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[54] **RESILIENT SUPPORTING STRUCTURE FOR RELIEF OF PRESSURE**

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[21] Appl. No.: **301,724**

Related U.S. Application Data

[63] Continuation of Ser. No. 24,099, March 31, 1970, abandoned.

[52] **U.S. Cl.** ..... **5/345 R,** 5/361, 5/13, 5/DIG. 2, 5/337

[51] **Int. Cl.** **A47c 23/00**

[58] **Field of Search** ..... 5/327, 337, 395, 361, 348, 5/357, DIG. 2; 117/168

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[57] **ABSTRACT**

A resilient cellular patient-supporting resin material that has at least one flat surface portion thereof that is subdivided by a number of relatively deep crisscross grooves into a number of longitudinally and transversely spaced pads that distribute the contact pressure, resulting from a patient lying or sitting on the material, uniformly over the maximum surface area of the patient for comfort, and to minimize the probability of the patient being subjected to bed sores. Bed sores normally result from the weight of the patient being concentrated at a few localized areas of the body that are in pressure contact with the supporting surface.

The resin material above defined is adapted for numerous uses in the medical field, such as the lining for casts, spiral-wound bandages when the material is in strip form, and as components of seats and mattresses when the material is in sheet or block form. The pads when they deform, do so without the external patient-supporting surfaces thereof being subjected to surface tension. Such surface tension is undesirable as it restricts the resiliency of a supporting body such as a seat cushion or a mattress.

5 Claims, 9 Drawing Figures

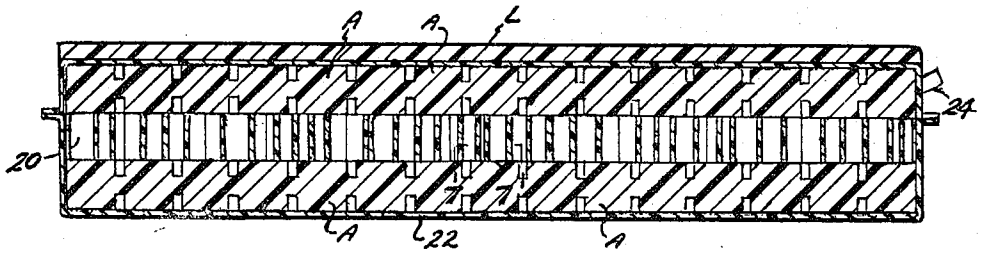


FIG. 1

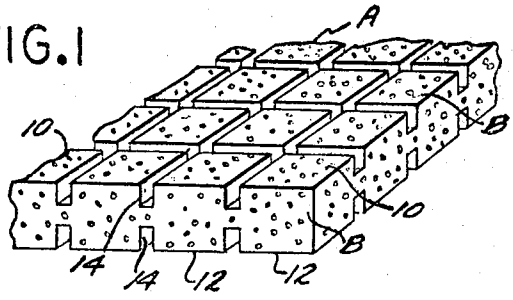


FIG. 2

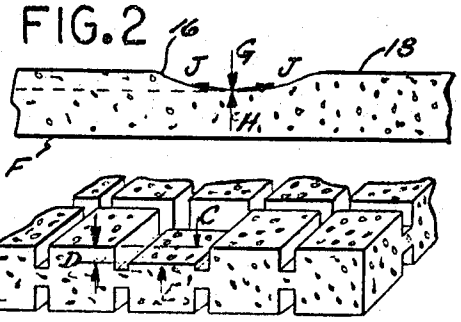


FIG. 3

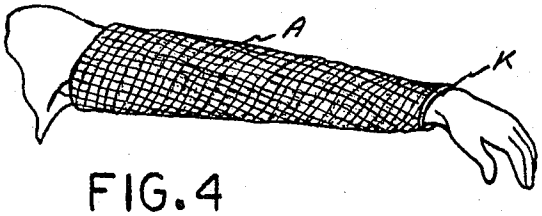


FIG. 4

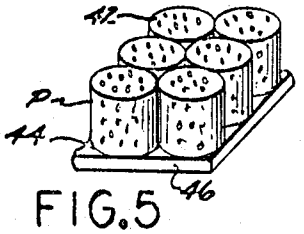
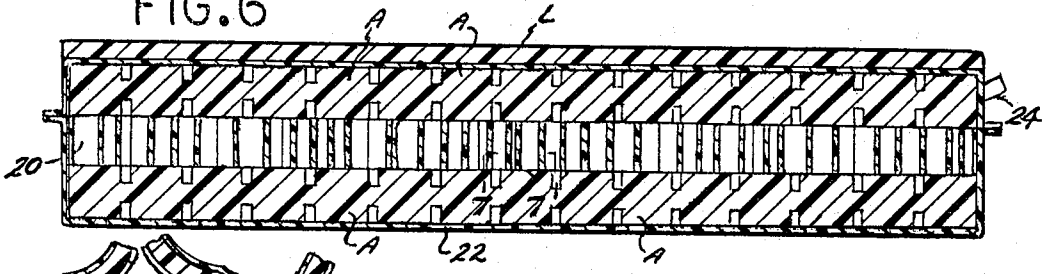


FIG. 5

FIG. 6



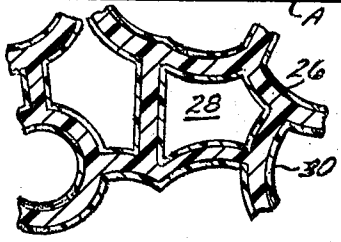


FIG. 7

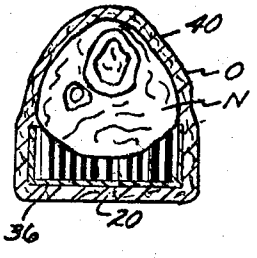


FIG. 9

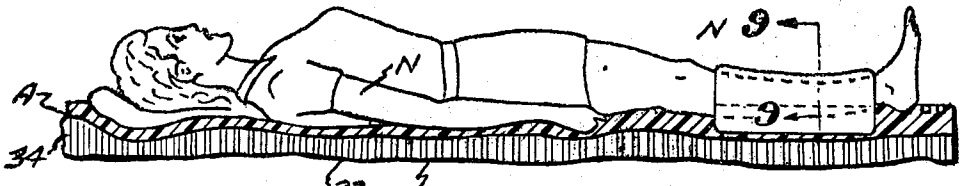


FIG. 8

RESILIENT SUPPORTING STRUCTURE FOR RELIEF OF PRESSURE

This application is a continuation of Ser. No. 24,099, filed Mar. 31, 1970, now abandoned.

BACKGROUND OF THE INVENTION

1. Field of the Invention

Patient-Supporting Resilient Cellular Material

2. Description of the Prior Art

In the past, resilient cellular resin sheets and blocks have been used to form cushions and mattresses, but such cushions or mattresses are unsatisfactory for use by invalids or patients that must sit or lie on the same for prolonged periods of time. This unsatisfactory condition arises from the fact that the contacting surface of the resilient material is subjected to surface tension when pressure contacted by curved and flat portions of a patient's body, and as a result the resilient material does not provide uniform support for the patient. Furthermore, due to the curved configuration of a patient's body, resilient cushions and mattresses as have been used in the past have certain portions thereof compressed to a greater degree than the balance thereof, and as a result the supporting resilient cushion or mattress does not exert uniform pressure contact on the patient lying or sitting thereon.

The primary purpose in devising the present invention is to provide a resilient cellular material that is in full pressure contact with the portion of the patient exerting weight thereon, with the weight of the patient being distributed uniformly over the resilient material, to substantially eliminate the operational disadvantages of prior art devices that employed cellular resilient material as a patient support.

SUMMARY OF THE INVENTION

A resilient cellular resin material preferably in the form of a sheet or elongate block that has at least one flat surface portion thereof subdivided by relatively deep crisscross grooves into a number of longitudinally and transversely spaced pads that exert uniform contact pressure on the portion of a patient's body resting thereon. The resilient cellular material may be used either individually as a pad or mattress to support a patient in a sitting or lying position thereon, and may be employed in conjunction with a bitumen-impregnated-foam resilient material for this purpose, or material having like physical characteristics.

A major object of the present invention is to supply a resilient cellular resin material that is particularly adapted for use in the medical field in providing a seat or mattress on which a patient may sit or lie, and with the pad or mattress conforming to the contour of the contacting surface of the patient to exert uniform pressure thereon.

Another object of the invention is to furnish a cast, bandage or the like in which the contacting portions thereof exert uniform pressure on the portions of the patient's body with which they are in contact.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a perspective view of a section of the patient-supporting resilient cellular material;

FIG. 2 is a vertical cross-sectional view of a conventional resilient foam pad and showing the manner in which surface tension is created in the patient-contacting surfaces thereof when the foam material is subjected to the weight of the patient;

FIG. 3 is a perspective view of the material shown in FIG. 1, and illustrating the manner in which one of the pads may be subjected to a localized downward force, without creating surface tension in the pad, or disturbing the configuration of the pads adjacent thereto;

FIG. 4 is a perspective view of an arm of a patient that has been spiral-wound with a bandage defined by the material shown in FIG. 1;

FIG. 5 is an alternate form of the resilient patient-supporting material in which individual resilient pads may deform due to pressure contact with a patient without the pads adjacent thereto being disturbed;

FIG. 6 is a longitudinal crosssectional view of a cushion that embodies the material shown in FIG. 1, as well as a bitumen-impregnated-resin core that conforms to the contour of the portion of a patient's body in contact with the cushion;

FIG. 7 is an enlarged fragmentary cross section of a portion of the bitumen-impregnated-foam material shown in FIG. 6 and taken on the line 7—7 thereof;

FIG. 8 is a longitudinal cross-sectional view of a mattress that embodies the material shown in FIG. 1 as well as the bitumen-impregnated resin illustrated in FIG. 7; and

FIG. 9 is a transverse cross-sectional view of a leg of a patient enveloped in a cast, and fully supported by an elongate body of the bitumen-impregnated resin shown in FIG. 7, and taken on the line 9—9 of FIG. 8.

DISCLOSURE OF THE PREFERRED EMBODIMENTS

A segment of the patient-supporting cellular material A is shown in FIG. 1. The material A may be either a closed or open cell foamed resin such as polyurethane or the like. The material A shown in FIG. 1 is in sheet form and includes two laterally separated first and second side surfaces 10 and 12. A number of spaced crisscross grooves 14 are formed in at least the portion of the material A most adjacent the first surface 10, and subdivides this surface portion into a number of longitudianlly and transversely separated pads B.

The grooves 14 as illustrated in FIG. 1 extend longitudinally and transversely relative to one another and as a result the pads B are of square or rectangular shape. However, the grooves 14 may intersect one another at an angle if desired and in that event the pads B will be in the shape of parallelograms. Should it be desired grooves 14 may also be formed in the material A and extend inwardly from the second surface 12 as illustrated in FIG. 1. The grooves 14 in first and second surfaces 10 and 12 need not be aligned as illustrated in FIG. 1.

The function that each pad B serves is best illustrated in FIG. 3. It will be noted in FIG. 3 that when one of the pads B is subjected to a downward force C, the pad is deformed downwardly a distance D. The force C is resisted by a counterforce E that develops in the deformed pad B due to the resiliency of the material defining the pad. The deformation of each pad B is dependent solely on the resiliency of the material defining the same, and is in no way affected by surface tension such as develops when a localized area of a flat-surfaced resilient body is deformed.

For instance, when a sheet or block F of resilient material as shown in FIG. 2 is subjected to a localized

downward pressure G, a concave area **16** is formed in the surface portion **18** of the material. After the deforming force G forms the concave area **16** to a depth **18** as illustrated in FIG. **2,** the force G is balanced not only by an upwardly directed force H as shown in FIG. **2,** but by two outwardly and oppositely directed forces J that develop as a result of the surface tension formed in the surface **18.** The forces J tend to restrict the resiliency of the material F and in some instances prevent full contact of the surface **18** with the downwardly deforming body (not shown) that impresses the force G on the material F. In FIG. **3** it will be seen that the above-mentioned deficiency of prior art resilient sheets in fully and completely conforming to the contour of the deforming body is eliminated by use of material A, as the pads B are independently movable relative to one another, particularly when subjected to a downwardly directed force C.

The material A shown in FIG. **1** when in relatively thin strip form may be spiral wound around any desired portion of a patient, such as the arm K, illustrated in FIG. **4** to exert substantially uniform pressure on the entire exterior surface of the portion irrespective of the curvatures and contours therein.

The material A when in sheet form of substantial depth is particularly adapted for use as a component in a cushion L on which a patient (not shown) may rest in a seated position. In FIG. **6** the cushion L is illustrated as defined by two spaced parallel sheets of the material A that are attached on their adjoining surfaces to a rectangular core of a bitumen-impregnated-foam material **20** of the structure illustrated and described in the Laban Mast U.S. Pat. No. 2,964,424 that issued on Dec. 13, 1960. When a patient (not shown) sits on the cushion L as illustrated in FIG. **6,** the upper material A in the cushion immediately deforms to achieve a configuration that conforms to the surface portion of the patient that is resting on the cushion. The weight of the patient is transferred throughout the upper sheet of material A to the core **20,** which core has the property of conforming to the contour of the portion of the patient that exerts weight on the cushion. The two sheets of the material A and the core M are bonded to one another by conventional means and are enclosed within an air and liquid tight envelope **22** of sheet plastic material such as one of the vinyl resins or the like. A pad of resilient material L is preferably bonded to the upper surface portion of the envelope **22** as illustrated in FIG. **6,** or otherwise held in a fixed abutting position therewith. The envelope **22** has conventional valved fluid inlet means **24** formed as a part thereof, and either air or liquid may be discharged into the confines of the envelope to further control the resiliency thereof. FIG. **7** illustrates an enlarged segment of the core material **20** in which it will be seen that a resin foam such as polyurethane has the walls **26** defining the cells **28** therein coated with an asphaltic bitumen material **30.** The method of preparing the bitumen-impregnated-foam material that defines the core M is fully described in the Mast U.S. Pat. No. 2,964,424. A cushion L that is workable is provided when the evelope **22** is cloth. However, when cloth or other permeable sheet material is used for the envelope it is more difficult to control the resiliency of the cushion L to a desired degree.

A mattress M is shown in FIG. **8** that includes an elongate block **32** of the same material that defines the core **20.** The block **32** is encased in a plastic envelope **34** to prevent bitumen incorporated in the block **32** staining ligh-colored objects that the block might contact. The upper surface of envelope **34** has a sheet of the material A overlying the same. When a patient N lies on the mattress M the block **32** slowly deforms to follow the peaks and valleys of the contacting body portion of the patient, and the pads B due to the resiliency thereof being in full pressure supporting contact with the patient.

When it is desired to provide full surface support for the lower portion of a leg or arm N or other selected portion of the body, the cast O shown in FIG. **8** may be employed. Cast O includes an elongate member **36** of channel-shaped transverse cross section. Member **36** has a core **20** of the bitumen-impregnated foam therein on which the lower portion of a leg N or other selected portions of the body rests as shown in FIGS. **8** and **9.** The core **20** in cast O deforms to the matching configuration of the portion of the leg N resting thereon, and supports the leg N with uniformly distributed pressure thereon. To prevent the leg N or other portion of the body inadvertently moving relative to the cast O in which it is disposed, a Plaster of Paris impregnated bandage **40** is transversely wound about member **36** and leg N. It will be apparent that means other than the bandage **40** may be employed in lieu thereof.

An alternate form of cushion or mattress structure P is illustrated in FIG. **5** that includes a number of resilient cylindrical bodies **42** of uniform height that are disposed side by side and have their lower surfaces **44** bonded to a rigid sheet **46.** The structure P operates in substantially the same manner as the pads B in fully conforming to the contour of a surface (not shown) in contact with the cylinders.

The use and operation of the inventions disclosed herein have been previously described in detail and need not be repeated.

I claim:

1. A cushion for effecting full surface contact with the peaks and valleys of the body portion of a patient situated thereabove to evenly distribute the weight of said patient on said cushion, said cushion comprising:

a. a resilient one-piece first sheet of a foamed resin that supports said patient, with the portion of said first sheet most adjacent said patient having a number of criss-cross grooves therein that subdivide said portion into a plurality of spaced segments that are independently movable relative to one another, and each of said sections having a height that is immediately responsive to the magnitude of the downward force exerted thereon; and

b. a second sheet of bitumen-impregnated foamed resin of substantial thickness on which said first sheet rests, with said second sheet when subjected to the weight of said patient that is transferred thereto through said first sheet slowly deforming to conform to the peaks and valleys of the portion of the patient's body supported by said first sheet, and the deformation of said second sheet being stabilized and completed when the weight of said patient is evenly distributed over said sections and said sections are in full surface contact with the peaks and valleys of the portion of the patient's body that rests on said first sheet.

2. A cushion as defined in claim **1** which, in addition includes:

c. a pliable bitumen-impervious membrane interposed between said first and second sheets to prevent bitumen from said second sheet discoloring said first sheet.

3. A cushion as defined in claim **1** which, in addition, includes:

c. a third sheet on which said second sheet rests, with said third sheet being of the same composition and structure as said first sheet.

4. A cushion as defined in claim **3** which, in addition, includes:

d. a resilient fluid-impervious envelope that encases said first, second and third sheets.

5. A cushion as defined in claim **4** which, in addition, includes:

e. means for discharging a desired quantity of a fluid into said envelope to control the resiliency of said cushion.

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