March 14, 1967 W. R. SPENCE 3,308,491

CUSHION STRUCTURE

Filed Dec. 22, 1965 3 Sheets-Sheet 1

Fig. 1

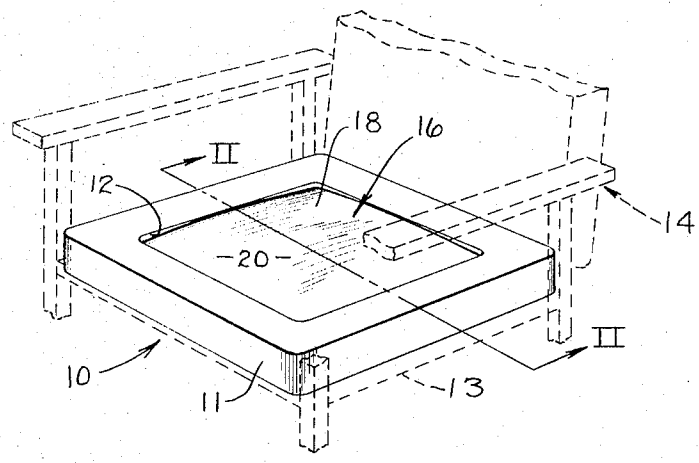


Fig. 2

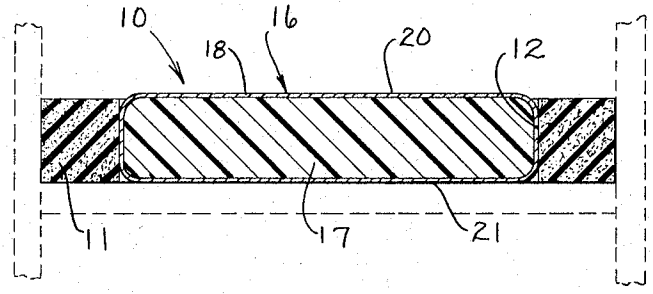


Fig. 3

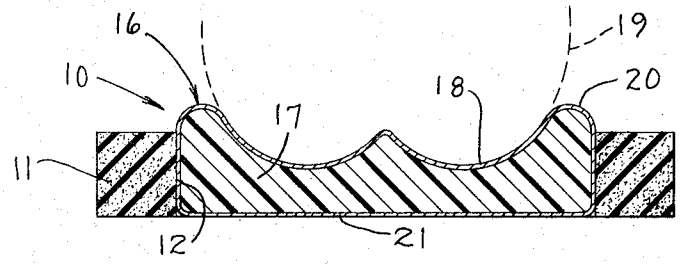
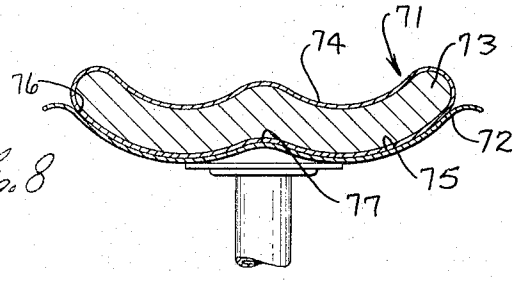


Fig. 8



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March 14, 1967 W. R. SPENCE 3,308,491

CUSHION STRUCTURE

Filed Dec. 22, 1965 3 Sheets-Sheet 2

Fig. 4

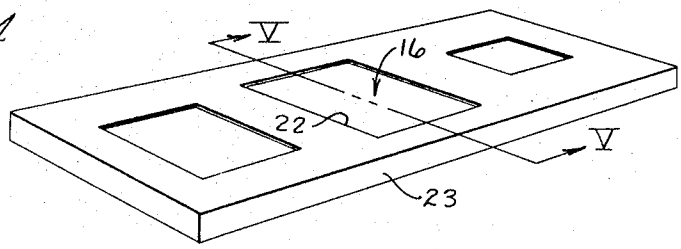


Fig. 5

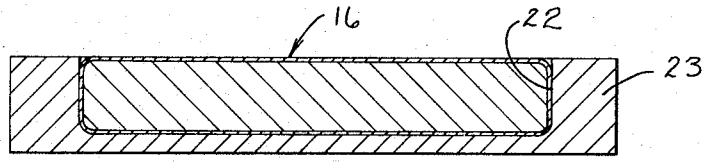


Fig. 7

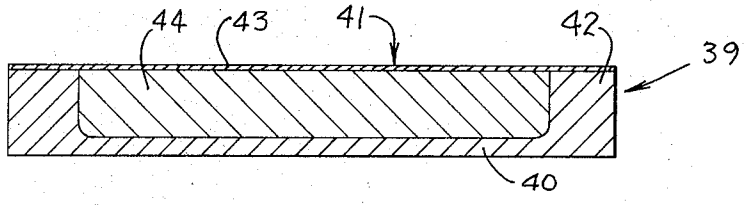
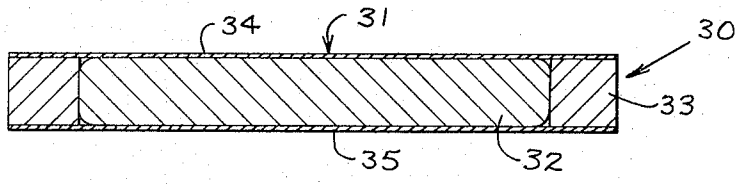


Fig. 6



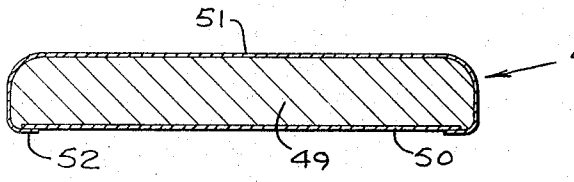


Fig. 9

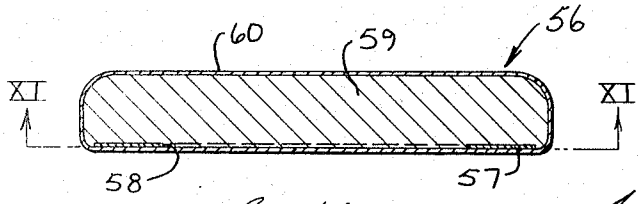


Fig. 10

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March 14, 1967 W. R. SPENCE 3,308,491

CUSHION STRUCTURE

Filed Dec. 22, 1965 3 Sheets-Sheet 3

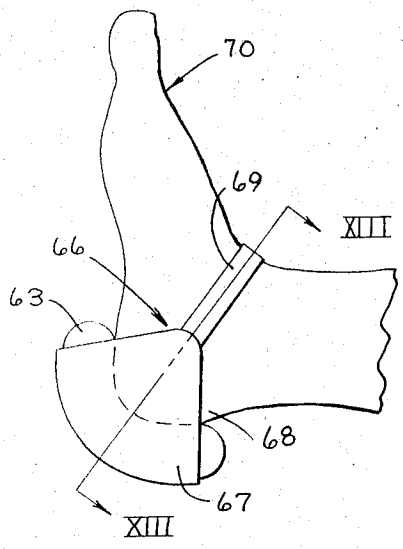

Fig. 12

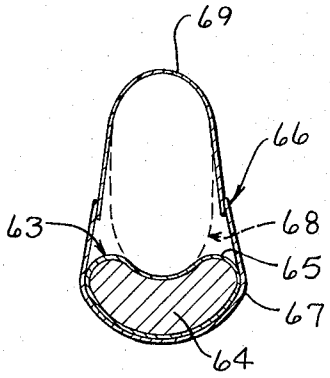

Fig. 13

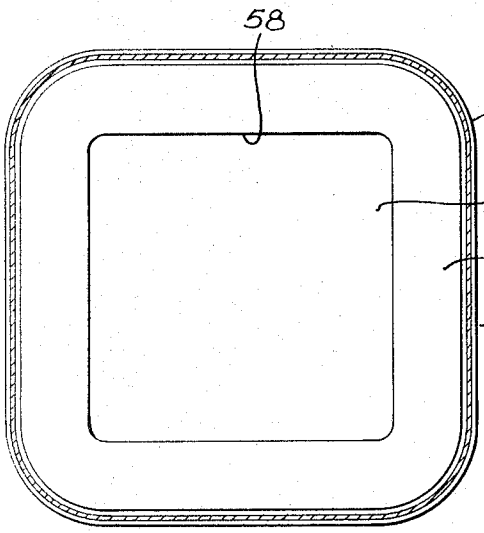

Fig. 11

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United States Patent Office 3,308,491 Patented Mar. 14, 1967

3,308,491

CUSHION STRUCTURE

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Filed Dec. 22, 1965, Ser. No. 515,525
16 Claims. (Cl. 5—348)

This invention relates in general to a structure for supporting a human body and, more particularly, to a type thereof which is capable of distributing the supporting pressure substantially uniformly throughout the area of engagement between the body and said structure.

Doctors, and particularly their patients who must spend substantial periods of time in beds, chairs or the like, have always been troubled with the problem of avoiding pressure necrosis, which includes decubital ulcers, commonly referred to as bedsores. It has long been known to the medical profession that the most acute cases of pressure necrosis develop on body surfaces where the bone structure of the patient is close to the supporting surface, e.g., over the sacrum or ischial tuberosities, so that the support of the patient tends to be concentrated in relatively small pressure areas on said supporing surface. Although numerous attempts have been made to overcome this problem, very little success has been achieved, insofar as I am aware.

Previous attempts to solve this problem have, in general, followed the line of using the softest and/or most resilient pads available under these pressure areas, which often do not exceed one or two square inches. However, due to the compressibility of such pads, the undesirable necrosis ultimately develops, even though the development may be delayed somewhat. In other words, previous attempts to solve the problem may have produced some relief for patients who require relatively short periods of convalescense in a bed or chair, but they have been inadequate for patients who require relatively long periods of confinement to a bed or a chair.

The problem has also arisen with burned patients having large or numerous areas which are extremely sensitive to pressure and lateral shearing forces, and where contact with cloth is avoided. That is, burned patients, for example, are confronted with the dual problem of avoiding decubital ulcers and also avoiding reinjury from the shearing forces which can result from even minor lateral movement of the patient with respect to the surface supporting the patient.

In the course of examining these problems with respect to patients who have come under my observation, it became apparent that the problems could be greatly relieved and perhaps solved by developing a cushion which would distribute the support pressure substantially uniformly over a relatively wide area, and also permit substantial lateral movement of the patient without substantial resistance. By such means, the force between small units of area in the contacting surfaces would be relatively small and injurious shearing forces could be avoided.

In pursuing this new approach, I discovered that certain types of gel, such as the organosiloxanes described in Patent No. 3,020,260, are capable of being formed into a substantially self-contained cushion which, when properly contained and placed upon a supporting surface beneath an irregularly shaped body, will apply a substantially uniform supporting pressure upon the supported body throughout the engaging surfaces. Moreover, the organosiloxane is characterized by the ease with which it can be displaced laterally in response to externally applied pressure, after which it returns to its original form when the pressure is removed. That is, this gel has a hydrostatic property whereby one portion of a mass of the gel can be moved transversely with respect to another portion of the same mass with very little force. Due to other properties of the gel and the importance of sanitation, it has been found highly advantageous (perhaps essential for the best performance) to cover the gel with a membrane or cover made from a highly elastic material. The membrane can be arranged so that it does not materially reduce the effectiveness of the organosiloxane to provide a substantially uniformly distributed support pressure and minimum resistance to lateral movement. For example, where said membrane is a resiliently flexible envelope, the organosiloxane can readily adapt itself to the contour of the surface of the supported body without impairing the pressure equalizing effect of the organosiloxane and without creating the shearing effect.

The disclosure in this application will be directed primarily to the use of the invention in connection with the protection and/or treatment of human patients. However, it will become apparent that the invention can be readily adapted for use with other mammals wherein the prevention of pressure necrosis has also been a problem. In this connection, it is noted that the specific gravity of most mammals is about the same and, accordingly, their bone structures are at least approximately the same, primarily because they serve substantially the same purposes. Thus, it is believed that the invention will serve equally well in the prevention of pressure necrosis for all mammals. In fact, tests conducted to date strongly support this belief.

Although there appears to be a difference of opinion with respect to the precise physiological conditions which give rise to pressure necrosis, there is some support to the theory that it will occur when the pressure on a given surface of a human body, for example, exceeds the capillary pressure for such area during a given length of time. That is, when the externally applied pressure reaches a certain value, it tends to block or otherwise adversely affect the proper flow of blood adjacent the surface of the skin in the area of such pressure, whereby necrosis occurs. Accordingly, it is of critical importance that any pressure applied to a human body for a prolonged period must be kept below the level where the necrosis can occur.

It is believed that the tolerances of various individuals to pressure will vary so that pressure necrosis will not always occur on two different people under the same circumstances. Also, it is believed that a pressure per unit area, which creates necrosis when applied to a relatively small area, may not produce said necrosis when the same pressure per unit area is applied over a larger area. It follows, therefore, that use of the invention may produce a two-fold advantage, namely, an increase in the area of engagement and a reduction in the pressure per unit area.

Accordingly, a primary object of the invention has been tht provision of a support structure for a human body whereby the support pressure can be substantially uniformly distributed over a relatively wide surface so that the occurrence of pressure necrosis is greatly reduced, if not eliminated.

A further object of this invention has been the provision of a support structure, as aforesaid, which is hypoallergenic, stable over a relatively wide temperature range, which will not support the growth of algae and/or bacteria, which is relatively easy to handle and maintain, which is soft, nonfriable and jelly-like in its consistency, which has good properties of moisture and thermal resistance, and which can be adapted for use in combination with a chair seat, a bed pad or the like.

A further object of this invention has been the provision of a support structure, as aforesaid, which can be maintained in a highly sanitary condition with a minimum of effort, which is particularly effective in greatly reducing, if

not eliminating, decubital ulcers as well as the injurious shearing forces, which have resulted from the use of existing support structures.

A further object of this invention has been the provision of a support structure, as aforesaid, which can also be attached to a portion of the patient to serve as a protective cushion on surfaces where pressure will or may be applied as the result of the position or the treatment of the patient.

Other objects and purposes of this invention will become apparent upon reading the following descriptive material and examining the accompanying drawings, in which:

FIGURE 1 is a perspective view of a support structure embodying the invention and shown in combination with a broken line fragment of a chair.

FIGURE 2 is a sectional view taken along the line II—II in FIGURE 1.

FIGURE 3 is a sectional view substantially similar to that appearing in FIGURE 2 when supporting a part of a human body.

FIGURE 4 is a perspective view of a bed pan embodying the support structure of the invention.

FIGURE 5 is a sectional view taken along the line V—V in FIGURE 4.

FIGURE 6 is a sectional view similar to that appearing in FIGURE 2 and showing a modified support structure.

FIGURE 7 is a sectional view similar to that appearing in FIGURE 2 and showing a further modified support structure.

FIGURE 8 is a cross-sectional view of a support structure embodying the invention and mounted upon the seat of a tractor, horse saddle or the like.

FIGURE 9 is a cross-sectional view of an alternate support structure embodying the invention.

FIGURE 10 is a cross-sectional view of another alternate construction embodying the invention.

FIGURE 11 is a sectional view taken along line XI—XI in FIGURE 10.

FIGURE 12 shows the foot and ankle of a patient with a support structure embodying the invention attached thereto.

FIGURE 13 is a sectional view taken along line XIII—XIII in FIGURE 12.

For convenience in description, the terms "upper," "lower" and words of similar import will have reference to the structure of the invention as appearing in FIGURES 1, 4 and 8. The terms "inner," "outer" and derivatives thereof will have reference to the geometric center of said structure.

General construction

The objects and purposes of the invention, including those set forth above, have been met by providing a support structure comprising a cushion made from a gel-like substance, such as an organosiloxane gel comprising the reaction product of an organosiloxane and a hydrogenosiloxane which is preferably a copolymer of a particular combination of siloxanes. and covered with a resiliently flexible cover which is relatively thin and highly elastic. In one preferred embodiment, this cushion is then placed within a central opening in a pad made from a foam rubber or synthetic foam material.

Under some circumstances, the cushion is attached by a suitable harness to some part, such as the heel, of a patient. Many other variations in specific construction and/or used will become evident.

Detailed description

As shown in FIGURE 1, which illustrates one embodiment of the invention, the support structure **10** is comprised of a pad **11** having a central opening **12**, which is shown as square but may be of another shape. Also, said central opening may be replaced by a cup-shaped

recess **22**, as shown in FIGURE 5, if desired. The pad **11** (FIGURE 1) is substantially rectangular in outside shape so that it will serve as a body-supporting structure on the seat frame **13** of a chair **14**, which may be a wheelchair or any other type of chair.

The pad **11** is preferably, but not necessarily, fabricated from a resiliently flexible material, such as foam rubber or polyethylene foam, which is reasonably comfortable when pressed against a portion of a human body. The opening **12** is preferably at least large enough to receive a cushion **16** having lateral dimensions sufficient to engage substantially the entire buttocks of a human being supported upon the chair **14** in a normal sitting position, particularly as shown in FIGURE 3.

The cushion **16** is comprised of a core **17** which is preferably made from an organosiloxane gel, substantially of the type disclosed and described in said Patent No. 3,020,260. Thus, said core will have a soft, slightly tacky, nonfriable and jelly-like consistency in its cured condition. Specific reference is made herein to the use of a gel and, more specifically, to those gels known as organosiloxane gels because this particular material has been found especially suited to the purposes of the invention. However, it may be found that other gels and/or colloids, including jelly-like substances which, strictly speaking, are not colloids, would serve satisfactorily in carrying out the purposes of the invention.

The core **17**, which is normally relatively flat and of about the same thickness as the pad **11** (FIGURE 2), is preferably covered by an elastic membrane or cover **18** which, in one preferred embodiment, is made from a gum or latex sheet material, such as "dental dam sheet rubber." This elastic material has been found to be satisfactory where the thickness thereof is maintained between approximately .010 of an inch and .015 of an inch, and where the material can be stretched so that it is at least 600 percent larger than its normal unstretched size without fatiguing the material. It has been found that where a material of this type is used, the amount of depression which a supported human will make upon the core **17** is reduced by approximately 20 percent over the amount of depression made where there is no covering whatsoever upon the core. However, it has also been found that an elastomeric cover **18** of the afore-mentioned type does not materially alter the capacity of the core to distribute the support pressure between the cushion **16** and the body **19** substantially uniformly throughout the area of their mutual engagement. Moreover, the cover **18** does not materially inhibit the hydrostatic properties of the core **17**, whereby the lateral displacement is made possible, as long as the cover is reasonably flexible.

The core **17**, as well as its elastic cover **18**, are carefully and intentionally selected from materials which are hypoallergenic, incapable of supporting the growth of algae and/or bacteria and which will have stable physical characteristics over a relatively wide temperature range and for relatively long periods of time or use. The cover **18** includes a top sheet **20** which engages the patient and a bottom sheet **21** which engages the supporting device, such as the chair seat **13**.

In a particular preferred embodiment of the invention, the pad **11** is preferably about one and one-half inches in thickness and approximately 18 inches square, and the opening **12** is approximately 16 inches square. However, it will be recognized that the thickness and opening size may be varied in accordance with the needs and/or the particular portion of the human or other body being supported by the structure **10**. That is, for example, where it becomes desirable to support a patient upon a bed, the bed pad **23** (FIGURE 4) is provided with a number of recesses **22** (or openings) which are strategically arranged in locations where pressure necrosis otherwise normally develops. Generally speaking, pads **11** and **23** having thicknesses in the range from one inch to

four inches, and cushions **16** having thicknesses in the range of one-half inch to three inches, will normally meet most of the needs for this invention.

Operation

Although the operation of the support structure **10** is probably evident from the foregoing descriptive material, it is pointed out that an essential, if not critical, feature of the applicant's invention resides in the ability of the cushion to conform itself to the contour of the engaged surface on the supported body so that the support pressure is substantially uniformly distributed over the entire area of engagement. That is, the cushion performs as though substantially the same amount of pressure is being applied on each small increment of the entire engaged surface, and such pressure is being applied in a direction substantially perpendicular to such surface. Thus, the effect upon the patient is almost the same as though the patient were being floated in a liquid of sufficient density to support the patient. However, since the pressure increases with the depth of a liquid, and since pressure is applied equally in all directions according to Pascal's law, the distribution of the supporting pressure might be slightly more uniform with the cushion of the invention than by the liquid in which the same body is floated.

In the case of burned patients, contact of the burned regions with any rough, tacky or similar surface must be avoided. Furthermore, lateral movement of the patient must be minimized to reduce the injurious effects of the resultant shearing action. The cover **18** on the cushion **16** provides a flexible, sanitary and easily cleaned surface which feels smooth and comfortable to the patient. The core of gel permits the top sheet **20** to move a substantial distance with respect to the bottom sheet **21**, in directions parallel with said sheets, without imposing an injurious shearing force upon the body surface engaged by the top sheet **20**. This is particularly important where the engaged surface includes healing areas which can be reinjured by relatively small shearing or rubbing action.

In a preferred embodiment of the invention, the hydrostatic or flowability properties of the gel in the core **17** are such that the upper surface of the core can be moved with respect to its lower surface a distance at least equal to the thickness of the core by applying a force which will be insufficient to effect an injurious shearing action. The equalized pressure minimizes discomfort and interference with skin grafts.

The organosiloxane core **17** and its elastomeric cover **18** tend to resume their original unstressed condition of FIGURE 2 after the object which they have been supporting is removed therefrom. Thus, the distortion created in the cushion, as shown in FIGURE 3, when it is supporting an object, is not permanent and does not in any way effect the subsequent use of the cushion for supporting the same or a different object.

Modified structures

The modified support structure **30** appearing in FIGURE 6 is comprised of a resiliently flexible enclosure **31** in which the core **32** is confined. The enclosure **31**, which preferably is water-tight, comprises a resiliently flexible ring **33**, which may be fabricated from foam rubber or the like, and the sheet members **34** and **35**, which define the upper and lower walls of the enclosure **31**. The core **32** may be substantially the same as the core **17** of FIGURE 2, and the sheet members **34** and **35** may be fabricated from the same type of material as the cover **18** in FIGURE 2. It has been determined that the structure **30** will have substantially the same characteristics as the cushion **16** disclosed in FIGURE 2, and will have no adverse affect upon the desirable properties of the gel. The edges of the two sheet members are firmly secured to the ring **33** completely therearound by any suitable adhesive, which may include the heating of the sheets and/or ring so that they weld together when cooled.

The modified structure **39** appearing in FIGURE 7 differs from the structure **30** of FIGURE 6 in that the lower wall **40** of the enclosure **41** is provided by an integral portion of the resiliently flexible ring **42**. The upper surface of the ring **42** is covered by a sheet member **43**, which may be substantially identical with the sheet members **34** and **35** shown in FIGURE 6. The core **44** is preferably similar to the core **17** of FIGURE 2.

FIGURE 9 illustrates a modified support structure **48** wherein the core **49** of gel is mounted upon a substantially rigid base plate **50** fabricated from a material which preferably has a minimum of affinity for the gel of the core **49**. Thus, freedom of lateral movement of the gel, according to the teachings of the invention, is not inhibited by the rigidity of the base plate **50**. A substantially cup-shaped, sheet member **51** surrounds the upper surface and side walls of the core **49**, and its peripheral edge **52** is firmly secured, preferably in a liquid-tight manner, to the peripheral edge of the base plate **50** so that the core **49** is completely enveloped by the combined sheet member **51** and base plate **50**. The sheet member **51** is preferably similar in thickness and composition to the cover **18** of FIGURE 2.

The support structure **56** shown in FIGURE 10 is a modification of the support structure shown in FIGURE 9. Specifically, the support structure **56** of FIGURE 10 includes a base plate **57** which is flat and annular so that it has a substantial opening **58** therethrough. Thus, the core **59** not only rests upon the base plate **57**, but extends into the opening **58**. Accordingly, the sheet member **60** completely envelopes both the core **59** and the base plate **57** in order to prevent contamination of the core **59**. The base plates of FIGURES 9 and 10 may be of any shape, such as square or round.

FIGURES 12 and 13 illustrate a further adaptation of the invention wherein a cushion **63** is attached to a specific part of the body, such as a heel, by a harness **66**. The cushion **63** has a resiliently flexible core **64** of gel, as in the core **17**, and a resiliently flexible, elastomeric cover **65** which may be substantially identical in structure with those shown in FIGURE 2 but somewhat smaller in size. The cushion of FIGURE 13 may be approximately four inches in diameter and one-half inch in thickness where it is supporting only the weight of the foot and adjacent part of the leg. It follows, of course, if the patient must be able to support his entire weight upon the cushion **63**, then it would be considerably thicker to support the additional weight, but might be no larger in diameter.

The harness **66** is comprised of an elongated, flat sheet member **67** which is sufficiently wide to provide adequate support for the cushion **63** in holding it against the heel **68**. The opposite lengthwise ends of the sheet member **67** are connected to a strap **69** which extends across the ankle or instep of the foot **70** to hold the sheet member **67** so that it cradles the cushion **63** against the heel **68**. The strap **69** can, of course, be made from two parts adjustably connectible by a buckle in a substantially conventional manner.

By reference to the harness construction and cushion shown in FIGURES 12 and 13, it will be readily recognized that similar harness structures can be provided for holding a cushion against a knee, an elbow or a hip. In fact, due to the shock-absorbing properties of the gel, a cushion of appropriate size and shape in combination with a suitable mounting structure can be used advantageously in knee, hip and/or shoulder pads of the type used by athletes, particularly in football, and such use is contemplated. That is, the cushion would merely replace the present fibrous or resiliently flexible pads now used for this purpose.

A cushion and harness structure similar to that appearing in FIGURE 12 can also be integrated into the body-engaging parts of a traction device commonly used for patients who have serious bone injuries.

While the foregoing descriptive material placed considerable emphasis upon the use of the invention on human patients, it will be recognized that the advantageous features of the invention are equally adaptable to use on the animal patients of veterinarians. For example, it is common knowledge that the larger animals like horses and cows, must be suspended in cradles when they break a leg. It is also common knowledge that the existing harnesses cause the serious injury to the belly of the animal where it is engaged by the harness due to pressure necrosis. By adapting the teachings of the invention as disclosed in FIGURES 12 and 13 and providing a cushion and harness of adequate size, it will now be possible to suspend such animals without causing pressure necrosis.

The cushion **71**, appearing in FIGURE 8, is particularly adapted for use on the seat **72** of a tractor, horse saddle, or the like. In general, the cushion **71** is comprised of an organosiloxane core **73** disposed within an elastomeric cover **74** which may be similar to the cover **18** for the cushion **16**. However, because of the more severe use to which the cushion **71** will normally be subjected, the cover **74** should be sufficiently strong to withstand such use. Thus, it may be necessary, or at least advisable, to fabricate the cover **74** from one of the recently developed, synthetic sheet materials which are woven so that the material is elastic, but strong and durable.

The nature of the tractor seat **71** is such that it provides its own recess **75** which restricts the tendency for the core **73** to be displaced under pressure. This restriction is augmented by the elastomeric cover **74** which may be somewhat heavier and stronger than the envelope **18**. The stronger cover may tend to reduce somewhat the uniformity of the support pressure due to the hammock or bridging effect produced by the heavier cover **74**. That is, there may be a slight tendency for the cover **74** to bridge between the highpoints **76** and **77**, for example, when the cushion **71** is occupied by the operator of the tractor. However, in this instance, the cushion **71** is being used by a person who is presumably healthy and not by a patient. Also, the cushion **71** will normally be used for relatively short periods of time. Moreover, the cushion **71** will still outperform any existing cushion or other device as regards lateral flowability and the equalization of pressure over the entire surface of engagement, whereby the operator of the tractor can perform his work in a much more comfortable condition.

In addition to the comfort achieved by the uniform or substantially uniform distribution of pressure over the supported surface, even with the cushion **71**, a further function is performed by the cushion **71** which has not been previously available. That is, the cushion **71** serves as a hydrostatic shock-absorbing device, which at least reduces the discomfort resulting from sudden changes in the vertical position of the tractor seat **72**, during the normal operation of the tractor to which it is attached. If the upward or downward movement of the seat **72** is sudden and relatively large, the occupant of the cushion **71** tends to move slightly into the cushion but with substantially uniform pressure over the entire area of engagement therewith. There is no feeling of "bottoming," and the parts of the bone structure in the buttocks near the surface of engagement are protected from bruises and discomfort.

The cushion **71**, as well as the cushion **16**, has been found so effective in distributing pressures uniformly that an irregular object, such as a key case, can be placed upon the cushion **71** after which the cushion can be occupied by a human being who may not be conscious of the existence of the key case. That is, the organosiloxane core **73** of the cushion **71** will recede away from the key case as said key case is depressed into the cushion by the occupying person. In a matter of moments, the same uniform pressure will be created across the entire engaging surfaces including the surface of the key case. In tests conducted on dogs, no adverse effect, such as pressure necrosis, was detected on these animals who remained in the same position on said cushions almost constantly for periods of two weeks or more.

While the cover **18**, for example, has been disclosed herein as formed from sheet material, it will be seen that said cover can be formed by applying a liquid elastic to the core which solidifies to provide an elastomeric shell around the core. In fact, other surface means, which is capable of providing a suitable contact with the supported patient, may be used.

The cores **17**, **32**, **44**, **49**, **59**, **64** and **73** are preferably made of the reaction product of an intimate mixture consisting essentially of (1) an organosiloxane having a viscosity of from 100 to 10,000 cs. at 25° C. and being a copolymer consisting essentially of units of the formula $RViSiO$, R_2SiO, and $CH_3R_2SiO_{.5}$ where each R individually is selected from the group consisting of methyl and phenyl radicals and Vi represents a vinyl radical, at least 0.174 molar percent of the units in said copolymer being the said RViSiO units, (2) a liquid hydrogenosiloxane of the average general formula

$$HRCH_3SiO(R_2SiO)_nSiCH_3RH$$

where each R is as above defined and n has an average value such that the viscosity of the hydrogenosiloxane is no more than 10,000 cs. at 25° C., no more than 25 molar percent of the total R radicals present in (1) and (2) being phenyl, and (3) a platinum catalyst in an amount sufficient to furnish at least 0.1 part per million of Pt based on the combined weight of (1) and (2); the proportions of (1) and (2) being such that prior to reaction there is an average of from 1.4 to 1.8 gram atoms of the silicon-bonded H atoms in (2) per gram molecular weight of (1) and there being at least one RViSiO unit in (1) for every silicon-bonded H atom in (2), the molecular weight of (1) being calculated by the equation:

$$\text{Log visc.} = 1.00 + 0.0123M^{.5}$$

where M is the molecular weight and "visc." is the viscosity of (1) in cs. at 25° C.

While the cores **17**, **32**, **44**, **49**, **59**, **64** and **73** may be made of a pure reaction product as described in the immediately preceding paragraph, it has been found desirable to incorporate a substantial quantity of a filler or extender material in the reaction product in order to minimize cost. It has been found especially satisfactory to use a filler consisting essentially of dimethylsiloxane liquid which can be uniformly mixed in the reaction mixture before the reaction begins. It has been found that up to 65 percent by weight of the cores can consist of the filler material.

Although particular preferred embodiments of the invention have been disclosed hereinabove for illustrative purposes, it will be recognized that variations or modifications of such disclosure, which come within the scope of the appended claims, are fully contemplated.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

What is claimed is:

1. A cushion structure attachable to a supporting device for engaging a portion of a body, comprising:

a self-contained, resiliently flexible and semisolid core means having a soft, nonfriable and jelly-like consistency, said core means being hypoallergenic, stable over a selected temperature range and incapable of supporting the growth of algae and bacteria; and

wall means adjacent said core means for protecting the said core means from external contamination.

2. A cushion structure according to claim **1**, in which said core means is capable of supporting said body so that the supporting pressure is substantially uniformly distributed over the portion of the core means closely adjacent the body; and in which said wall means envelopes

said core means, the portion of said wall means engageable with said body being capable of being stretched without fatigue so that it is at least twice its normal unstretched size.

3. A cushion structure according to claim 1, in which said wall means is resiliently flexible and substantially envelopes said core means and is in substantially snug contact therewith, said wall means including relatively thin sheet means arranged for engaging and closely conforming to the shape of said body and capable of being elastically stretched without fatigue.

4. A structure according to claim 3, wherein said wall means comprises an annular, resiliently flexible side wall means around said core means;

wherein said sheet means comprises a first sheet extending across the upper surface of said core means and a second sheet extending across the lower side of said core means, said sheets being firmly secured along the peripheral edges thereof to said side wall means, whereby said core is totally enclosed by said wall means.

5. A structure according to claim 3, wherein said wall means includes a substantially rigid base plate means disposed adjacent the lower side of said core means and readily movable with respect thereto; and

wherein said sheet means extends over the upper surface and around the sideward edge surfaces of said core means and is firmly secured along the peripheral edges thereof to said base plate means, whereby said core is totally enclosed by said wall means.

6. A structure according to claim 3, wherein said wall means includes an annular, relatively flat base plate means adjacent the lower surface of said core means and easily movable with respect thereto; and

wherein said core means and said base plate means are totally enclosed by sheet means.

7. A structure according to claim 3, including harness means for removably attaching said cushion structure to a selected part of said body, said harness means comprising a flat, elongated sheet member in which the cushion structure is cradled, and strap means connected to the opposite ends of said sheet member, said strap means being adjustable.

8. A structure according to claim 1, wherein said wall means is formed from a resiliently flexible sheet means having a thickness of from .010 to .015 of an inch and being capable of being stretched without fatigue so that it is at least 600 percent larger than its unstretched size; and

wherein said core means is a relatively flat mass of an organosiloxane gel.

9. A cushion structure according to claim 1, in which the core means is an organosiloxane gel which is the reaction product of an intimate mixture consisting essentially of (1) an organosiloxane having a viscosity of from 100 to 10,000 cs. at 25° C. and being a copolymer consisting essentially of units of the formula RViSiO, R_2SiO, and $CH_3R_2SiO_{.5}$ where each R individually is selected from the group consisting of methyl and phenyl radicals and Vi represents a vinyl radical, at least 0.174 molar percent of the units in said copolymer being the said RViSiO units, (2) a liquid hydrogenosiloxane of the average general formula $HRCH_3SiO(R_2SiO)_nSiCH_3RH$ where each R is as above defined and n has an average value such that the viscosity of the hydrogenosiloxane is no more than 10,000 cs. at 25° C., no more than 25 molar percent of the total R radicals present in (1) and (2) being phenyl, and (3) a platinum catalyst in an amount sufficient to furnish at least 0.1 part per million of Pt based on the combined weight of (1) and (2); the proportions of (1) and (2) being such that prior to reaction there is an average of from 1.4 to 1.8 gram atoms of the silicon-bonded H atoms in (2) per gram molecular weight of (1) and there being at least one RViSiO unit in (1) for every silicon-bonded H atom in (2), the molecular weight of (1) being calculated by the equation:

$$\text{Log visc.} = 1.00 + 0.0123M^{.5}$$

where M is the molecular weight and "visc." is the viscosity of (1) in cs. at 25° C.

10. A cushion structure for supporting the body of a mammal, comprising:

a one-piece soft, resilient, nonfriable cushion of jelly-like consistency having surface means adapted for contacting the mammal body, said cushion being capable of relatively free flow in response to a weight placed thereon so that it can conform to the contour of a body supported thereon and can return to its original condition when the weight is removed, said cushion consisting essentially of an organosiloxane gel which is the reaction product of an intimate mixture consisting essentially of (1) an organosiloxane having a viscosity of from 100 to 10,000 cs. at 25° C. and being a copolymer consisting essentially of units of the formula RViSiO, R_2SiO, and $CH_3R_2SiO_{.5}$ where each R individually is selected from the group consisting of methyl and phenyl radicals and Vi represents a vinyl radical, at least 0.174 molar percent of the units in said copolymer being the said RViSiO units, (2) a liquid hydrogenosiloxane of the average formula

$$HRCH_3SiO(R_2SiO)_nSiCH_3RH$$

where each R is as above defined and n has an average value such that the viscosity of the hydrogenosiloxane is no more than 10,000 cs. at 25° C., no more than 25 molar percent of the total R radicals present in (1) and (2); the proportions of (1) and (2) being such that prior to reaction there is an average of from 1.4 to 1.8 gram atoms of the silicon-bonded H atoms in (2) per gram molecular weight of (1) and there being at least one RViSiO unit in (1) for every silicon-bonded H atom in (2), the molecular weight of (1) being calculated by the equation:

$$\text{Log visc.} = 1.00 + 0.0123M^{.5}$$

where M is the molecular weight and "visc." is the viscosity of (1) in cs. at 25° C.

11. A cushion structure according to claim 10, in which the cushion contains a filler material substantially uniformly distributed throughout.

12. A cushion structure according to claim 11, in which the filler material is dimethylsiloxane and the amount of said filler material is less than about 65 percent by weight based on the total weight of the cushion.

13. Support means for a human body, comprising:

resiliently flexible and substantially flat pad means having a thickness in the approximate range of from one-half inch to three inches, said pad means having a central opening therein;

relatively flat and resiliently flexible cushion means formd from a reaction product of the process which comprises reacting

(1) an organosiloxane which is a copolymer of MeViSiO, Me_2SiO and $Me_3SiO_{.5}$ units, with

(2) a liquid hydrogenosiloxane of the average general formula $HMe_2SiO(Me_2SiO)_nSiMe_3H$, in the presence of

(3) a platinum catalyst;

said cushion means being snugly disposed within said opening, said cushion means having a thickness in the range of from approximately one-half inch to three inches and having a soft, nonfriable and jelly-like consistency, said cushion means being hypoallergenic, incapable of supporting the growth of algae and bacteria and being stable over a relatively wide temperature range, the support pressure applied by said cushion means to the portion of said body engaged by said cushion means being distributed sub-

stantially uniformly throughout the surface of said portion engaged by the cushion means; and

a relatively flexible cover member substantially completely enveloping said cushion means, said cover member having a thickness of between approximately .010 and .015 of an inch and being capable of stretching without fatigue so that it is at least 600 percent larger than its unstretched condition.

14. Support means for a human body according to claim **13**, in which

(1) the organosiloxane has a viscosity of from 400 to 5,000 cs. at 25° C. and at least 0.174 molar percent of the units in said copolymer being the said MeViSiO units, and

(2) the liquid hydrogenosiloxane has a viscosity of from 2 to 2,000 cs. at 25° C.

15. A method of preventing pressure necrosis of mammals, which comprises:

supporting a mammal on cushioning means consisting essentially of an organosiloxane gel which is soft, resilient, nonfriable and of jelly-like consistency and which is capable of relatively free flow in response to a weight placed thereon so that it can conform to the contour of the body supported thereon and can return to its original condition when the weight is removed, said gel being the reaction product of an intimate mixture consisting essentially of (1) an organosiloxane having a viscosity of from 100 to 10,000 cs. at 25° C. and being a copolymer consisting essentially of units of the formula RViSiO, R_2SiO, and $CH_3R_2SiO_{.5}$ where each R individually is selected from the group consisting of methyl and phenyl radicals and Vi represents a vinyl radical, at least 0.174 molar percent of the units in said copolymer being the said RViSiO units, (2) a liquid hydrogenosiloxane of the average formula

$$HRCH_3SiO(R_2SiO)_nSiCH_3RH$$

where each R is as above defined and n has an average value such that the viscosity of the hydrogenosiloxane is no more than 10,000 cs. at 25° C., no more than 25 molar percent of the total R radicals present in (1) and (2) being phenyl, and (3) a platinum catalyst in an amount sufficient to furnish at least 0.1 part per million of Pt based on the combined

weight of (1) and (2); the proportions of (1) and (2) being such that prior to reaction there is an average of from 1.4 to 1.8 gram atoms of the silicon-bonded H atoms in (2) per gram molecular weight of (1) and there being at least one RViSiO unit in (1) for every silicon-bonded H atom in (2), the molecular weight of (1) being calculated by the equation:

$$\text{Log visc.} = 1.00 + 0.0123M^{.5}$$

where M is the molecular weight and "visc." is the viscosity of (1) in cs. at 25° C.;

whereby a substantially uniform, relatively low supporting pressure is applied on the entirety of the body of the mammal supported on the cushioning means.

16. A cushion structure, particularly adapted for supporting a mammal body, comprising:

a one-piece homogeneous cushion made of an elastic, monporous, jelly-like, semisolid material capable of flowing laterally under pressure and capable of returning toward its original shape when pressure is removed, said cushion having a mammal supporting surface and being of sufficient depth to provide support for the mammal thereon so that when a mammal contacts said surface the material comprising said cushion will flow laterally in order substantially to equalize the supporting pressure applied over the entire area of engagement of said mammal and said cushion.

References Cited by the Examiner

UNITED STATES PATENTS

1,491,146	4/1924	Larson	297—393 X
2,248,413	7/1941	Rathbun	5—361 X
2,627,302	2/1953	Forsyth	5—348
2,691,179	10/1954	Kann	5—348
2,987,735	6/1961	Nail	5—348
3,008,464	11/1961	Atkins	128—24
3,020,260	2/1962	Nelson	264—46.5
3,043,049	7/1962	Gleason	248—188.4

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