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(54) **Title**: ANATOMICAL, PRESSURE-EVENIZING MATTRESS OVERLAY WITH PRESTRESSED CORE, AND BAFFLED, LATERAL-EDGE CORE RESPIRATION

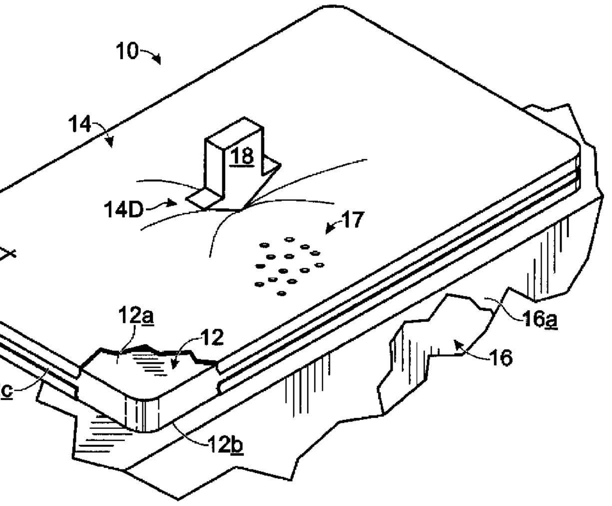

Fig. 1

(57) **Abstract**: An anatomical pressure-evenizing mattress overlay including a dynamic-response core having spaced, upper and lower, surfaces and an intermediate, perimetral edge. The core is formed including a 100% open-cell, compressible and flowable, viscoelastic foam expanse, and possesses a relaxed-state volume which resides in about an 8-10% nominally compressed condition. Load-transmissive!y bonded to the entire outside of the core, so as to function as a dynamically- responsive unit with it, and possessing a relaxed-state, internal, prestressed, tension condition, is an elastomeric, moisture- and gas-flow-managing coating, including fluid-flow-controlling, baffled, respiration window structure which exposes a portion of the core's edge to accommodate respiration of and for the interior of the core.

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ANATOMICAL, PRESSURE-EVENIZING MATTRESS OVERLAY WITH PRESTRESSED CORE, AND BAFFLED, LATERAL-EDGE CORE RESPIRATION

Cross Reference to Related Applications

This application is a continuation-in-part of U.S. Patent Application Serial No. 12/798,390, filed April 2, 2010, for "Anatomical, Pressure-Evenizing Mattress Overlay and Associated Methodology", which is a continuation-in-part of U.S. Patent Application Serial No. 12/657,568, filed January 21, 2010, for "Anatomical, Pressure-Evenizing Mattress Overlay". The entire disclosure contents of these three, prior-filed applications are hereby incorporated herein by reference.

Background and Summary of the Invention

The present invention pertains generally to an anatomical, pressure-evenizing mattress overlay with a prestressed core, and baffled, lateral-edge core respiration windowing. More particularly, and with these generally-stated features solidly in place, it relates to a special-purpose, special-capability, breathable, friction- and shear-controlling, anatomical-support, pressure-evenizing, "mattress overlay" intended to be placed on top of, and used in conjunction with, an underlying, yieldable support surface, such as that provided by a mattress, for the purpose of furnishing "direct", pressure-evenizing under-support for a substantially bed-ridden person. Respiration-window structure, and associated baffling, are employed to control cooling air-flow (gas-flow breathability) in the overlay-internal core structure for cooling and keeping perspiration-free a supported person, with the baffling also functioning to minimize (hopefully to prevention) the penetrating leakage of supported-person body liquid into that core structure. The concept of structural breathability, featured by the invention, is also intentionally referred to herein, pseudo-anagogously, in the language of "respiration" -- a term most usually associated with human (or other animal) breathing.

In one of its important aspects, the present invention involves an improved version of the invention described in the above-referenced '568 application, and in another important one of its aspects, it proposes an improved version of the invention described in the above-referenced '390 application.

The overlay of the invention, in its preferred "thickness" configuration, is specifically designed, as will be explained more fully below, with a thickness (or thinness, depending on point of view) suitable, with the provision of appropriate, external yieldable under-support, for handling persons weighing up to about 350-lbs.

In this configuration, it is definitively not designed to be used alone as a support on top of any rigid, underlying surface; nor is it intended to be a "stand-alone" support structure, such as a mattress, *per se*.

Where heavier persons are to be handled, such situation may be addressed either in the manner described in the above-referenced "390 patent application, i.e., through the use of an external bariatric support structure, or may be accommodated differently, according to the present invention, by employing a herein illustrated and described, modified, plural-layer-core, thicker overlay structure which, for such a "heavy-handling" requirement, includes a different internal core formation that specially resists inadvertent, and problematic, "bottoming-out". More will be said later about these ways of dealing with this especially heavy-weight, successful support matter.

For the more normal, "non-overly-heavy" supporting condition, the overlay proposed by the present invention, in its preferred and best-mode form, has a thickness which is no more than about 1-inches. This preferred thickness militates against its utilization respecting the "not-designed-for" uses just above mentioned.

The term "bed-ridden" as used herein as a "person characterization" is intended broadly to include a wide range of differently convalescing persons who may spend significant amounts of extended, body-support time not only specifically in hospital beds, but also on and in conjunction with other bed-like mattress structures.

Speaking with more particularity about the invention, and about what we see to be its remarkable, and experimentally demonstrated capability, it, the proposed "mattress overlay", has as its special purpose the dramatic minimization of the onset and development of decubitus ulcers (sores) -- medical conditions that lead to dangerous and potentially lethal injuries which come from long-term body-rest/support conditions. Accordingly, the overlay of the present invention is naturally, and particularly, well suited for placement on top of conventional, long-term, person/patient-support mattresses, such as hospital-bed mattresses.

With regard to use of the overlay of the invention on a conventional hospital-bed mattress, an interesting feature of the invention, which will be discussed more fully below, is its ability to stick relatively naturally, and without much potential for lateral slipping, on the surface of such a mattress on account of the fact that such a surface is typically defined by a smooth, gas- and moisture-impermeable, moistureproof, mattress-body cover, such as a smooth vinyl cover. This propensity for overlay “stickage”, “or stiction”, discussed more fully later herein, results from a kind of distributed, “suction-cup” surface character which exists in the outer coating layer in the overlay owing both to the manner of coating fabrication and to the nature of the selected coating material, *per se*. Undesirable sticking to an overlay-supported person does not, for various reasons, occur. These reasons will also be identified later in this disclosure text.

While such a hospital-bed setting clearly presents an ideal use environment for the present invention, the defining term “mattress overlay” is intended herein to refer to any overlay structure constructed in accordance with the special and unique features of the present invention which may be shaped, sized, etc., for use not only on top of an underlying, conventional mattress structure, *per se*, but also in other similar environments where nonambulatory people, such as convalescing patients, may lie recurrently supported for long periods of time. The above-expressed concept of “direct”, underlying, person support, while it could (and can) include the concept of direct-to-skin contact support, herein more typically means support which is furnished, for example, (a) “directly through” clothing (such pajamas, a hospital gown, etc.), (b) through a bed sheet, or (c) through some combination of these and like things.

Regarding the above-mentioned special purpose of the present invention, it is now, and has been for some time, well recognized that the medical issue involving the development of decubitus ulcers in bed-ridden, etc., patients, often those people who are still in the environment of a hospital recovering from some medical event or condition, is an extremely serious problem -- a problem which has recently caught the significant negative attention of medical-institutional (and related) insurance agencies who have come to recognize that prevention of the development of such ulcers is, in fact, quite possible, though through conventional approaches very challenging. This “negative attention” has translated itself, among other things, into agency refusals to offer/provide relevant insurance coverage. While the just-mentioned term “quite possible” is indeed true, real prevention -- that is, effective real prevention -- heretofore has been almost prohibitively expensive because of the fact that such prevention has, in reality, required substantial, frequent, personnel-intensive, one-to-one, or more-to-one, personal attendance to the changing of the resting “positions” of “bed-ridden” persons at risk.

The decubitus ulcer (decubitus-onset, decubitus-injury, decubitus-injury onset) problem is recognized today as being one of the most serious problems facing hospital and medical-care facilities, and these skilled care facilities are openly waging a fierce battle with state and federal agencies and insurance companies over who should pay the enormous costs in the treatment of this "new epidemic."

In this setting, the prior art, of which we are aware, that has been aimed at addressing the "decubitus-injury" problem is rich with purportedly effective, proposed approaches for resolving it. In practice, none appears to be particularly successful or satisfactory, owing, as we perceive it, to the significant and apparent failure to grasp a comprehensive understanding of the key body-support environmental and contact conditions which must exist if decubitus "onset" is to be avoided, or at least significantly minimized. The present invention, we believe, "possesses" this understanding.

Presently known (to us), patent-related pieces of this prior art include: U.S. Patent Application Publication No. 2001/0034908 A1 of Duly, for "Mattress"; U.S. Patent No 5,031,261 to Fenner, Sr., for "Mattress Overlay For Avoidance of Decubitus Ulcers"; U.S. Patent No 5,077,849 to Farley, for "Anatomically Conformable Foam Support Pad"; U.S. Patent No 6,052,851 to Kohnle, for "Mattress For Minimizing Decubitus Ulcers"; U.S. Patent No 7,356,863 to Oprandi, for "Mattress Pad".

While these identified, prior-art approaches address, and attempt to tackle with resolution, certain technical medical issues and conditions that can lead to the development of a decubitus injury (frequently referred to as a decubitus ulcer), clearly taking aim at successfully minimizing costly medical-personnel attention to "decubitus-at-risk" individuals, as far as we can tell, no one has successfully developed a truly effective support structure and/or methodology which has(have) the capabilities of substantially eliminating the likelihood that such a decubitus ulcer will develop.

The present invention changes this situation in a very pronounced fashion. While readings and study of this prior art, when compared with a reading of the present invention disclosure, may appear at first glance, and on certain points, to reveal only subtle differences, in reality these differences, in terms of substantially solving the problem of decubitus onset, are anything but subtle. Put another way, these differences "make the difference"!

While there are probably many issues that are usefully addressable in terms of preventing, or greatly limiting the possibility of the onset of, decubitus ulcers, the three, key considerations which we specially recognize in the characteristics of the present invention involve:

(a) (1) avoiding even very short-term (minutes) of high, applied anatomical pressure, (2) at all times pressure-evenizing the contact-loading characteristics which define how the anatomy of a bed-ridden patient is supported, and (3) specifically producing an anatomical loading condition, static and dynamic, whereby there exist substantially no notably high-pressure points (preferably none exceeding about 32-mm Hg, and even more preferably not exceeding about 20-mm Hg), and definitively no conditions involving a projecting portion of the person's anatomy (i.e., a protuberance) bottoming out against either a non-yielding, or relatively non-yielding, underlying support surface, or in any manner significantly raising (de-evenizing) anatomical support pressure;

(b) minimizing friction and shear engagement between the proposed overlay structure and a supported patient; and

(c), very importantly, providing effective, fluid-control-baffled, ventilating, heat-removing, perspiration-managing, cooling airflow (more broadly, cooling, gas-flow respiration) in the volumetric region disposed immediately beneath the supported anatomy so as to avoid the development of hot-spots and overheating, and especially recognizing that those portions of a supported anatomy, such as bony prominences, which create notable, downward "indentations" in an underlying support structure should be offered proportionally larger access to cooling air (gas) flow.

Stressing this just-identified, third, heat-removal and perspiration-managing, airflow-associated respiration concern, and repeating, with emphasis, the "proportionally" greater airflow comment just made above, it is especially relevant that the points/areas/regions of underlying anatomical support which must deal with the mentioned, notable, anatomical protuberances, and especially with pronounced (i.e., relatively "sharp") protuberances, be designed to furnish locally enhanced, rather than more constricted, airflow *within* the anatomical support structure. Put another way such protuberance-support areas are the ones that potentially define the greatest risk for decubitus-ulcer development, and as we have discovered, are the areas where the most robust, ventilating airflow and air-circulation respiration capability need to exist. Generally speaking, the greater the size and/or "sharpness" of the protuberance, and thus the greater and the deeper and the more angular the resulting support-surface indentation, the greater the need for enhanced, support-structure airflow and air-circulation capability.

Unfortunately, known and proposed prior art manners of attacking the decubitus-ulcer problem do not recognize this special, anatomical-protuberance-support observation of ours, and failing that observation, actually propose supposedly problem-resolving body-support structures and associated methodologies which exacerbate the airflow respiration problem associated with protuberance support by reacting to downward protuberances with either no attention paid to airflow, or even worse, increased constriction to airflow.

With this background in mind, the present invention takes the form of an anatomical pressure-evenizing mattress overlay including (a) a dynamic-response, preferably uniform-thickness core expanse, or core, having spaced, upper and lower, surfaces and a perimetral edge extending between these surfaces, formed of a 100% open-cell, uniform-density compressible and flowable, viscoelastic foam, and having a "relaxed-state" volume in the overlay which is prestressed, by being about 8-10% compressed, to create a pre-stressed, pre-compression condition in the expanse, and (b) a differential-thickness (i.e., possessing different regions, or portions, of relative thickness, as well as regions, or portions, of relative thinness), elastomeric, vinyl coating having, due to such differential thickness, specifically different moisture-handling and gas-breathability, respiration-enabling, respiration windowing characteristics furnished importantly at different, selected locations in the overlay (as will shortly be explained). This coating, which is referred to herein as an at least partially gas-breathable coating, is load-transmissively, interfacially bonded to the entirety of the outside surface area of the core expanse to function as a dynamically-responsive unit with the expanse -- with the coating possessing a "relaxed-state", internal, prestressed tension condition which is responsible for the pre-stressed, pre-compression condition in the core expanse.

As will be seen, the mentioned core-expanse prestressing appreciably aids the critically important behaviors of core-structure respiration, and supported-person cooling. The term "relaxed-state" employed herein is used to refer to the conditions of the overlay components when the overlay is not in use.

The core expanse is intendedly and preferably formed of a specific-character, solid-phase, single-component, single-density, polyurethane material, shaped with its upper and lower surfaces substantially equidistant (i.e., the core expanse has preferably a uniform thickness) to give the overlay, as a whole, a substantially uniform thickness of no more than about 1-inches, with the differential-thickness coating having a lesser thickness (i.e., a portion, or portions, of thinness) of about 0.01-inches on certain respiration windowing regions of the overlay edges, and a greater thickness (i.e., a portion, or portions, of thickness) of about 0.02-inches elsewhere. These are all, certainly, dimensional matters of user choice, but they have specifically been found by us to be very useful, and consequently "preferred".

Regarding the matter of differential coating thickness, two different, respiration-window-including, coating formations are proposed in different versions of the overlay that are described and illustrated herein. In one, the coating is defined with an elongate, continuous, diminished-thickness, respiration-windowing band (or, from another point of view, plural, elongate, end-connected, overlay-side bands) extending around the perimetral edge of the overlay. This band is also referred to herein as a perimetral band of thinness. The two, thickened, spaced, coating edges which define this band (or these bands) offer a respiration baffling function, are also referred to herein as baffle-function edges, and may be thought of as being a form of moisture-and-gas-control baffle structure.

In the other, the coating has, preferably, only a pair of very small, opposite-end (which may be thought of as "head-end" and "foot-end" parts of the overlay, though the overlay has no such specific "end" designations), edge-disposed, diminished-thickness portions, referred to as windows and as respiration window structure, each masked by a special, window-specific, moisture-and-gas-controlling baffle, or baffle structure. This special baffle structure takes the form of a sacrificial baffling assembly which offers a visibility, liquid-leakage, tell-tale function (relative to potential liquid leakage into the overlay core structure through the baffle-associated window structure), and, as will be later explained herein, is sacrificial in the sense that it is easily and repeatedly replaceable when such a leakage condition has been detected.

These relatively small respiration windows in this second-mentioned coating embodiment offer the additional, useful effect of promoting a kind of pneumatic resistance to core-structure compression as a supported person adjusts position on the overlay.

Accordingly, and for important structural and performance reasons which will be explained later herein regarding the coating, immediately outwardly (from the core expanse) beyond an initially created, overall primer sublayer (which flows bindingly into the core expanse material -- an open cell foam material), the coating, distributed in an all-over configuration relative to the core expanse, is formed therefore on both the overlays' perimetral edges and on its broad-surface areas, and specifically is preferably formed with ten, approximately 0.001-inches thick, cured, sublayers. These ten sublayers, further, are preferably spray-applied, one over another, under "wet-form", interlayer bonding circumstances, where the "previously applied", next-spray-receiving sublayer, including the mentioned primer sublayer (which adds substantially no depth to the coating, *per se*), is still wet and not yet cured. The ten sublayers define the "diminished-thickness" portions of the coating just mentioned above.

In some instances, less than ten, for example about six, sublayers may be used, resulting both in lesser material usage in overlay manufacture, and in somewhat greater respiration flowability, without appreciably diminishing needed overlay thickness.

Staying with the ten-sublayer construction for more detailed description purposes, different-thickness (greater-thickness) coating portions cover the two, broad-surface areas (each having what is referred to herein as an area A) in the overlay, as well as certain portions (differing in the two, different coating formations generally described above) of the overlay's perimetral edge regions. These thicker coating portions, which furnish moisture-shielding (impervious), core-protection, include outer, eleventh, individually thicker (about 0.01-inches) sublayers which are sprayed onto the immediately underlying, ten, thinner, "all-over, basic" sublayers after those underlying basic sublayers have dried.

The just-mentioned, wet-interlayer sublayer-joinder methodology (and arrangement) em ployed in relation to the preferred, ten, basic sublayers in the coating produces, structurally, a final, cured, layered coating having, between substantially all next-adjacent, basic sublayers, and between the innermost, basic sublayer and the primer sublayer, what we refer to structurally herein as being finally cured, but initially wet, interfacial surfaces of joinder. We have found that this special type of wet, interfacial joinder structure enhances not only the gas-breathability characteristics of the overall coating, but also, importantly, the controlled shrinkage of the coating to produce the desired level of coating-internal tension, and core-expanse-internal compression. The one "area", however, and as was just pointed out, of the prepared coating wherein the wet-interfacial joinder approach is not employed involves the application to each of the broad facial areas in the overlay of the final, eleventh coating sublayer.

Interestingly, and as was mentioned/suggested briefly above, when the outer layer has finally cured, it presents a special, exposed surface characteristic which outwardly presents an overall distribution of extremely tiny, i.e., essentially microscopic, suction-cup-like indentations. These indentations, quite by surprise, cause the overlay of the invention, when it rests upon the typically smooth, moisture- and gas-impermeable surface of the usual hospital-bed-mattress cover, to stick to that cover, through suction-cup action, tenaciously against lateral slippage. This sticking behavior furnishes a work-saving "blessing" to care personnel who must, as part of their "patient vigil", be certain that an employed overlay remains properly in place beneath a supported person whose motion-restlessness might otherwise cause it to migrate precariously over the surface of its own undersupport.

Regarding the selectively differential gas-breathability aspects of the proposed coating (i.e., what may be thought of as being the coating "permeability-differentiating" features), the two (upper- and lower-face) broad-area regions of the coating in the overlay, and the extra-thickness coating sublayers which join with these broad-area regions at certain locations, are structured with their respective, eleventh, outermost, 0.01-inch-thickness sublayers formed so as to be substantially both *moisture-impervious* and *gas-impermeable* in nature, whereas the associated, ten, next-inner, "basic" sublayers are structured to be both *moisture-resistant (but moisture-pervious)* and *gas-permeable*. The "basic" sublayers, where not covered by the eleventh sublayer, function, in both of the described coating versions, as respiration windows to and for the core structure.

One practical and successful way of creating the coating to possess the mentioned sublayers with the respective, desired thicknesses and differential-permeability characteristics is set forth later herein.

The detailed description of the invention which follows below will describe fully the features of, and the importances attached to, the matters of core-expanse-material flowability, coating tension, core-expanse compression, coating-core-expanse mechanical binding to one another, and coating "permeability-differentiating" features.

The overlay, *per se*, which is elongate and generally planar in nature, and as has already been mentioned, has no preferential upper or lower end. Nor does it have any preferential top or bottom face, or side. It can, accordingly, confidently be placed with and in any suitable orientation on an appropriate supporting under-structure.

Functionally, and as will become very fully apparent, the invention features an overlay structure for furnishing pressure-evenized, dynamic-reaction support for the anatomy, which structure, in use, importantly supports the anatomy with a 100% open cell, polyurethane, viscoelastic foam that reacts to both static and dynamic, anatomical-unevenness-produced indentations in it to expand and contract foam-cell-openness size relatedly, whereby deeper and sharper foam indentations result in greater cell-openness size to promote significant, indentation-related core-structure air-flow "breathing" (i.e., respiration). Nominal compression in the core structure, and nominal tension in the coating structure, cooperate, and greatly assist this respiration behavior.

These and other features and advantages that are offered by the present invention will become more fully apparent as the detailed description which now follows is read in conjunction with the accompanying drawings.

Descriptions of the Drawings

Fig. 1 is a simplified, isometric view of an anatomical pressure-evenizing mattress overlay constructed in accordance with one preferred and best-mode embodiment of the present invention resting upon a fragmentarily shown hospital-bed mattress, and with a portion of one corner of the illustrated overlay broken away to illustrate details of internal construction. Components here are not necessarily shown to scale relative to one another.

Fig. 2 is a larger scale, fragmentary, cross-sectional view taken generally along the line 2-2 in Fig. 1.

Fig. 3 is an even larger-scale, fragmentary illustration of the region generally embraced by the two, curved arrows 3-3 in Fig. 2.

In Figs. 2 and 3, it is also the case that the various overlay components are not necessarily drawn to scale.

Fig. 4 is a simplified, fragmentary view, drawn on about the same scale which is employed in Fig. 2, illustrating anatomical, load-bearing response of the overlay of Figs. 1-3, inclusive, and especially showing how the dynamic-response core of the overlay of the present invention responds to such loading. What is shown in Fig. 4 should be read along especially with what is seen in Fig. 1.

Fig. 5 is a simplified, fragmentary, isometric view in view of another preferred and best-mode embodiment of an anatomical pressure-evenizing mattress overlay constructed in accordance with the invention, this overlay also being shown resting upon a fragmentarily illustrated hospital-bed mattress. Portions of coating structure in this overlay have been broken away to reveal the internal core structure. This figure, which is drawn on about the same scale as that employed in Fig. 1, does not necessarily illustrate pictured components in correct proportions relative to one another. The embodiment pictured here includes both the above-mentioned, overlay-end-disposed, respiration window structure, and the also above-mentioned, special, sacrificial, tell-tale, respiration-window baffling structure.

Fig. 6 illustrates a pre-shaping, pre-installation preparedness condition of an isolated, respiration-window baffling assembly including a pair of baffle filter blocks and transparent adhering tape in their configuration and conditions relative to one another immediately before attachment of this assembly to form the lateral baffling structure, and an enclosed baffle chamber, for the respiration window structure which is pictured in and for the overlay shown in Fig. 5.

Fig. 7 is an enlarged-scale, fragmentary cross section showing a modified form of core structure in a modified overlay constructed in accordance with yet another embodiment of the invention, specifically showing an embodiment which is designed to handle large, overweight persons.

Detailed Description of the Invention

Turning attention now to the drawings, and referring first of all to Figs. 1-3, inclusive, indicated generally at 10 is one preferred and best-mode embodiment of an anatomical, pressure-evenizing mattress overlay constructed in accordance with the present invention. Overlay 10 herein has an overall thickness of about 1-inches (a preferred maximum thickness), a lateral width of about 36-inches, and a length of about 75-inches. Each broad face of the overlay has an area A, not specifically labeled in the drawings. Overlay 10 is formed, basically, from two different components, or portions, including a single-piece, dynamic-response core expanse, or core, 12, and a "differentiated character", elastomeric coating 14 whose differentiated features, which relate to thickness, moisture-handling, and gas permeability/respiration (and consequently heat-removal handling) will shortly be described. Coating 14, as will shortly be explained, is load-transmissively (mechanically), interfacially (face-to-face) bonded to the entireties of the outside broad-planar-facial and edge-surface areas of expanse 12. The broad-planar-facial areas in core expanse 12 are shown at 12a, 12b, and the edge-surface area, which is full perimetral in nature, is shown at 12c.

In Figs. 1 and 2, overlay 10 is shown resting upon a hospital-bed mattress of conventional construction shown generally, and fragmentarily-only, at 16 in these two drawing figures. The main body of mattress 16 herein is covered with a conventional, smooth-surfaced, gas- and moisture-impervious cover 16a. As has been mentioned earlier herein, the mattress overlay of this invention need not necessarily be used in the setting of a conventional, hospital-bedding mattress, but may also be used, appropriately perimetrally shaped, to fit into other environments involving convalescing patients. In all instances, it is important that the mattress overlay of this invention be supported upon a mattress-like support structure, or other, similar, suitably yieldable understructure, in order to prevent core expanse 12 from bottoming out. Typically, though not necessarily, the overlay will be employed with a thin, fabric, sheet-like jacket to furnish a bed-sheet-like feeling to a supported person.

In this context, the about 1-inches thickness proposed herein as being preferable for the core expanse has been chosen for several reasons, one of which is that, when properly under-supported, and as above described, it will readily handle a person weighing about 350-lbs, and will also successfully deal, without bottoming out, with notably projecting, angular portions of the anatomy even involving persons of such weight. Under circumstances where an especially heavy person, for example someone who weighs more than about 350-pounds and up to about 500-lbs, is to be supported in accordance with practice of the invention, it is important that the overlay not be placed upon a hard and non-yielding undersurface, or be used alone as a mattress with stiff under-support. Such conditions could easily lead to undesirable bottoming-out. Rather, a modified form of the overlay, later to be described herein, should be used.

In addition to the mattress overlay of Fig. 1 having, as a whole, a preferred thickness of about 1-inches in order to prevent a bottoming-out situation, another important reason for choosing an overlay thickness limited to about 1-inches in this embodiment of the invention is that this is a thickness which works well to assure maximum availability of the significant air-breathability capabilities of the selected overlay components.

According to one very important feature of the present invention, core expanse 12 is formed of a 100% open-cell, single-density, viscoelastic foam, most preferably made from the product known as #5010 CF Visco, polyurethane, Domfoam made by Domfoam International, Inc. in Montreal Quebec, Canada. This foam is both compressible and flowable. Significantly, this foam which has been chosen for the core expanse has another, very important, internal structural character whereby, under changing compression-pressure conditions, it exhibits a compressive-deflection vs. compression-force (or load) curve which includes an extremely linear region over which a relatively wide change in compressive deflection is accompanied by what turns out to be an anatomically insignificant (i.e., only slightly perceptible) change in compression pressure. This feature plays a very important role in assuring evenized support pressure applied statically and dynamically to the underside of a supported anatomy, notwithstanding the presences of, say, any bony anatomical protrusions.

For a reason which will now be explained, and as has already been mentioned above, core expanse 12, within the overall structure of overlay 10, is in a pre-stressed compressed condition, with a "relaxed-state" compression internally of about 8-10%. This compression is brought about by virtue of the presence of allover overcoating by coating 14 which is a multi-sublayered, sprayed-on, elastomeric, vinyl coating prepared with a "varied" overall thickness, as was mentioned earlier, and as will be more fully explained shortly, lying preferably in the range expressed earlier herein of about 0.01-inches to about 0.02-inches. Coating 14 preferably is made from a vinyl material such as that manufactured and sold by PlastiDip International in Blaine, MN under the identity Miraculon PDF-830. As was also mentioned earlier herein, coating 14 is prepared, illustratively and preferably, and in certain different regions of the coating, with different pluralities, and different, overall thicknesses, of sublayers, most of which (i.e., the "basic" sublayers), individually, have thicknesses of about 0.001-inches, and a few of which have the greater sublayer thickness which is employed herein of about 0.01-inches -- these different sublayer pluralities and thicknesses accounting for the coating's "varied, or differential, thickness" nature.

The coating is formed, almost throughout, in a special manner to ensure several important structural and performance features. One of these features is that, except in those coating regions included in the broad-area portions of the overlay, and in thicker-coating portions of the perimetral edge regions of the overlay, a special, inter-sublayer joinder exists between each of the sprayed-on sublayers to improve moisture-handling, gas-breathability, and attendant heat-removal and perspiration-management capabilities of the coating. Another of these features is that the coating, when completed, demonstrates a controlled shrinkage which is responsible for placing core expanse 12 into nominal, overall compression, and the coating into a nominal prestressed, tensed condition.

In the just-mentioned, broad-area and perimetral-edge thicker portions of the overlay, a different inter-sublayer joinder structure exists between the outermost sublayer, and the immediate next-inner sublayer. This will be more fully described shortly.

In the embodiment of the invention now being described, the coating-structure regions which cover facial areas 12a, 12b in the core expanse, as well as those which cover certain (upper and lower as seen in Figs, 1 and 2) portions of perimetral edge area 12c, have outer sublayers that differ somewhat in construction from that of the outermost sublayer regions of coating 14 which cover the vertically central, "horizontally elongate", clearly visible, band-like, or band, portions of perimetral edge area 12c in the core expanse.

Directing attention specifically to Figs. 2 and 3, here fragments of core expanse 12, and of different portions of the plural-sublayer construction of coating 14, are illustrated. Coating 14 includes (a) two, broad-area, about 0.02-inches-thick, facial portions 14A which extend over and cover facial areas 12a, 12b in core expanse 12, (b) two, elongate, vertically spaced, 0.02-inches-thick, perimetral edge stretches 14B which extend over and cover spaced upper and lower parts of perimetral edge-area 12c in the core expanse, and (c) an elongate, vertically central, about 0.01-inches-thick, perimetral edge band 14C which extends over and covers that portion of the core expanse's perimetral edge-area 12c which lies between coating stretches 14B. The vertical dimensions of coating stretches 14B, and band

14C are substantially equal with dimensions each of about 1/3-inches -- the term "vertical" herein relating generally to the orientations of Figs. 2 and 3.

Coating stretch 14C may be thought of as being one continuous, elongate, overlay-perimetral band of thinness in the coating, or as an endo-connected collection of overlay edge-side-specific, plural bands of thinness therein, and this stretch is referred to herein as a window, as a respiration window structure, and as a baffled, respiration window structure. The spaced, confronting edges of coating stretches 14B which evidently define this band-like window structure are referred to herein also as baffle-function edges which laterally baffle the associated window structure to control fluid flow (liquid and gas) through the window structure into and out of the core expanse.

Fig. 3 illustrates, more particularly, the respective constructions of coating portions and stretches 14A, 14B, 14C.

Each of these three coating portions/stretches commonly includes (1) a primer sublayer 14a (shown in dashed lines) which has penetrated the adjacent outer portion of core expanse 12, and which adds no appreciable thickness to the coating, and (2) ten, joined, thin, "basic" sublayers, such as the two, basic sublayers shown at 14b. An interfacial bond (of the special, "wet-form" nature mentioned above), one of which is shown by a heavy line 14c in Fig. 3, exists between each of these just-mentioned primer and "basic" sublayers. This special interfacial bond is referred to herein as being defined by "initially wet", interfacial surfaces of joinder.

Coating portions 14A and stretches 14B, alone among the regions in coating 14, include the previously-mentioned, additional, eleventh, thicker outer sublayer, such being pictured at 14d in Fig. 3. Sublayers 14d in these coating portions and linked stretches form, in coating 14, a kind of cap, or capping structure, which "receives", to about one-third each the overall core-expanse thickness, the opposite facial zones in the core-expanse structure. Such capping structure(s), and particularly the edge stretches therein, define the above discussed, laterally vertically-central breathing and moisture-venting respiration window band, or bands in the overall overlay structure.

Coating region 14C includes only the combination of primer sublayer 14a and each of the ten, basic, thin sublayers 14b.

A consequence of this construction is that coating portions 14A and stretches 14B preferably have overall thicknesses herein of about 0.02-inches, whereas coating portion 14C has preferably an overall thickness of only about 0.01-inches.

As illustrated in Fig. 3, whereas all of the sublayers that are there pictured within the illustrated coating portions have been shaded similarly to make them easily readable as individual sublayers, outer, thick sublayer 14d is different internally, in that it is constructed to have somewhat different gas-permeability and heat-removal behaviors than those like-character behaviors of each of the next ten, other, underlying sublayers. More specifically, sublayer 14d has-been prepared so as to be, essentially, both *moisture-impervious* and *gas-impermeable* in nature, whereas the next ten, underlying, other sublayers, the so-called basic sublayers, have been prepared differently so as to be *moisture-resistant* (i.e., not impervious to moisture) and *gas-permeable* in nature.

Describing now the process preferably employed to create the different sublayers in the different regions, or portions, of coating 14, generally speaking, there are two, different spraying arrangements which are used during coating creation. One of these involves supporting a flat expanse of "material" (i.e., either an initial, not yet in any way coated, flat expanse of the mentioned core material alone, or, a flat expanse of partially coated core material) on a generally horizontal table, and producing linear, repetitive, plural-cycle relative motion between an overhead plurality of appropriately laterally and vertically spaced/distanced spray heads and the material-supported material expanse. This is preferably accomplished by holding the table and supported material stationary, and moving the spray heads. The other arrangement involves supporting a material expanse (by this time partially coated, as will be explained) in what might be a somewhat clamp-like jig, and producing relative rotational motion between the so-supported expanse and, typically, a single spray head, appropriately distanced so as to create the perimeter edge portions of the desired coating.

Preferably, spraying takes place, utilizing conventional Devilbiss spray-equipment spray guns (or spray heads) each with a #704 cap and a 0.055 spray tip and needle, in an environment which has a temperature of around 65°F, with a blend of air and the above mentioned Miraculon spray product supplied for spraying at the same temperature which is essentially. Environmental humidity preferably lies at about 25%. Throughout spraying, air and Miraculon are supplied to the spray-heads at respective flow pressures of 80-psi and 50-psi. As will be pointed out below, during different steps of spray-application, spray gun control valves are operated variously either fully open with respect to the supply of Miraculon, or "throttled down" to substantially 1/3-open conditions.

Further describing general spray-application conditions, it is preferable that the spray heads be disposed at a distance from the "target structure" by about 10- to about 12-inches, with the spray head organization which is employed during spraying broad-expanse areas of “target structure” being spaced by a distance whereby their respective sprays, where these strike the target, overlapping one another by about 50-percent. It is also preferable that relative (liner and rotational) motion, depending upon where spraying is taking place, at the rate of about 3-inches-per-second, be used between the spray-head structure and the structure being spray coated.

Coating preparation begins by placing a not yet edge-sized, i.e., not yet perimeter-sized, expanse of the above-mentioned Domfoam material on a horizontal table, and by then applying to the exposed broad surface area of the expanse, and first of all, a primer sublayer 14a of Miraculon material with the valves in the spray-heads fully open, and with “primer spraying” occurring in a single pass over the mentioned, exposed expanse area. This primer sublayer soaks into the Domfoam expanse to create a tenacious, mechanical bond directly with that expanse, leaving a wet surface exposed on the face of the expanse, but exhibiting no appreciable “external” depth (i.e., outwardly of the core expanse).

This primer sublayer spraying is immediately followed, while the primer sublayer material is still wet and uncured, with ten, successive next-adjacent-sublayer spray-head passes over the same, exposed expanse area, with the only difference being that the spray-head valves, in each pass, are throttled down to their above-mentioned 1/3-open conditions. Each of these next ten spray passes follows the immediately preceding pass while the last-applied sublayer is still wet and uncured to create the “wet-form”, inter-sublayer bonds 14c. Each of these next, ten, “throttled-down”, “wet-interface” passes produces a Miraculon sublayer 14b having a thickness of about 0.001-inches, and which is characterized with a quality of open “stringiness”.

Following the procedure which has just been described relative to one broad surface of a Domfoam expanse, a spraying is paused for a period of about 30-

minutes to allow the layers of material that have just been sprayed to dry and cure more thoroughly. Thereafter, the expanse is turned over and the process just described is repeated in its entirety to create a similar multi-sublayer coating on the opposite broad face of the expanse. This repeated procedure is followed by a similar pause in spraying as was just mentioned.

Thereafter, the Domfoam core expanse, which now has, on its opposite, broad faces, an almost completed coating (complete except for missing just the final, eleventh, thicker outer sublayer 14d), is allowed to "rest" for about 24-hours to enable all then-applied basic sublayers to cure substantially, and is then appropriately trimmed to have the correct perimetral outline.

The perimeter-trimmed expanse is next placed in a suitable supporting jig, which may take the form of a broad-platen clamping jig, for controlled relative rotation, first, in a single rotation cycle past a spray head (which is fully open) to apply an edge primer sublayer 14a, followed in quick succession by ten additional rotation cycles (with the spray head throttled down to a 1/3-open condition) to apply the intended, ten, edge-coating, wet-bonded sublayers 14b. Spraying is now paused for the same, above-mentioned, about 30-minute time interval, and for the same reason.

At this point in the coating process, the coated structure which has been created so far is broad-surface supported on a horizontal table, one side at a time, and sprayed on each broad surface with the spray heads in fully open conditions, and in a single spray pass per side, to create the required, about 0.01-inches thickness, final, eleventh, outer broad-area coating sublayers 14d. A spraying pause interval, here of about 24-hours, is interposed the spraying of these two broad surfaces.

What next occurs is that, effectively for each edge of the overlay structure formed so far, and with that partially completed overlay structure resting in a substantially horizontal plane, an elongate, about 1/4-inch-diameter, metal (or plastic) rod (or the like) is suitably supported in a condition substantially horizontally disposed, parallel to and closely adjacent the edge, and vertically centered relative to the upper and lower broad faces of the structure, so as to furnish a "spray-shadow" mask which will be employed now for the purpose of assisting in the creation, along the relevant edge, of the two, separated, upper and lower coating stretches 14B, and the associated, separating edge band 14C. This "rod-masking" may be performed (for spraying) either (a) on an edge-by-edge, single-edge basis, or (b), for all four edges "at once", utilizing a masking rod for each edge, or even a single, suitably sized and angled, single, "bent", circumsurrounding rod.

With rod-masking in-place, and with the overlay structure suitably supported, along with the masking rod structure, in a jig of the type generally mentioned earlier herein, a single spray pass (per edge) of the type generally employed to create just-described, thick coating sublayers 14d is implemented to create, around the perimetral edge of the structure what may be thought of as angularly intersecting, continuation portions of previously created, broad-surface-area layers 14d, in order to create the differential-thickness coating structure which is clearly illustrated in Fig. 3 in the drawings.

After this final edge spraying has taken place, the rod-masking structure is removed, and the entire, and all of the various spray sublayers in the now fully spray-coated core expanse are allowed to cure and dry even more thoroughly in an environment whose temperature is about 95°F, and for a period preferably of about 3-5-days.

When sublayer spraying takes place in accordance with these just mentioned and described, different spray-application (parameter) considerations, the various sublayers evidence the desired, differentiated gas-handling and moisture-permeability characteristics generally described for them above. A clear consequence of this coating-creation procedure is that different regions in the coating behave differently. In the two, broad-area portions 14A, and the two, vertically spaced, perimetral, edge portions (stretches) 14B, of the coating, as far as the "outside world" is concerned, relative to the overlay's internal core expanse, there is a substantial moisture and gas-flow, impermeability barrier. Immediately inwardly in these two areas, however, i.e., immediately inwardly of the outer coating sublayer 14d in these areas, there is gas-breathability within the basic-sublayer, internal portions of the coating extending inwardly to adjacent the core expanse. In the vertically central, perimetral edge areas (band) 14C of the coating, there is moisture resistance (but not impermeability), and gas-breathability, through and throughout this portion of the coating structure and in communication with the core expanse.

These important coating considerations result in several significant overlay conditions and behavioral features. In particular, the resulting structural joinder which develops in the interfacial regions between the individual, basic sublayers in coating 14 offers improved gas-breathability in the relevant regions mentioned above in the final structure of coating 14, and further, promotes appropriately controlled shrinkage of coating 14 as a whole to create the different pre-stressed compression and tension conditions mentioned above for the core expanse and the coating, respectively.

Thin application of at least the first-to-be-sprayed-on (i.e., core-expanse-contacting) primer sublayer regions in coating 14 causes the coating as a whole to bond robustly mechanically (in a manner which we refer to as load-transmissively) to the entire outside surface area of the core expanse, with the result that the localized regions of joinder of the core expanse and the coating function essentially as a unit everywhere within the overlay.

As mentioned briefly above, a surprise to us resulting from the coating process which has just been described is that the outer coating layer 14d, on curing, develops over its entire outside surface a distribution of tiny, essentially microscopic, suction-cup-like dimples, or suction cups. Fig 1 in the drawings generally, schematically, and entirely out of scale, illustrates this surface condition at 17. These dimples furnish the earlier-herein-mentioned anti-migration stiction which the overlay of the invention advantageously demonstrates when it is placed on a smooth support surface, such as that offered by the usual vinyl cover provided for a hospital-bed-like mattress.

Adding reference now to Fig. 4 along with the other drawing figures, this bonding condition produces an "in-use" action, extremely important in the behavior of overlay 10, wherein expansive stretching of the coating, such as that which occurs, for example, when the anatomy, and particularly a sharp, anatomical protuberance therein, depresses the overlay support surface (see representative arrow 18 in Figs. 1 and 4), pulls on the bonded core expanse, and causes (a) core-openness size in that pulled-on and resultingly expanded, core-expanse region to enlarge, and (b) airflow openness in at least the innermost sublayers in the coating to increase locally, thus immediately promoting increased airflow capability and activity in that region. Prestress compression in the core expanse importantly aids in this action, since that compression urges the core expanse to swell non-resistively, and expand. When the protuberance represented by arrow 18 engages the overlay, and with an understanding that things are purposely illustrated exaggeratedly in Fig. 4, it produces a significant depression 14D in coating 14, and a matching depression in the upper surface of core expanse 12. Given the modest thickness of the core expanse, this depression "telegraphs" its presence to some extent to the immediate underside of the expanse to produce the gentle downward bulging in coating 14 shown at 14E.

This "depression/bulging" condition is characterized, of course, by an expanding and stretching of the coating at the 14D, 14E locations therein, and attendant increasing of the there-local airflow permeability of at least the internal sublayers in the coating. This expanding and stretching, in addition to producing an interesting and effective, internal, "bellows" air-flow condition, causes related, outward, lateral "dragging" of the bonded core expanse, aided in that "dragging" by the relaxation of compression in that expanse. The squeezing which results in the core expanse between locations 14D, 14E produces slight, lateral, outward flowing of the expanse as indicated by arrows 20, 22, with outwardly flowed core expanse-material represented in the two, angular, lightly shaded region of that expanse shown at 24. 26.

Further considering air-flow (gas-flow) management features of overlay 10, particularly with reference to how the broad-area and vertically central, perimetral-edge regions of the core structure perform, the fact that the thicker, outer sublayers 14d in the coating are, effectively, gas-impermeable, depressions and relaxations of depressions which occur in the overlay, for example as a person supported on the overlay moves from time to time, recurrently create the just-above-mentioned kind of bellows air-flow effect within the inside of the overlay, forcing air to flow inwardly and outwardly through the gas-permeable (breathable) band portion(s) 14C in the coating.

It is these, several air-management features of the invention, promoted by relative thinness in the overall overlay, by the mechanical bondedness which exists between the core expanse and the coating, by the coating structure, and by the pre-compression/pretension conditions extant in the core expanse and coating, respectively, which cause the overlay to adapt needed anatomical-support airflow, and associated heat removal and perspiration-management, in a manner whereby those supported areas of the anatomy which should receive enhanced, cooling airflow in the context of being protected against "decubitus onset" do receive such enhanced treatment. This adaptation behavior is dynamic, in the sense that changes in supported anatomy position are followed appropriately and instantly in the context of most-needed airflow availability.

We have also discovered that the thicker, outer coating sublayers in the overlay, on one of which a supported user will always be lying, aid in heat removal -- transferring excess heat to the interior of the overlay, wherein air flow functions to discharge it laterally outwardly through the edges of the overlay. These same outer, thicker sublayers play an important role in minimizing friction and shear engagements with the anatomy of a supported person. Such engagements are also naturally minimized by the presence of any fabric which may be interposed the overlay a supported anatomy, as well as by the fact that the outer surface of coating layer 14d does not have a tendency to stick to the skin.

Prior art structures that are known to us have no such capabilities for offering this important decubitus-injury-minimizing behavior. In many instances, unfortunately, prior art structures often respond to support indentation in a harmful manner which closes off support-offering airflow capability the deeper/larger the indentation which exists.

Regarding a certain aspect of moisture management, the moisture-impervious character of the thicker, outer broad-area and lateral-edge sublayers in the coating tend to inhibit external moisture entry into the core expanse, including, importantly, along the lateral margins of the overlay.

The overlay embodiment which has been described so far herein has been found to perform very satisfactorily in many applications and situations, but there are certain environments in which it has been determined to be important that the overlay furnish an even greater control over respiration-window access to the central core structure, particularly to minimize, as close to zero as possible, the likelihood that body fluids from a person resting on the overlay might work their way through the respiration window structure into the 100% open-cell foam core expanse.

Accordingly, while the overlay configuration pictured specifically in Figs. 1-3, inclusive, affords generally adequate fluid-flow, and particularly liquid-flow baffling to prevent such liquid seepage/leakage into the core expanse, another important and preferred embodiment of the invention, now to be described, more definitively controls the prevention of such an event, i.e., liquid leakage. This alternative embodiment, which offers the most robust "anti-leakage" control is illustrated in Figs. 5 and 6 in the drawings, to which attention is now specifically directed.

Indicated generally at 30 in Fig. 5 is a mattress overlay which is constructed in accordance with the features of the alternative embodiment of the present invention just mentioned above, and now to be described. Overlay 30, which possesses a long, central axis 30A, is pictured in a condition wherein it is supported on a conventional hospital-bed mattress shown fragmentarily at 31.

In many ways, overlay 30 is substantially the same in construction (sizes, i.e., dimensions, and materials) as previously described overlay 10, with the exception that, while its core structure is essentially identical, and its coating-structure layer-arrangement is also essentially identical, its coating-provided respiration window structure, in terms of size, location, and fluid-flow-control baffling, is quite different.

Continuing, included in overlay 30 is a core expanse 32 having (as was just mentioned) the same material construction, dimensionality, and functional features as those described for previously discussed core expanse 12. Core expanse 32, also referred to both as a core structure and as a core, is coated by a multi-layer/sublayer coating, or coating structure, 34 which, in terms of its specific layer arrangement, its layer formation by spraying, and its layer dimensionality, is identical (as was also just mentioned) to previously described coating, or coating structure, 14.

Because of the substantial structural identities just mentioned between the two core expanses, and between the layer/sublayer arrangements in their respectively associated coating structures, we do not repeat here any detailed descriptions of these structures -- focusing attention instead on how coating structure 34 in modified overlay 30 is specifically configured differently to create the different form of overlay-end-disposed respiration window structure mentioned generally above.

What specifically distinguishes the comparative constructions of overlays 10 and 30 is that, whereas in overlay 10, the included, baffled respiration window structure takes the form, effectively, of an endless, elongate, thin-coating-region band extending perimetrally around the outside of the overlay, as described above, the baffled respiration window structure in overlay 30 takes the form of a pair of relatively small, rectangular windows, such as the window seen at 36 in Fig. 5, one each formed adjacent the opposite, long-dimension ends of the overlay. Because of the fragmentary nature of what is shown in Fig. 5, only one of these two windows is pictured in the drawings. Window 30, and its counterpart located adjacent the opposite (and unseen) end of overlay 30, is basically defined as a rectangle (as mentioned) formed in the outer, thicker layer, of coating 34, with the coating-layer edges that define this rectangular window furnishing a portion of the lateral baffling which exists for each of these windows. These windows herein have lateral dimensions of about 1-inch by about 1.75-inches.

The adjacent, thicker and thinner regions in coating 34 which define window 36 are similar to what is illustrated in enlarged, cross-sectional detail in Figs. 2 and 3 for the adjacent, thicker and thinner regions in coating 14, and these two figures (2 and 3), accordingly, may correctly be viewed as furnishing a closer, and more detailed, "picture" of the structure of window 36 than that which is presented for it more generally, and distantly, in Fig. 5.

While different specific dimensionality may be chosen for the windows, such as for window 36, a particular dimensional ratio in overlay 30 has been determined as one which furnishes very satisfactory respiration breathability for the core expanse in the overlay, while at the same time minimizing overall window size to inhibit the likelihood of liquid leakage into core 32 should any such leakage liquid get past the foam filter blocks. This ratio relates the surface area of one broad side of the overlay to the combined areas of the two windows, such as window 36. More specifically, in accordance with this special ratio, where the overall surface area of a single broad side of the overlay is given by the variable A, the combined surface areas of the two windows, should equals about 0.0013A.

Focusing attention now specifically on the region in overlay 30 which is immediately adjacent respiration window 36 as seen in Fig. 5, directly, structurally and functionally associated with this window is important, additional baffling structure, referred to also herein as tell-tale-functioning, sacrificial baffling structure, which takes the form of a baffling assembly 38. Assembly 38 includes a pair of laterally spaced, breathable, foam filter blocks 40, referred to herein as baffle-filter blocks, disposed slightly spaced from, but positioned generally relatively closely adjacent, the laterally opposite sides of window 36. These blocks, which have nominal (i.e., before an assembly 38 is installed, as will shortly be explained) rectilinear configurations with dimensions of about 1x1x1/2-inches, are held in place in the overlay by an expanse of transparent, moisture- and gas-impervious adhering tape 42 having an adhesive side which attaches to the two foam blocks, and to the clearly illustrated surface regions adjacent window 36 on the opposite broad surfaces of coating 34. As will also shortly be explained, attachment of the baffling assembly to coating 34 to have the appearance seen in Fig. 5 produces the outwardly projecting, dome-like "rounding", or out-of-rectangularity distortion, in those sides of the blocks which generally face the viewer in Fig. 5.

Blocks 40 and tape 42 collaborate to form the entirety of assembly 38, and collectively define an enclosed, moisture-passage barriering, but gas-respiration-breathable, baffle chamber 44 disposed in communication with, and on the outside of, window 36. As can be seen in Fig. 5, baffle chamber 44 is defined, on its laterally opposite sides, by blocks 40, on its inner side by the overlay edges of coating 34 which lie between these blocks and which include window 36, and on its outer side, which faces generally toward the viewer in Fig. 5, by tape 42.

This same kind of baffling assembly is present (though not seen in the drawings) adjacent the other, end-disposed respiration window structure in the overlay. Preferably, though not necessarily, the two respiration window structures, such as window structure 36, and the two, associated baffling assemblies, such as assembly 38, are positioned somewhat to one side of the longitudinal centerline, 30A, of the overlay to avoid any damage to these structures in the event that the overlay is folded along this centerline for storage, or for any other reason. This positioning condition can clearly be seen for these structures in Fig. 5.

Preferably, the foam filter blocks are formed of the same material which is employed in core expanse 32, and the adhering tape is formed of 3M #8672 8-mil vinyl tape made by the 3M Corporation. Also preferable is that the color of the specific foam material employed in blocks 40 be light in color (such as white or off-white), so that these blocks will function, via discoloration which will be visible through the adhering tape, as "tell-tales" to signal the occurrence of any liquid leakage which may be attempting to reach the margins of the baffled respiration window.

Fig. 6 in the drawings illustrates, as mentioned above in the description of this figure, a pre-shaping, pre-installation preparedness condition for baffling assembly 38. Here, what can be seen is that a piece of appropriately sized tape 42, with its adhesive side appropriately exposed and upwardly facing in this figure, has placed upon it, near a pair of its lateral margins, as illustrated, and with the dispositions pictured, two, foam, baffle filter blocks 40, each of which, as was also mentioned earlier herein, nominally has a rectilinear block shape. Also placed upon it, in order to cover the tape's adhesive surface which would otherwise be openly exposed in the rectangular zone residing between blocks 40, is a thin, transparent-material film 45 (shown only fragmentarily). Film 45 prevents this zone in the tape from inadvertently attaching itself to the portions of the outer coating in the overlay that are exposed within baffle chamber 44 in a manner which might partially, or completely, seal window 36.

With this pre-installation condition established, the assembly is suitably curled, as indicated by arrows 46, 48, and placed appropriately in juxtaposition to one of windows 36, with suitable tension introduced into tape 42 in the installation process to compress and reform the filter blocks so that they take on the outwardly projecting domed shapes which are pictured clearly for them in Fig. 5.

The adhesive material which forms part of tape 42 is "non-damaging" in relation to coating 34, and as a consequence, this allows a baffling assembly, in its "sacrificial" mode of operation, namely, once there may be indicated a fluid leak which has discolored one or both of the filter blocks, easily to be removed for replacement by another, similar, baffling assembly. Transparency in tape 42 easily enables one to see, by a looking for discoloration in the preferably lightly colored filter blocks, any indication that an undesired liquid leak has taken place, or has begun.

Where it is desired that the overlay of the present invention be employed with a person whose weight lies in the range, for example, of about 350-lbs to about 500-lbs, two different handling approaches, generally mentioned earlier herein, may be employed. In one, a suitable, independent, bariatric, under-support structure may be used. Preferably, such an under-support structure will have essentially the same perimetral outline as that of the supported overlay, and will furnish appropriate yieldable under-support to prevent bottoming out of the core expanse in the supported overlay. While many different kinds of such bariatric under-support structures may be employed, we have experimented successfully with a 1-inches thick pad formed of two layers of different, rate-sensitive, viscoelastic foam materials specifically made by AEARO Specialty Composites in Indianapolis, IN, with an upper layer in this pad having a thickness of about 0.75-inches and being formed of the material sold as Confor CF-42 foam, joined by adhesive bonding to a lower layer of the material sold as Confor CF-45 foam having a thickness of about 0.25-inches.

There are, of course, many other materials which may be employed successfully for such a bariatric under-support structure.

Another approach is illustrated in Fig. 7 in the drawings generally at 50 which pictures another modified version of the overlay of the present invention. Overlay 50, as proposed herein, includes an overall thickness of about 2-inches, and is formed with a plural-layer core, or core structure, 52 formed with a 1/2-inches thick underlayer 54 of the above-mentioned Confor CF-45 foam material, suitably adhesively bonded to an intermediate layer 56 of the above-mentioned Confor CF-42 foam material, also having a thickness of about 1/2-inches, and with layer 56 being suitably adhesively bonded to a layer 58 having a thickness of about 1-inches, formed of same core-expanse material previously described herein for expanses 12, 32.

Overlay 50 further includes an overall coating 60, which is substantially identical in layer arrangement to the coatings which have already been discussed herein. Coating 60 includes a pair of baffle-chambered respiration windows (not specifically shown) which are like those that have been described for the invention embodiment of Figs. 5 and 6, such respiration windows essentially being formed so as to expose only core layer 60, generally at opposite ends of overlay 50, and occupying regions generally illustrated at W in Fig. 7.

Thus the present invention, now described in several preferred embodiments, offers an anatomical pressure-evenizing mattress overlay including (1) a core, in different-modification forms, with each modification form possessing a dynamic-response core expanse having spaced, upper and lower, surfaces and a perimetral edge extending between these surfaces, the core expanse being formed from a 100% open-cell, compressible and flowable, viscoelastic foam, and having a relaxed-state volume in the overlay which is prestressed, and about 8-10% compressed, thus to create a pre-compression condition in the expanse, and (2) an elastomeric, moisture- and gas-flow-managing, specially baffled, respiration-windowed, coating, load-transmissively bonded to the entirety of the outside of the core expanse to function as a dynamically-responsive unit with the expanse, and possessing a relaxed-state internal prestressed tension condition.

Within this structure, the core expanse exhibits a compressive-deflection vs. compression-force curve which includes an extremely linear region over which a relatively wide change in compressive deflection is accompanied by an anatomically insignificant change in compression pressure.

Accordingly, a unique mattress overlay structure which is aimed with a very particular focus on helping to resolve the decubitus ulcer/injury problem have thus been illustrated and described herein, with certain variations and modifications suggested. Among the important factors relating to resolving this very dangerous and widespread kind of injury, namely, (a) paying close attention to furnishing support for the anatomy with an overall, evenized pressure which falls within a certain, identified range of pressures, (b) controlling and minimizing friction and shear conditions in the interface between the overlay support structure and the anatomy, and (c), extremely importantly, furnishing adequate cooling airflow to the supported anatomy via respiration window structure which is specially baffled to control both air(gas)-flow, and liquid-leakage, all are dealt with effectively by the present invention.

As has been pointed out with great particularity, the unique structure of the present mattress overlay includes a special core foam material which is completely 100% open-celled in nature, and which is nominally under compression, coated by a differential-thickness, moisture- and gas-managing elastomeric layer which is bonded tenaciously (interfacially, mechanically bonded) to surface areas of such core foam. This unique collaborative union of structures results in the occurrence of a very special performance regarding anatomically-cooling airflow, wherein the deeper the indentation produced in the overlay by a portion of the body supported on it, the greater the "effective openness" of the supporting core foam material to enhance airflow in the region, or regions, of such indentation, or indentations.

In conclusion, while a preferred and best mode embodiment of, and manner of practicing, the present invention have been illustrated and described herein, and certain variations and modifications suggested, we appreciate that other variations and modifications may be made without departing from the spirit of the invention, and it is our intention that all of the claims to invention will be construed as covering all such other variations and modifications.

WE CLAIM:

1. An anatomical pressure-evenizing mattress overlay comprising

a dynamic-response core expanse having spaced, upper and lower, surfaces and a perimetral edge extending between said surfaces, formed of a 100% open-cell, compressible and flowable, viscoelastic foam, and having a relaxed-state volume in the overlay which is prestressed, and about 8-10% compressed, thus to create a pre-compression condition in the expanse, and

an elastomeric, moisture- and gas-flow-managing coating, including respiration window structure operatively associated with said core expanse's said perimetral edge, load-transmissively bonded to the entirety of the outside of said expanse to function as a dynamically-responsive unit with the expanse, and possessing a relaxed-state, internal, prestressed, tension condition.

2. The overlay of claim 1, wherein said core expanse is elongate and includes opposite ends, and said respiration window structure includes a pair of laterally baffled windows disposed, one each, adjacent said core expanse's said opposite ends.

3. The overlay of claim 2, wherein the lateral baffling for said windows includes, suitably anchored to said coating, and for each window, (a) a pair of laterally spaced, outwardly projecting baffle filter blocks disposed adjacent laterally opposite sides of the window and formed of the same viscoelastic foam material which is employed in said core expanse, and (b) an expanse of transparent adhering tape bridging the space between said blocks, and anchoring the blocks to said coating via attachment of the tape both (1) to portions of said blocks and (2) to portions of said coating which overlie the upper and lower surfaces of said core expanse adjacent the window.

4. The overlay of claim 3, wherein each pair of baffle filter blocks and the associated adhering tape define an enclosed baffle chamber in fluid communication with the associated window.

5. The overlay of claim 3, wherein each of said core expanse's said upper and lower surfaces has an area A, and said two windows collectively have an area which is approximately 0.0013A.

6. The overlay of claim in 1, wherein said respiration window structure includes a perimetral band of thinness in said coating extending around the perimetral edge of said core expanse generally centrally intermediate the core expanse's said upper and lower surfaces, said band being edge-defined by spaced, upper and lower, baffle-function edges formed in thicker regions in said coating.

7. The overlay of claim 1, wherein said core expanse exhibits a compressive-deflection vs. compression-force curve which includes an extremely linear region over which a relatively wide change in compressive deflection is accompanied by what turns out to be an anatomically insignificant change in compression pressure.

8. The overlay of claim 1, wherein said core expanse is specifically formed of a polyurethane material.

9. The overlay of claim 1, wherein said upper and lower surfaces are, allover, substantially equidistant.

10 The overlay of claim 1, wherein said expanse has a thickness throughout of about 1-inches.

11. The overlay of claim 1, wherein said expanse has opposite broad faces linked by a perimetral edge, and said coating, where it covers said broad faces, is formed so as to be substantially both moisture-impervious and gas-impermeable, and where it covers said edge so as to be, at least in its included respiration window structure, both moisture-resistant (but moisture-pervious) and gas-permeable.

12. The overlay of claim 11, wherein said coating throughout possesses a plurality of approximately 0.001-inches thick sublayers including next-adjacent sublayers joined though initially wet, interfacial surfaces of joinder.

13. The overlay of claim 1, wherein said coating has an outer surface which is characterized by an overall distribution of suction-cup-like dimples.

14. An anatomical pressure-evenizing mattress overlay comprising

a core expanse of single-density, 100%, open-cell, compressible and flowable, polyurethane, viscoelastic foam, and

an at least partially gas-breathable, elastomeric coating extending over the entirety of the surface area of said core expanse, and interfacially, mechanically bonded to said surface area, said coating being everywhere in tension and placing said core expanse everywhere in compression.

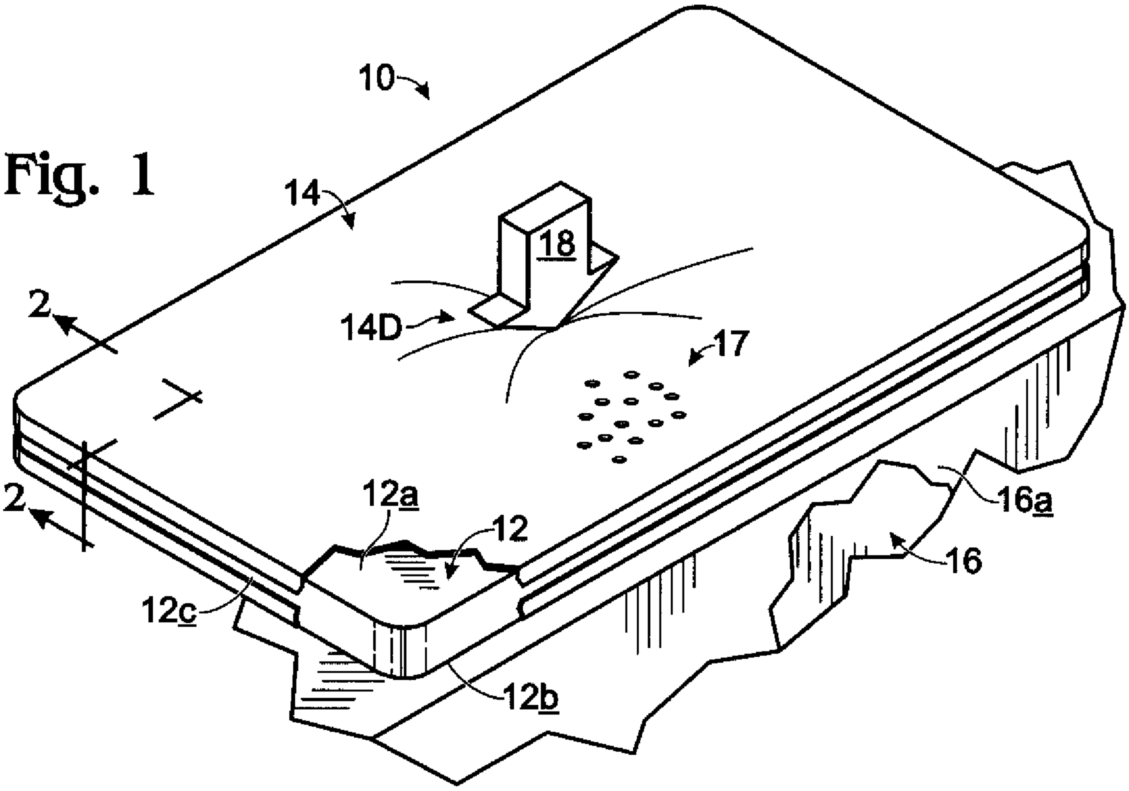
15. An anatomical pressure-evenizing mattress overlay comprising

a prestressed, dynamic-response core assembly having spaced, upper and lower, surfaces and a perimetral edge extending between said surfaces, formed with (a) a first core expanse made of a 100% open-cell, compressible and flowable, viscoelastic foam disposed adjacent said upper surface, (b) a second core expanse made of a different, closed-cell, viscoelastic foam disposed adjacent the opposite side of said first core expanse relative to said upper surface, and (c) a third core expanse made of yet another, closed-cell, viscoelastic foam disposed adjacent said core assembly's lower surface and the opposite side of said second core expanse relative to said first core expanse,

said core assembly having a relaxed-state volume in the overlay which is prestressed, and about 8-10% compressed, thus to create a pre-compression condition in the core assembly, and

an elastomeric, moisture- and gas-flow-managing coating, including respiration window structure operatively associated with said core assembly's said perimetral edge, load-transmissively bonded to the entirety of the outside of said assembly to function as a dynamically-responsive unit with the assembly, and possessing a relaxed-state, internal, prestressed, tension condition.

Fig. 1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16a
16
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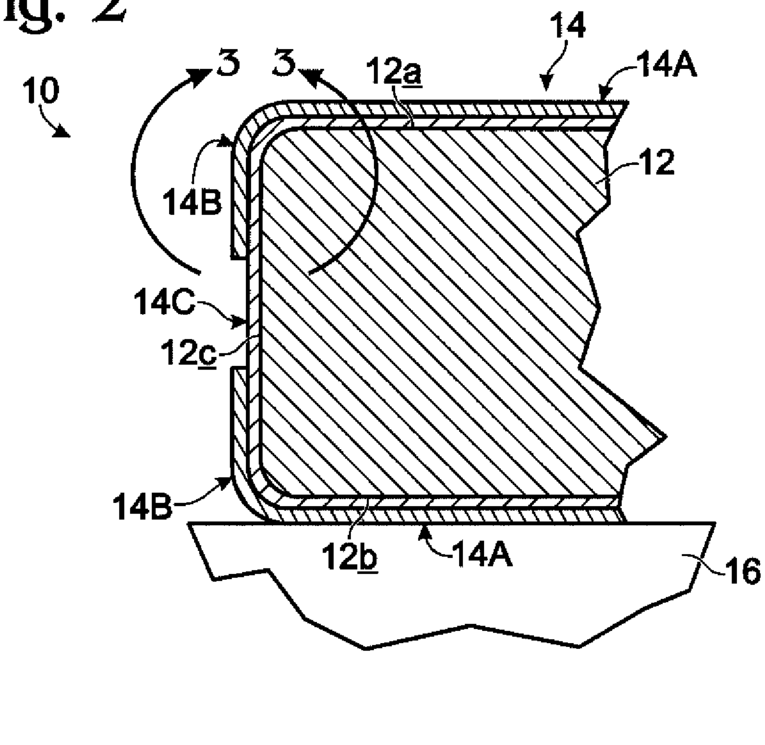
12b

Fig. 2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14A
16

Fig. 3

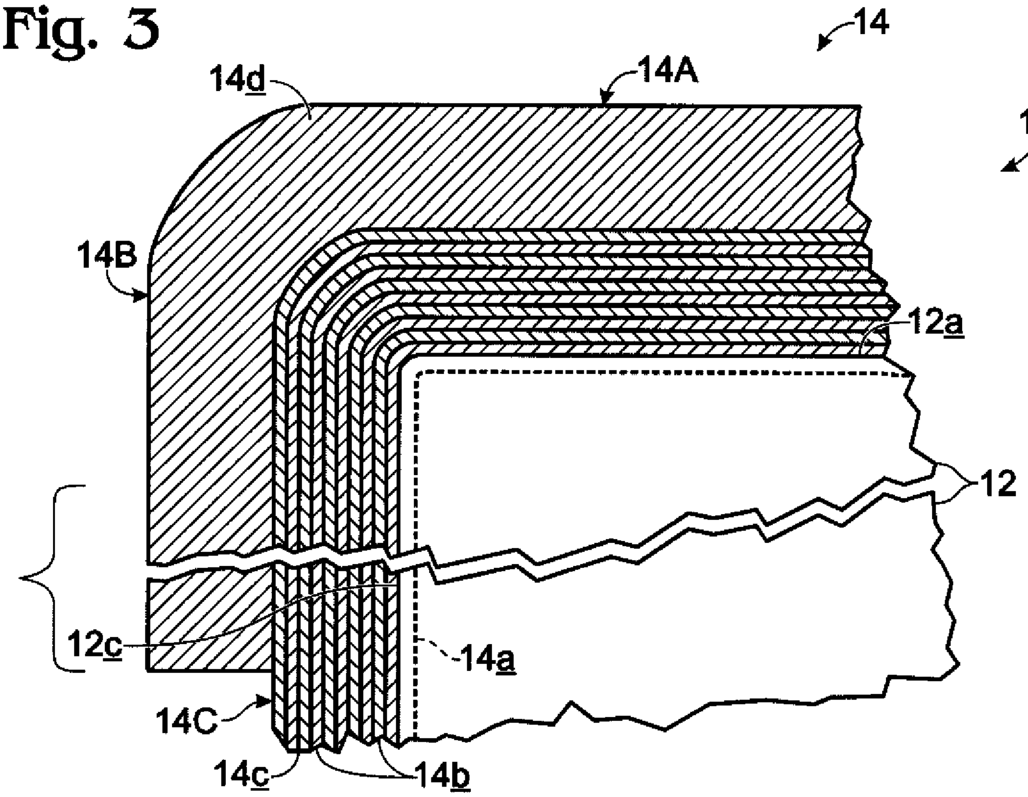
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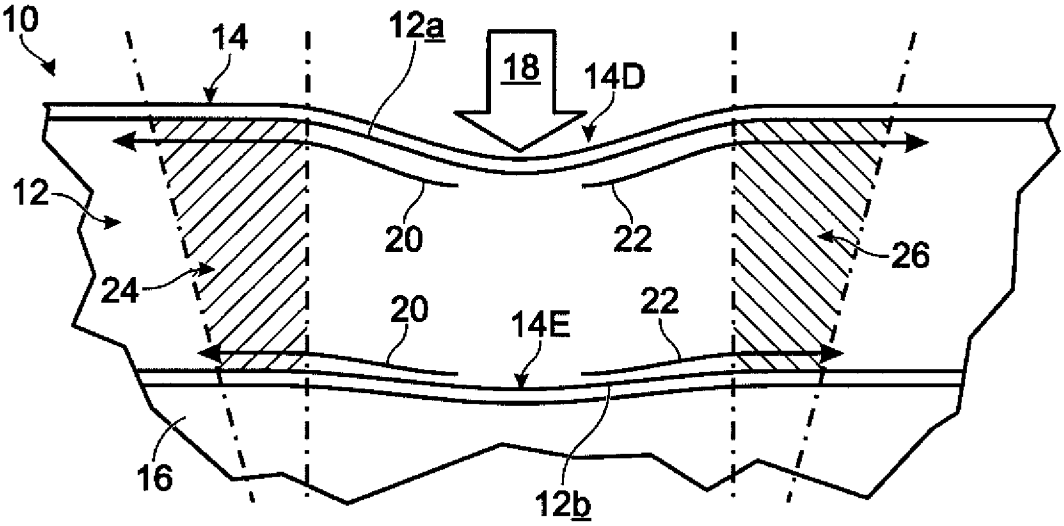
Fig. 4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12b

Fig. 5

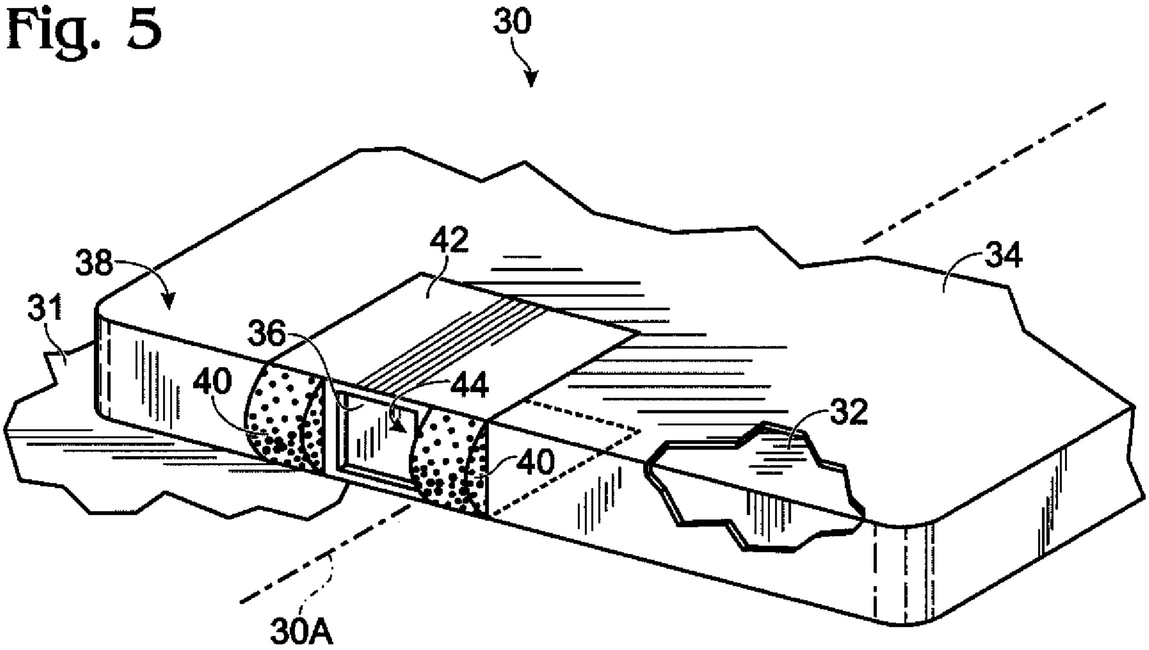


Fig. 6

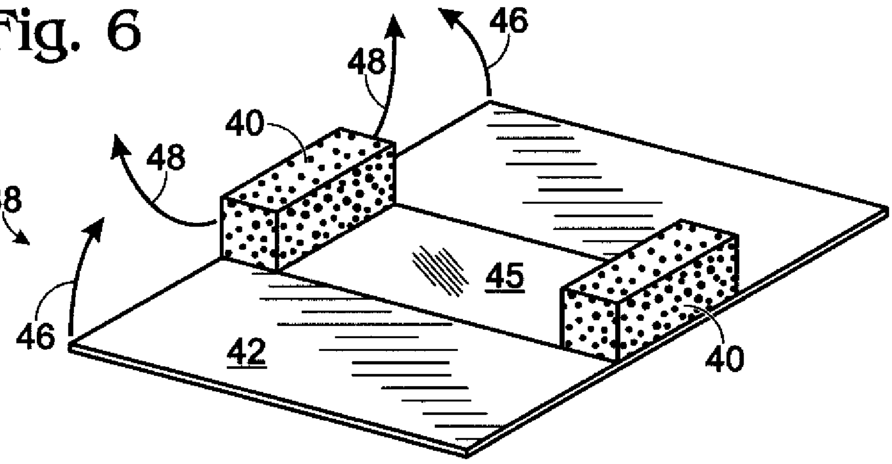
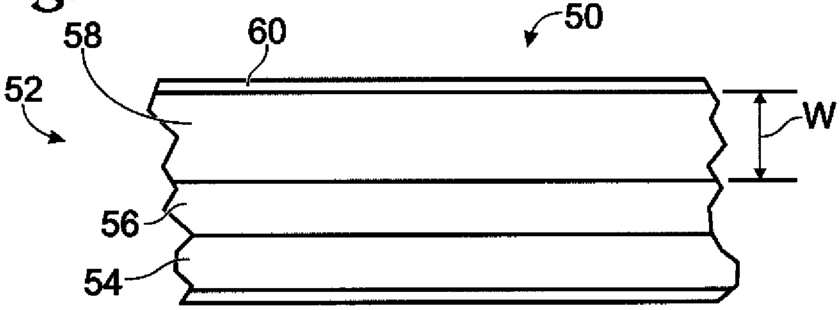


Fig. 7



INTERNATIONAL SEARCH REPORT

International application No.
PCT/US 10/59006

A. CLASSIFICATION OF SUBJECT MATTER
IPC(8) - A47C 27/14 (2011.01)
USPC - 5/740
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC(8): A47C 27/14 (2011.01)
USPC: 5/740

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
IPC(8): A47C 27/14 (2011.01) - see search terms below
USPC: 5/699, 691, 740 - see search terms below

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
PubWEST(USPT,PGPB,EPAB,JPAB); GooglePatents; GoogleScholar
Search Terms: Decubitis, bedsores, ulcer, mattress, bed, overlay, foam, baffle, air, foam, tape, scotch, clear, transparent, adhesive, moisture, resistant, tension, precompress, prestress, open, cell

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 5,031,261 A (FENNER, SR.) 16 July 1991 (16.07.1991), entire document especially Fig 1-7, col 2, ln 43-45, col 3, ln 10-13, col 3, ln 23-26	1-13, 15
Y	US 5,282,286 A (MACLEISH) 01 February 1994 (01.02.1994), entire document especially Fig 3-7, col 5, ln 49-61, col 9, ln 49-54	1-13, 15
Y	US 2009/0188048 A1 (SHLOMO) 30 July 2009 (30.07.2009), entire document especially Fig 13, para [0047], [0077], [0078], [0080], [0085]	1-15
Y	US 2002/0148045 A1 (GIORI et al.) 17 October 2002 (17.10.2002), Fig 1, 10, para [0063]	2-5
Y	US 4,245,364 A (CALLEANCE) 20 January 1981 (20.01.1981), Fig 6, col 5, ln 41-45	3-5
Y	US 4,292,703 A (GOGUEN) 06 October 1981 (06.10.1981), Fig 1-2, col 2, ln 23-24	6
Y	US 2002/0148047 A1 (CORZANI et al.) 17 October 2002 (17.10.2002), Fig 1-2, para [0028], [0048]	11-12
Y	US 2004/0250348 A1 (GRIMES) 16 December 2004 (16.12.2004), Fig 3, para [0026]	12
Y	US 4,901,387 A (LUKE) 20 February 1990 (20.02.1990), Fig 4, col 3, ln 40-44	14

☒ Further documents are listed in the continuation of Box C. ☐

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"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)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"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
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"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
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
20 January 2011 (20.01.2011)	07 FEB 2011

Name and mailing address of the ISA/US	Authorized officer:
Mail Stop PCT, Attn: ISA/US, Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-3201	Lee W. Young PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US 10/59006

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 2007/0022540 A1 (HOCHSCHILD) 01 February 2007 (01.02.2007), Fig 2, para [0031]	15
A	US 2010/0192306 A1 (DENNIS et al.) 05 August 2010 (05.08.2010), Fig 1-4	1-15