions which contribute to the
15 formation of decubitus ulcers include circulatory disease and the exposure of tissue to extreme temperatures, as well as shearing, i.e., friction against the skin, which can stretch and close blood vessels. A major cause of decubitus ulcers, however,
20 is pressure.

For example, when an individual lies in a given position for an extended period of time, protrusions in the skeletal structure, such as at the back of the

head, the buttocks and the heels, cause the soft tissue covering these portions of the skeletal structure to be squeezed against an underlying support surface, such as a mattress. This soft tissue is squeezed and the blood
5 flow therein altered, and so such tissue is especially susceptible to decubitus ulcers. The position and spacing of these relatively small and localized pressure points vary from individual to individual.

Efforts have been made to design mattresses which
10 minimize the possibility of decubitus ulcers. An example may be found in U.S. Patent 3,742,528 to Munch. There, a foam frame is cemented to a rigid base and includes a central cut out. Inserts may be placed
15 in the central cut out while other portions of the cut out are left open so that the mattress can be shaped to relieve local pressure on the body of the patient. However, this mattress cannot be used on an adjustable bed frame and the crevices created by the cut out and inserts make cleaning difficult. A person lying on the
20 mattress will also tend to experience the uncomfortable sensation of "dropping into a hole," and the edges around the empty portions of the cut out can create a "cookie cutter effect" on portions of the patient lying thereon as the body presses against the mattress
25 surface. Another source of discomfort is derived from the relatively high friction coefficient of the foam mattress which tends to shear against a patient's skin as the patient descends into the mattress.

U.S. Patent 3,146,469 to Slade also discloses a
30 mattress having cut outs for conforming to a body shape, in order to reduce the possibility of bed sores. There, a mattress is mounted on a plurality of wooden slats and is made of a foam material entirely

encased by waterproof vinyl. Cut outs in the mattress may be filled with correspondingly shaped blocks. However, this mattress does not reduce heat build-up, which increases the susceptibility of skin damage or breakdown. Moreover, the cleaning, comfort and shear problems associated with Munch will also arise in Slade.

Best Mode for Carrying Out the Invention

It is the object of the present invention to provide a decubitus ulcer mattress which can selectively eliminate the pressure-creating surfaces in juxtaposition to pressure-sensitive body parts.

It is a further object of the present invention to provide a decubitus ulcer mattress that offers selective pressure relief that can be changed to different body locations for patients of varying sizes and shapes.

It is a further object of the present invention to provide a decubitus ulcer mattress with selectively removable sections that are secured in place without the use of mechanical or adhesive means.

It is a further object of the present invention to provide a decubitus ulcer mattress which can be accommodated on an adjustable bed frame.

It is a further object of the present invention to provide a decubitus ulcer mattress which is easily cleaned.

It is a further object of the present invention to

provide a decubitus ulcer mattress which is reusable for different patients.

5 It is a further object of the present invention to provide a decubitus ulcer mattress which provides passive air flow directly beneath the top cover, preventing heat build-up under the patient's skin.

It is a further object of the present invention to provide a decubitus ulcer mattress which does not create a "cookie cutter effect" on the patient's skin.

10 It is a final object of the present invention to provide decubitus ulcer mattress which does not create shear stress on a patient's skin.

These and other objects of the invention are provided by a mattress in the form of an open-celled
15 foam body having recesses in a top surface thereof, the recesses being positioned at locations of protruding portions of a patient lying on the mattress. The recesses may be selectively filled with foam block bodies at such locations that for a given patient, the
20 recesses remain unfilled at locations corresponding to the protruding portions of that patient. The foam block bodies are not glued or otherwise permanently fixed within the mattress but are instead held in place by the naturally high friction properties of the
25 surrounding open-celled foam. The mattress is preferably parallelepiped shaped and the recesses preferably do not extend entirely through the thickness of the mattress, and so have foam bottoms.

30 The foam mattress body is entirely encased within an encasement member. The encasement member has fabric

sides and bottom, and has a top including a foam sheet covering the top surface of the foam mattress body and being laterally secured to the upper side panel. The foam sheet prevents the patient from experiencing a feeling of "falling into a hole" at the locations of the recesses which are not filled with foam blocks, eliminates discomfort that might otherwise be caused by the inherent wrinkling of the top sheet, reduces overall pressure even with cubes in place, and also distributes the pressure from the edges of the foam block bodies adjacent the recess so that the "cookie cutter effect" can be avoided.

The foam sheet is in turn covered by an oversized top sheet of waterproof, non-reflective, non-shearing, flame retardant, anti-bacterial fabric. This thin fabric absorbs and conducts radiated body heat to the foam sheet, which acts as a plenum to vent such heat through the zipper, reducing heat to skin tissue. The top sheet is impervious to urine, spilled liquids, and sweat, protecting the mattress body. This avoids the cleaning problems arising due to numerous crevices, which was experienced in the prior art.

In order to avoid shearing of the patient's skin, the waterproof, non-reflective, non-shearing, flame retardant and antibacterial top sheet, which has a lower coefficient of friction than does foam, is "bloused". That is, the top sheet has a larger dimension than does the foam sheet and upper side panel to which it is attached at its lateral edges, and so is loosely held onto the top of the mattress. Therefore, if a patient moves or sinks into the mattress, any shearing force which might otherwise arise is absorbed by sliding between the top sheet and the underlying

foam sheet.

Separating upper and lower side panels of the encasement member is a zipper. The zipper gives access for removal of the foam blocks from the encasement member so that the number and position of the foam block bodies within the recesses may be varied. The zipper, which is not air tight, also provides air ventilation. For example, patient movement on the mattress and selectively compresses and releases pressure on different parts of the mattress body, portions of the mattress body will selectively expand and contract, thus forming a bellows effect by which air is pumped into and out of the mattress through the zipper, thereby replenishing the fresh air and removing excess heat through the material of the top sheet, preventing a sweaty condition which will lead to the loss of skin integrity.

Brief Description of the Drawings

Various other objects, features and attendant advantages of the present invention will be more fully appreciated as the same becomes better understood from the following detailed description when considered in connection with the accompanying drawings in which like reference characters designate like or corresponding parts throughout the several views and wherein:

FIGURE 1 is an orthogonal view of the mattress with the zipper partially opened;

FIGURE 2 is an orthogonal view of the mattress with the encasement member removed.

Detailed Description of the Preferred Embodiment

As best seen in FIGURE 1, the mattress consists of a rectangular foam body 2 which is encased within an encasement member 4. The foam body is preferably formed of 5 inch thick polyurethane foam having 1.8 pound per cubic feet density and 35 ILD firmness and is sized so as to fit a conventional adjustable bed frame. The foam body 2 has a substantially flat top surface 6 within which are formed a number of essentially rectangular recesses 8. The recesses do not extend entirely through the foam body, and so have bottoms formed of the same material as the foam body. A preferred manufacturing technique for fabricating the recesses is to form the foam body of two layers 10 and 12. For example, the layer 10 can be 3 inches thick and the layer 12 can be two inches thick. Cut outs are then cut entirely through the thickness of the layer 10 at positions corresponding to the recesses 8, after which the layers 10 and 12 are joined by adhesive. This results in a unitary foam body 2 in which the top surface of the layer 12 forms the bottom of each of the recesses 8.

Since patients of different sizes and body shapes must use the same mattress, the recesses 8 are positioned on the mattress at locations which generally correspond to protruding portions of such patients, but have an area corresponding to a wide range of patient sizes. Block bodies 14 and 16 can then be placed at desired locations within the recesses according to the specific body shape characteristics of the patient who will be lying upon the mattress. The block bodies 14 and 16 are formed of a foam having the same composition as the foam body 2, and have the same height as the

depth of the recesses 8, so that when the block bodies 14 and 16 are positioned within the recesses, the top surfaces thereof are substantially coplanar with the top surface 6 of the foam mattress body. The block bodies 14 and 16 are not secured within the recesses by adhesive, but are instead held in place by the naturally high friction existing between adjacent contacting open cell foam surfaces. The block bodies are, of course, sized so that they closely abut adjacent block bodies and completely fill the recesses, except for those areas where block bodies are intentionally left out.

The encasement member 4 includes a foam sheet 18 which lies directly atop the top surface 6 of the foam body. The foam sheet 18 is formed of relatively soft polyurethane foam having 1.0 pound per cubic feet density and a 15 ILD firmness. The foam sheet 18 preferably has a 1 inch thickness.

Lateral edges of the foam sheet 18 are secured, as by sewing, to the upper side panel 20B of the encasement member. Both the upper 20B and lower 20A side panels are preferably formed of nylon reinforced vinyl and are shaped to closely conform to the sides of the body 2. A bottom panel 22 is sewn to the lower side panel and closely conforms to the shape of the bottom of the foam body 2. The result is an encasement member which closely and securely holds the foam body 2 therein, and so retains the shape of the foam body 2.

The encasement member also includes a top sheet 24 formed of a waterproof, non-reflective, non-shearing, flame retardant and antibacterial material such as a 70 denier taffeta laminated to nylon or polyester tricot

treated with an agent such as K-Kote FR (registered U.S. trademark), which is a flame retardant, fungicidal, waterproof urethane. The top sheet 24 is sewn at its lateral edges to the foam sheet 18 and the upper side panel 20B and lies atop of the foam sheet 18. However, the top sheet 24 is provided with excess material, and so is "bloused". That is, the top sheet 24 lies loosely on the taut foam sheet 18 so that the central portion of the top sheet 24 can easily slide over the foam sheet 18 in response to movement of a patient.

Separating the upper 20B and lower 20A side panels is a zipper 26 having a size sufficient to permit the foam body 2 to be removed from the encasement member. The zipper goes completely around the mattress, with the exception of the head end (right side in Figure 1), where the upper and lower panels are unitary.

In use, the foam body 2 is accessed using the zipper 26, exposing block bodies 14 and 16 which may be selectively added and removed so that the recesses 8 are limited to areas conforming to projecting parts, such as the heels and buttocks, of the particular patient who will be lying upon the mattress. The block bodies 14 and 16, which are not individually covered with any material, are held in place by the naturally high friction adhesion between adjacent open cell foam bodies, and the entire assembly of foam body 2 and foam sheet 18. Block bodies 14 and 16 may be reinserted into the encasement member, after which the zipper 26 is closed. The mattress can then be placed upon a conventional hospital bed frame without hindrance to the adjustability of the bed frame, since the entire mattress is formed of flexible material.

Upon the patient lying on the mattress, those projecting body portions which might otherwise be most subject to decubitus ulcers will lie on the top sheet 24 and the foam sheet 18 at positions over the unfilled
5 recesses 8. As the individual sinks down into the mattress, the bloused top sheet 24 is able to slide on the underlying foam sheet 18 as the mattress distorts, and so does not apply shear stresses to the patient's skin.

10 The bloused top sheet 24 is a necessary condition the top sheet sinks down into the recess left by the vacated cube. If the top sheet was taut (not bloused) a "trampoline" effect would exist above the cube
15 recess, destroying the pressure relief properties of the mattress.

Moreover, the foam sheet 18 will tend to stretch to conform to the shape of the projecting body portions over the recess 8. It also aids in distributing body weight over a fairly wide area, rather than over small
20 localized points, thereby reducing the pressure on the patient's skin and reduces any tendency for reductions in blood flow circulation. The patient will feel supported by the surrounding blocks and the foam sheet
25 18 and will not have a feeling of "sinking into a hole". The foam sheet 18 will also tend to distribute the area of support at the edges of the recess 8 so that the "cookie cutter effect" can be avoided.

Since the top sheet 24 is formed of a waterproof material, spills, perspiration and urine from the
30 patient cannot seep into the mattress and create sanitation problems. The cleaning of the mattress can be performed simply by wiping off the top sheet 24.

Moreover, heat dissipation occurs through the foam sheet 18, which acts as a plenum, to circulate air to the underlying portions of the mattress for removing heat from beneath the patient. Movements of the patient on the mattress creates a "bellows" effect by which air is circulated into and out of the encasement member, via the zipper 26.

The mattress of the present invention thus provides pressure relief for protruding portions of a patient's body, without the problems associated with the prior art, such as lack of cleanliness, lack of ventilation for heat dissipation and the dangers of shearing forces to a patient's skin. Moreover, the mattress of the present invention provides increased comfort without the feeling of "dropping into a hole" or the "cookie cutter effect".

Obviously, numerous modifications and variations of the present invention are possible in light of the above teachings. It is therefore to be understood that within the scope of the appended claims, the invention may be practiced otherwise than as specifically described herein.

Claims

1. A mattress comprising:

5 a first flexible and resilient body having a substantially flat top surface, said top surface having at least one recess;

10 at least one flexible and resilient second body fittable in said at least one recess and being sized and shaped such that when fitted in said at least one recess, a surface of said second body is substantially coplanar with said substantially flat top surface; and

a waterproof, non-shearing, flame retardant and antibacterial sheet covering said top surface.

15 2. The mattress of Claim 1 including a flexible and resilient sheet positioned between said top surface and said waterproof, non-shearing, flame retardant and antibacterial sheet.

20 3. The mattress of Claim 1 wherein said waterproof, non-shearing, flame retardant and antibacterial sheet has a lower friction coefficient than said top surface and is secured thereto by means for permitting a central portion of said waterproof, non-shearing, flame retardant and antibacterial sheet to slide on said top surface.

25 4. The mattress of Claim 2 wherein said waterproof, non-shearing, flame retardant and antibacterial sheet has a lower friction coefficient than said resilient sheet and is secured thereto by means for permitting a central portion of said waterproof, non-shearing, flame retardant and

antibacterial sheet to slide on said resilient sheet.

5 5. The mattress of Claim 4 wherein said
waterproof, non-shearing, flame retardant and
antibacterial sheet and said resilient sheet are fixed
to one another at lateral edges of said top surface,
and wherein said slide permitting means comprise said
waterproof, non-shearing, flame retardant and
antibacterial sheet being dimensioned with respect to
said resilient sheet such that said waterproof,
10 nonshearing, flame retardant and antibacterial sheet is
bloused when said resilient sheet is laid taut on said
top surface.

15 6. The mattress of Claim 2 wherein said first and
second bodies are formed of firm foam and said
resilient sheet is formed of soft foam.

7. The mattress of Claim 6 wherein said at least
one recess does extend through the thickness of said
first block, whereby said recess has a bottom surface.

20 8. The mattress of Claim 7 wherein said at least
one recess comprises a plurality of recesses positioned
at locations corresponding to protruding body portions
of a person lying on said mattress.

25 9. The mattress of Claim 4 including fitting
fabric panels covering at least sides of said first
body lateral to said top surface, said waterproof, non-
shearing, flame retardant and antibacterial sheet and
said resilient sheet being secured to one another and
to said panels at lateral edges of said top surface.

10. The mattress of Claim 5 including fitting

5 fabric panels covering at least sides of said first body lateral to said top surface, said waterproof non-shearing, flame retardant and antibacterial sheet and said resilient sheet being secured to one another and to said panels at lateral edges of said top surface.

11. The mattress of Claim 10 including a zipper in at least one of said fabric panels and separating said at least one of said panels into upper and lower panel portions.

10 12. The mattress of Claim 8 wherein said recesses and second bodies are substantially parallelepiped in shape.

15 13. The mattress of Claim 12 wherein said first and second bodies are formed of polyurethane foam having 1.8 lb density and an ILD of 35, and wherein said resilient sheet is formed of polyurethane foam having 1.0 lb density and an ILD of 15.

14. The mattress of Claim 10 wherein said panels are formed of nylon reinforced vinyl.

20 15. The mattress of Claim 1 wherein said waterproof, non-shearing, flame retardant and antibacterial fabric is a 70 denier Nylon taffeta, laminated to nylon or polyester tricot treated with a flame retardant, fungicidal, waterproof urethane agent.

25 16. A mattress comprising:

a substantially parallelepiped shaped first foam body having a substantially flat top surface, a bottom surface and a lateral sides connecting said top and

bottom surfaces, said first foam body including a plurality of substantially parallelepiped shaped recess extending from said top surface toward said bottom surface to a depth less than the thickness of said first foam body whereby said recesses have bottoms 5 formed of the material of said first foam body, said recesses being positioned at locations corresponding to protruding portions of a person lying on said mattress;

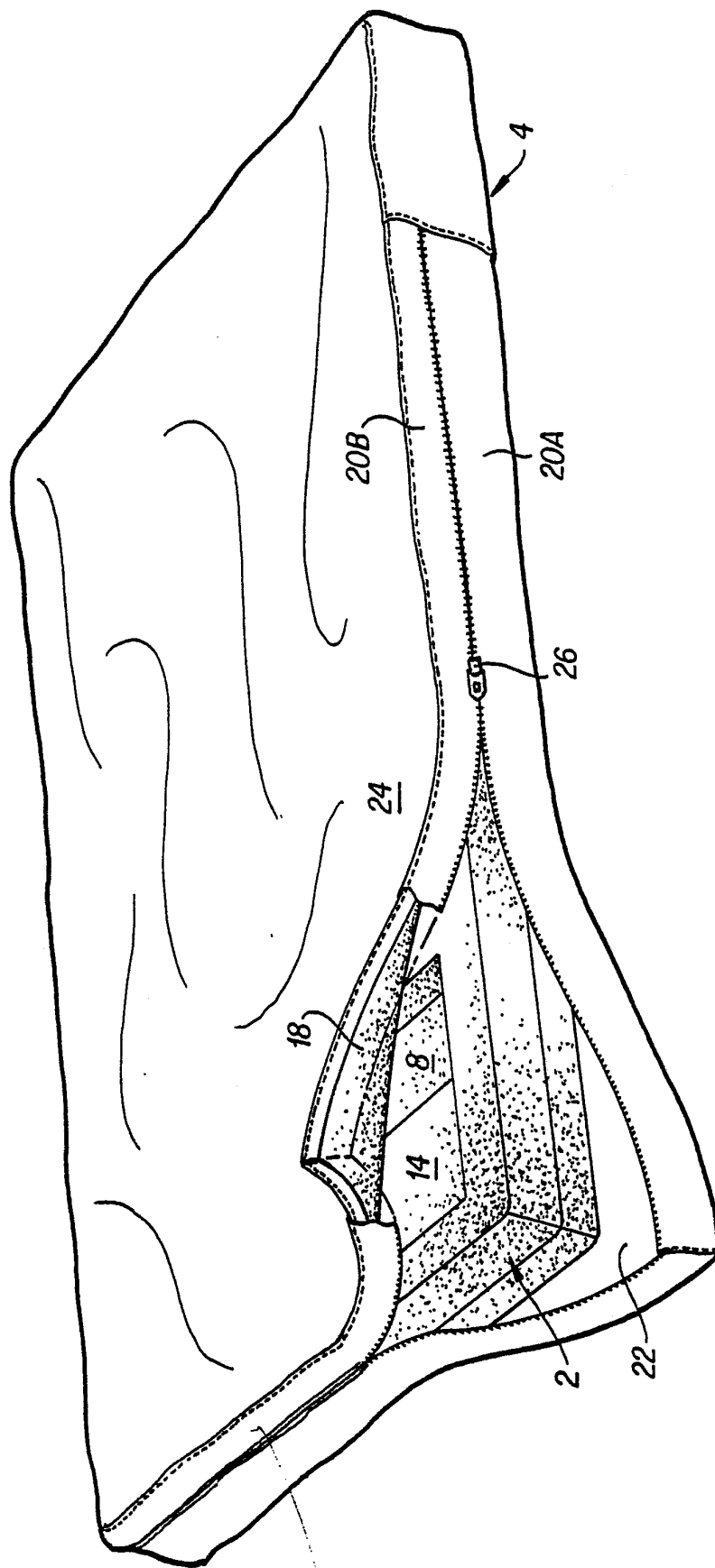
10 a plurality of second foam bodies fittable in said recesses, said second bodies being sized and shaped such that when fitted in said recesses, a surface of each of said second bodies is substantially coplanar with said top surface; and

15 an encasement member encasing said first body and comprising:

- 20 a) fabric panels covering, and closely conforming to, said lateral sides and bottom;
- b) a foam sheet covering, and closely conforming to, said top, said foam sheet being secured to said panels; and
- c) a waterproof, non-shearing, flame retardant and antibacterial top sheet loosely covering said foam sheet and being secured thereto.

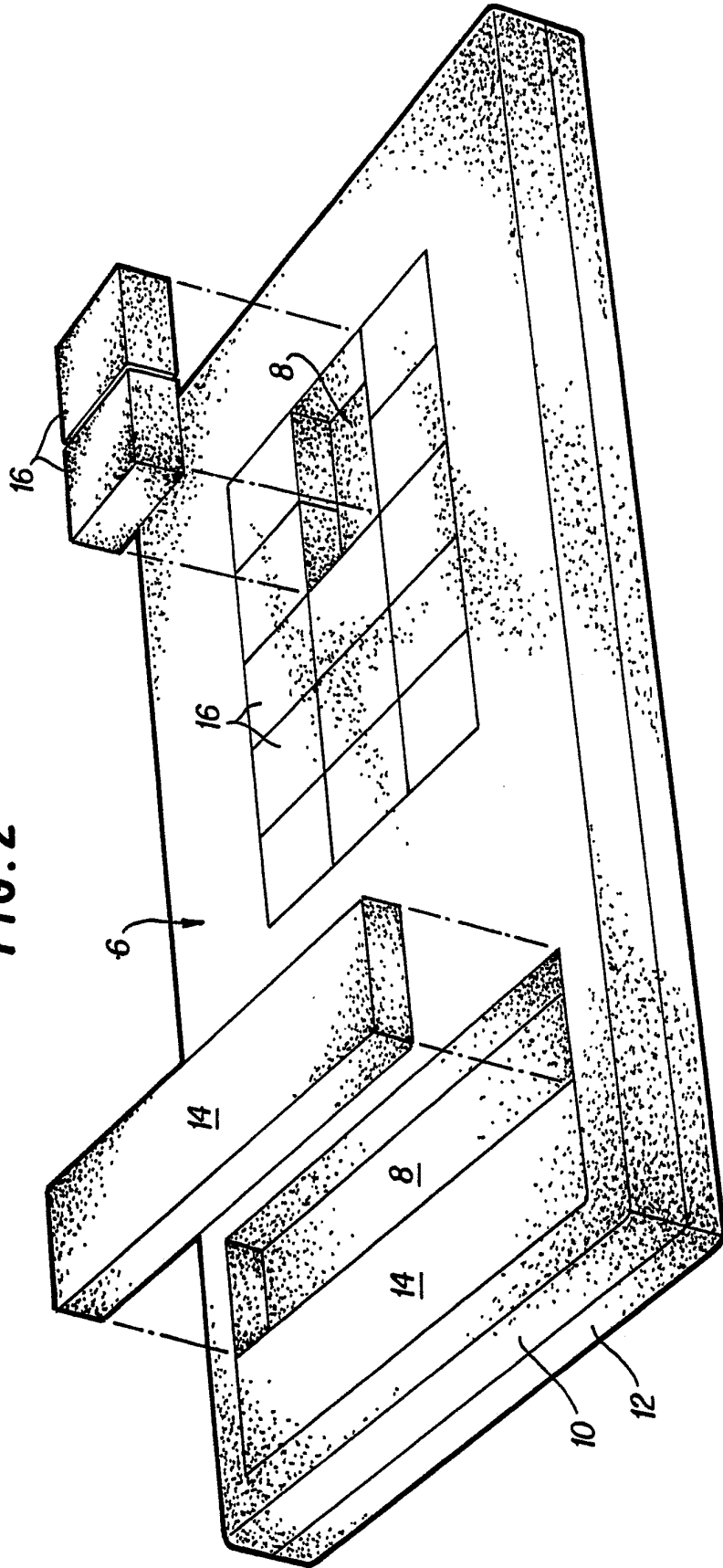
1/2

FIG. 1



2/2

FIG. 2



INTERNATIONAL SEARCH REPORT

International Application No PCT/US 87/00946

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) ³		
According to International Patent Classification (IPC) or to both National Classification and IPC		
IPC (4) A47 C 27/15 A61G 7/04		
U.S. CL. 5/464,470,473,481		
II. FIELDS SEARCHED		
Minimum Documentation Searched ⁴		
Classification System	Classification Symbols	
U.S.	5/465,464,481,470,471,473	
Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched ⁵		
III. DOCUMENTS CONSIDERED TO BE RELEVANT ¹⁴		
Category [*]	Citation of Document, ¹⁶ with indication, where appropriate, of the relevant passages ¹⁷	Relevant to Claim No. ¹⁸
Y	GB,A1,W081/02384 (Jourdan Ltd.) 3 September See Figures 5 and 2, claim 5. 1981	1-16
Y	NL,A, 8,004,755 (Rademaker) 16 March 1982	1-16
Y	US,A, 3,574,873 (Weinstein) 13 April 1971	1-16
Y	Bedding Magazine, April 1984 Issue, "Institutional Ticking' Function Over Fashion" See Column 1, Lines 8-11	1-16
A	US,A, 3,846,857 (Weinstock) 12 November 1974	1-16
A	US,A, 3,626,526 (Viel) 14 December 1971	1-16
<p>[*] Special categories of cited documents: ¹⁵</p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> <p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step</p> <p>"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.</p> <p>"&" document member of the same patent family</p>		
IV. CERTIFICATION		
Date of the Actual Completion of the International Search ²		Date of Mailing of this International Search Report ³
29 June 1987		29 JUL 1987
International Searching Authority ¹		Signature of Authorized Officer ²⁰
ISA/US		Alexander, Grosz