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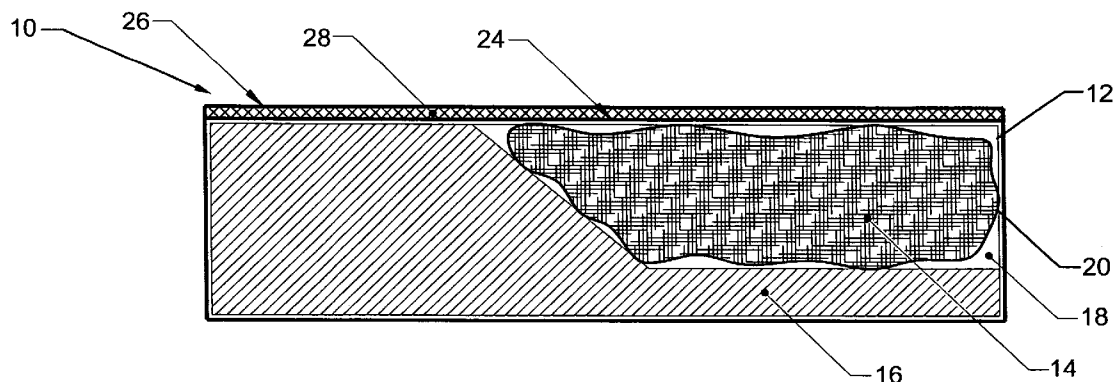
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(54) Title: TENSION FREE WHEELCHAIR SEAT COVER AND CUSHION THEREWITH



(57) Abstract: A seat cover, and a method for producing a seat cover, minimizes surface tension in the cover material, when the cover conforms to a highly contoured shape.



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TITLE

TENSION FREE WHEELCHAIR SEAT
COVER AND CUSHION THEREWITH

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application claims the benefit of United States Provisional Application No. 60/839,982, filed August 24, 2006, the disclosure of which is incorporated herein by reference.

BACKGROUND OF THE INVENTION

[0002] This invention relates in general to wheelchairs and, more particularly, to accessories for wheelchairs. Most particularly, the invention relates to an improved wheelchair seat cover.

[0003] Wheelchair users who spend a large portion of their day seated in a wheelchair are at risk of developing pressure ulcers (i.e., skin tissue breakdown) in their buttocks region. Pressure ulcers tend to occur in skin tissue that is in contact with the seat cushion, near the boney prominences of the hip. Regions most prone to developing pressure ulcers include skin surrounding the ischial tuberosities and the coccyx. A disabled wheelchair user, particularly one with partial or complete paralysis, is more likely to develop pressure ulcers because he or she lacks supportive muscular tissue that surrounds and protects the boney prominences of the buttocks. Poor circulation and an inability to reposition during seating compound this problem. Pressure ulcers cause severe discomfort, and can pose a serious health risk to the wheelchair user.

[0004] Attempts have been made to provide wheelchair seating that reduces the likelihood of pressure ulcers. Seat cushions have been developed in an effort to eliminate pressure hotspots (i.e., a center of high pressure within a larger area of relatively low pressure) at the boney prominences in contact with a cushion. One family of cushions uses a fluid medium as a means of supporting the user. The fluid

medium is intended to support the buttocks under hydrostatic (or evenly distributed) pressure. The fluid is typically contained within one or more thin pliable membrane sacks. The fluid is permitted to flow around the contour of the buttocks, with the boney prominences immersed within the fluid, so that the entire region supported by the fluid experiences substantially the same level of pressure. One limitation to the efficacy of such a cushion is surface tension created in the membrane sacks or material covers that are placed over the sacks. Surface tension in a cover material tends to cause pressure hotspots at regions of deepest immersion. Various methods have been employed to minimize the effects of surface tension in the membrane and cover, such as constructing the membrane shape to allow wrinkles in the membrane, or pleating the cover to create folds or wrinkles that will not produce surface tension as the cover is stretched. To achieve this successfully, the membranes and covers are very thin. Thin materials allow the membrane or cover to wrinkle without producing bumps that would result in pressure hotspots.

[0005] Other factors contributing to pressure ulcers and reduced comfort in a wheelchair cushion are high heat and humidity. An individual who remains seated for a long period upon a wheelchair cushion generates elevated heat and perspiration in the perineum. A cushion with a fluid medium contained within an impermeable membrane is capable of trapping heat and perspiration next to the user's skin. To mitigate this effect, special fabrics are sometimes employed that allow heat and humidity to dissipate from beneath the buttocks and out into the atmosphere. Covers are often constructed from spacer fabrics that have an open weave and provide a layer of air within the fabric to allow air circulation. These fabrics tend to be thick, and do not lend themselves well to wrinkling or pleating to alleviate surface tension.

SUMMARY OF THE INVENTION

[0006] This invention relates to a seat cover and a method for producing a seat cover to minimize surface tension in the cover material, when the cover conforms to a highly contoured shape.

[0007] Various aspects of this invention will become apparent to those skilled in the art from the following detailed description of the preferred embodiment, when read in light of the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

- [0008]** Fig. 1 is a sectional view of a seat cushion taken along the longitudinal axis of the cushion.
- [0009]** Fig. 2 is a top plan view of a perimeter sewn elastic top cover.
- [0010]** Fig. 3 is a top plan view of a perimeter sewn elastic top cover with spacer fabric compressed.
- [0011]** Fig. 4 is a top plan view of a compressed perimeter top cover.
- [0012]** Fig. 5 is a top plan view of a top cover compressed during construction.
- [0013]** Fig. 6 is a top plan view of spacer fabric with stress relief "S" cutting.
- [0014]** Fig. 7 is a top plan view of spacer fabric with stress relief straight cutting.
- [0015]** Fig. 8 is a top plan view of spacer fabric with stress relief spiral cutting.
- [0016]** Fig. 9 is a top plan view of spacer fabric with stress relief star cutting.
- [0017]** Fig. 10 is a sectional view of a seat cushion taken along the longitudinal axis of the cushion.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[0018] Referring now to the drawings, there is illustrated in Fig. 1 a wheelchair seat cover, generally indicated at 10, that may be designed, constructed or configured to reduce surface tension, for example, within the plane of the cover 10 (e.g., along the top of the cover 10 when viewing Fig. 1). The cover 10 may be placed over a cushion, generally indicated at 12, that may have a pressure relieving medium 14, for example, in the form of fluid and/or foam, or other suitable medium. The cushion 12 may be designed, constructed or configured to reduce the likelihood of pressure ulcers suffered by a seated user by relieving pressure against the boney prominences of the user's buttocks. Pressure relief may be achieved, for example, by allowing the boney prominences to immerse (e.g., immerse or at least partially immerse) within the fluid

and/or foam without creating regions of "high contact pressure." The cover 10 may be designed, constructed or configured to stretch (e.g., stretch or otherwise configured) to accommodate the contour of the buttocks during immersion, for example, without producing significant surface tension in the cover fabric, thereby reducing contact pressure against the boney prominences.

[0019] The cushion 12 may be comprised of a base 16, which may be formed, for example, of foam or other suitable material. The pressure relieving medium 14 may be provided above the base 12, or above at least a portion thereof, and the upholstery cover 10 may cover the base 16 and the pressure relieving medium 14. The base 16 may be constructed from material (e.g., semi-rigid foam or other suitable semi-rigid material), which may be shaped to provide postural support to the user, and which may contain the pressure relieving medium 14. The pressure relieving medium 14 may be contained within a well 18, for example, in an upper or top rear surface of the base 16 (i.e., to the right of the base 16 when viewing Fig. 1) in a region where pressure ulcers are likely to develop in the user, such as in the regions 20 shown in Figs. 6-9. The pressure relieving medium 14 may be one of several types, including fluid (e.g., any material or substance which flows or moves whether in a semisolid, liquid, sludge, gas or any other form or state). The fluid medium may be comprised of a viscous fluid contained, for example, within a membrane 22, which may be impermeable to the fluid. The membrane 22 may be partitioned so that the fluid may be contained within several reservoirs. Various shapes, sizes, and configurations of reservoirs may be contemplated to optimize pressure relief and support, and best meet the clinical needs of the user.

[0020] The pressure relieving medium 14 may be in the form of a foam construction. The foam medium may be more compliant than the foam base, which may be semi-rigid. The foam medium may include foams of varying density, and materials, including viscous or elastic polyurethane foam.

[0021] It should be appreciated that the pressure relieving medium 14 may be in the form of a combination of fluid or foam, or other material, and may include, for

example, gas filled pellets suspended in foam, liquid or a semi-solid, or other suitable combinations of materials.

[0022] The cushion 12 may be designed, constructed or configured to allow deep immersion of the user's buttocks within the pressure relieving medium 14. Deep immersion may distribute the supporting load of the buttocks, and may distribute the supporting load of most of the buttocks, if not the entire buttocks, without creating pressure hotspots at the boney prominences, or reducing the risk that pressure hotspots will be created at the boney prominences. The well 18 and medium 14 may be deep enough to prevent these prominences from bottoming out on the base 16 below.

[0023] The upholstery cover 10 may form an envelope that covers the cushion 12, or that surrounds most of the cushion 12, if not the entire cushion 12, or that covers at least a portion of the top surface of the cushion 12. The cover 10 may have an upper portion (e.g., top surface) which may be constructed to provide effective pressure relief and user comfort. The upper portion may include a tension-free layer, or one that has relatively little tension, conducive to pressure relief. The top portion may be formed, at least in part, by a layer of open weave fabric, such as Tytex 5912 or AirX (TM) of the Tytex Group, and manufactured by TYTEX, Inc., of Woonsocket, Rhode Island, U.S.A., to effectively control temperature and humidity next to the user's skin. Examples of relatively tension free cover portion construction are discussed as follows.

[0024] The cover 10 may be comprised of one or more layers of fabric material, which may be designed to control temperature and humidity. An inner layer 24 may be, at least in part, a wicking material that may be highly breathable, such as a micro denier fabric (i.e., a hydrophilic fabric), or a substance or substances that are water loving, or something that draws moisture. This layer 24 may serve to draw moisture away from the perineum towards the outer edges of the cover 10. An outer layer 26 may include an open weave material, to encourage air exchange (e.g., to allow air to flow or circulate and keep heat or moisture away for the user). The outer layer 26 may provide a smooth outer surface, which may be comfortable when in contact with the skin, and which may provide permeability to moisture. Both the inner and outer

layer materials may be relatively thin, and may eliminate or reduce the risk of pressure hotspots, if wrinkles or folds are present. To relieve tension from these layers 24, 26, the layer fabrics may be provided with pleats or otherwise configured, for example, along their perimeter (e.g., similar to the pleats of the fluid pad construction of the JAY 2 fluid seat cushion manufactured by Sunrise Medical Inc. of Longmont, Colorado, U.S.A.) or constructed so that they fit loosely on the base 16. A middle layer may be constructed from a spacer fabric 28, which may be a thicker and stiffer material. To prevent or reduce the risk of tension in the middle layer, an elastic or other suitable material may be provided (e.g., sewn or otherwise) around the perimeter of the spacer fabric 28 or a portion thereof, as shown in Fig. 2. The elastic material 30 may be stretched or otherwise configured with respect to the spacer fabric 28. The elastic material 30 may contract the spacer fabric 28 about its perimeter or portion thereof so as to compress the spacer fabric 28 so that the spacer fabric 28 may acquire a compressed shape, for example, like the compressed spacer fabric 32 shown in Fig. 3. The middle layer then may be applied between the inner and outer layers 24, 26. By pre-compressing the spacer fabric or portion thereof, the middle layer may stretch when sat upon to allow immersion into the pressure relieving medium 14, without producing surface tension, or by reducing the risk that surface tension will be produced. It should be appreciated that the elastic material 30 need not be provided around the perimeter of the spacer fabric 28. For example, one or more of the edges of the spacer fabric 28 can remain free of elastic, and be kept free floating between the inner and outer layers 24, 26 of the cover 10. Free floating edges could be provided on the front and/or rear edges of the spacer fabric 28 (i.e., the left and right edges of the spacer fabric 24 when viewing Fig. 1), for example, if the fabric weave allows more stretch in one direction over another.

[0025] In Fig. 4, a cover is shown having a layer wherein the elastic material is eliminated from around the perimeter thereof. The spacer fabric 28 may be situated between the inner and outer fabric layers. A technique (e.g., sewing or otherwise) may be employed to compress the spacer fabric perimeter 32. This can be done, for example, prior to attaching the spacer fabric 28 to the inner and/or outer layers 24, 26.

Again, the middle layer may remain pre-compressed to eliminate fabric tension during immersion stretching.

[0026] In Fig. 5, a cover is shown having a layer wherein the entire spacer fabric is generally compressed. The spacer fabric may be oversized in length and/or width with respect to the dimensions of the top portion of the cover 10. During assembly, a pocket may be formed using the inner and outer fabric layers 24, 26 and the spacer fabric may be inserted or stuffed within this pocket, so that the spacer fabric is compressed in length and/or width. The compressed spacer fabric 32 may help to eliminate fabric tension during immersion stretching.

[0027] In Fig. 6, a cover with a spacer fabric that may be pre-cut. As shown in Fig 6, the spacer fabric 28 may be provided with parallel cuts 34 in the form of "S" shapes. This pattern of cutting may allow the spacer fabric 28 to stretch in both lateral and longitudinal directions (e.g., horizontal and vertical directions when viewing Fig. 6) with little surface tension generated in the fabric. Stretching in the lateral direction may cause fabric rows to separate. Stretching in the longitudinal direction may cause individual rows to stretch by pulling the "S" shapes into a straighter line.

[0028] In Fig. 7, there is shown a cover with a spacer fabric that is pre-cut into parallel, substantially evenly spaced rows. The spacer fabric 28 may be constructed with a bi-directional weave that allows the fabric to stretch more in the longitudinal direction than the lateral direction. The parallel rows may be aligned along longitudinal axes (e.g., axes extending vertically when viewing Fig. 7). This pattern of cutting may allow the spacer fabric 28 to stretch in both directions with little surface tension generated in the fabric. Stretching in the lateral direction may cause the fabric rows to separate. Stretching in the longitudinal direction may cause the fabric to stretch within the weave of the fabric with minimal elasticity. This cover may be enhanced, for example, by using a spacer fabric that has a permanent set that pre-compresses it in the longitudinal direction. This allows for more elasticity (increased strain) in the longitudinal direction.

[0029] In Fig. 8, there is shown a cover with a spacer fabric 28 that is pre-cut in spiral patterns 38. The spiral patterns 38 may be centered approximately over the

ischial tuberosity region of the seat cushion 12. This pattern of cutting may allow the spacer fabric 28 to stretch in the direction of immersion with minimal surface tension forming in the fabric.

[0030] A spacer fabric 28 may be pre-cut into star patterns 40, as shown in Fig 9. The star patterns 40 may be centered more or less over the ischial tuberosity region of the seat cushion 12. This pattern of cutting may allow the spacer fabric 28 to stretch in the direction of immersion with minimal surface tension in the fabric.

[0031] It should be appreciated that an entire cushion may be constructed of spacer fabrics, such as those described above, which are manufactured by the Tytex Group, and manufactured by TYTEX, Inc., of Woonsocket, Rhode Island, U.S.A. For example, a relatively firm base 42 may be formed from a relatively thick spacer fabric, as shown in Fig. 10, in the order, for example, of about 1/2 to about 2 inches (about 12.7 mm to about 5.08 cm), or more or less. A middle layer 44 may be formed from a relatively thick spacer fabric, in the order, for example, of about 1/2 to about 2 inches (about 12.7 mm to about 5.08 cm), or more or less. An upper layer 46 of a relatively thin spacer material, in the order of, for example, about 1/8 to about 1/2 inch (about 3.175 mm to about 12.7 mm), or more or less, may be applied to the middle layer.

[0032] The principle and mode of operation of this invention have been explained and illustrated in its preferred embodiment. However, it must be understood that this invention may be practiced otherwise than as specifically explained and illustrated without departing from its spirit or scope.

What is claimed is:

1. A wheelchair cushion comprising a cover having a top surface comprising one or more layers of material, at least one of the one or more material layers having at least a portion that is pre-compressed so as to allow the pre-compressed portion to stretch while minimizing surface tension developing in the pre-compressed portion.
2. The wheelchair cushion according to claim 1 wherein the pre-compressed portion is formed during sewn construction of the cover.
3. The wheelchair cushion according to claim 1 wherein the at least one of the one or more material layers has a perimeter comprising one or more edges and the pre-compressed portion is compressed by having elastic material attached to the one or more edges of the perimeter, the elastic material being pre-stretched during attachment so as to pre-compress the portion that is pre-compressed when tension from the elastic material is removed.
4. The wheelchair cushion according to claim 1 in combination with a wheelchair, the combination comprising a base and a seat supported by the base, the cushion supported by the seat.
5. A wheelchair cushion comprising:
a cover having a top surface of known size, and
an insert material installed in relation to the cover and having a length and width, at least one of the length or width being oversized with respect to the size of the top surface, the length and width of the insert material being compressed so as to reduce at least one of the overall length or width of the insert material so as to allow the insert material to stretch freely while minimizing surface tension developing in the insert material.

6. The wheelchair cushion according to claim 5 wherein the insert material is installed into the top surface.

7. The wheelchair cushion according to claim 5 in combination with a wheelchair, the combination comprising a base and a seat supported by the base, the cushion supported by the seat.

8. A wheelchair cushion comprising a cover having a top surface comprising one or more layers of material, at least one of the one or more material layers being cut so as to allow the at least one of the one or more material layers to stretch in at least one of a lateral direction or a longitudinal direction while minimizing surface tension developing in the at least one of the one or more material layers.

9. The wheelchair cushion according to claim 8 wherein the at least one of the one or more material layers is cut by making one or more cuts in the at least one of the one or more material layers so as to allow the at least one of the one or more material layers to stretch in the at least one of the lateral direction or the longitudinal direction while minimizing surface tension developing in the at least one of the one or more material layers.

10. The wheelchair cushion according to claim 9 wherein the at least one of the one or more material layers is cut by making the cuts in a series of rows.

11. The wheelchair cushion according to claim 10 wherein the at least one of the one or more material layers comprises a fabric that is constructed in such a manner as to allow for more stretch in one direction than in another, and where the direction of more stretch is aligned relatively parallel to a long axis direction of the rows.

12. The wheelchair cushion according to claim 9 wherein one or more of the cuts are non-straight cuts that allow the at least one of the one or more material layers to stretch in a general direction of the cuts.

13. The wheelchair cushion according to claim 9 wherein one or more of the cuts form one or more "S" shaped patterns.

14. The wheelchair cushion according to claim 9 wherein one or more of the cuts form one or more zigzag patterns.

15. The wheelchair cushion according to claim 9 wherein one or more of the cuts form one or more spiral patterns.

16. The wheelchair cushion according to claim 9 wherein one or more of the cuts form one or more star patterns.

17. The wheelchair cushion according to claim 8 in combination with a wheelchair, the combination comprising a base and a seat supported by the base, the cushion supported by the seat.

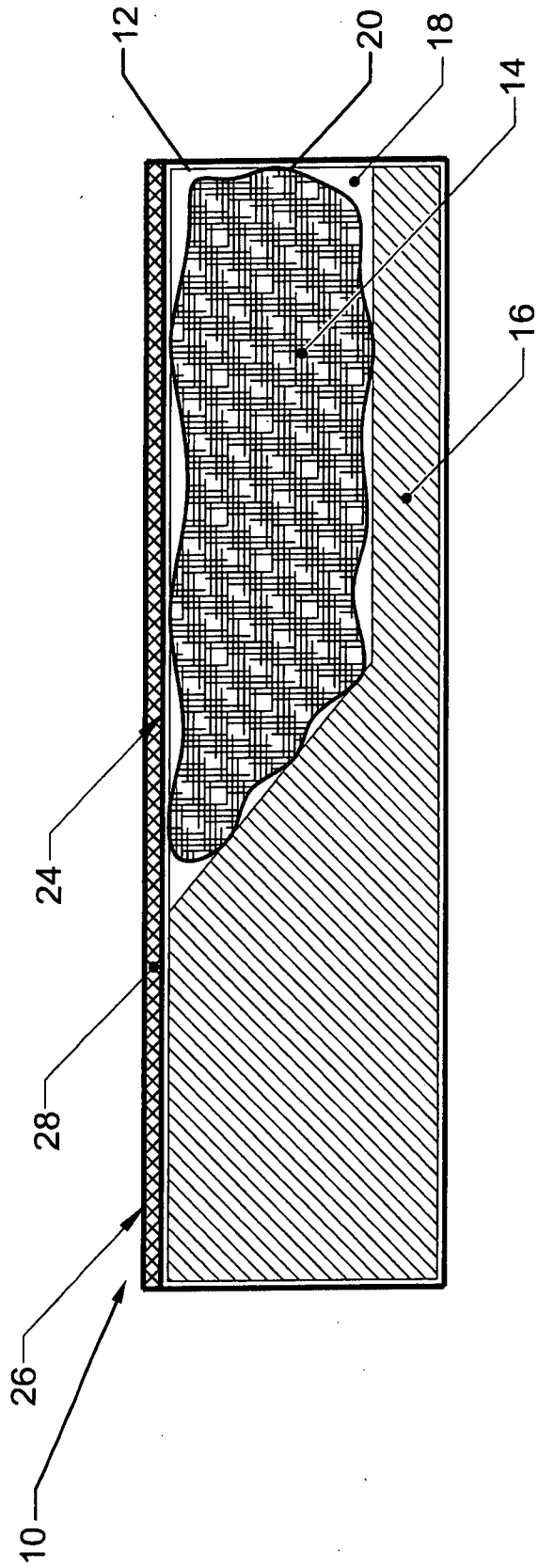


FIG. 1

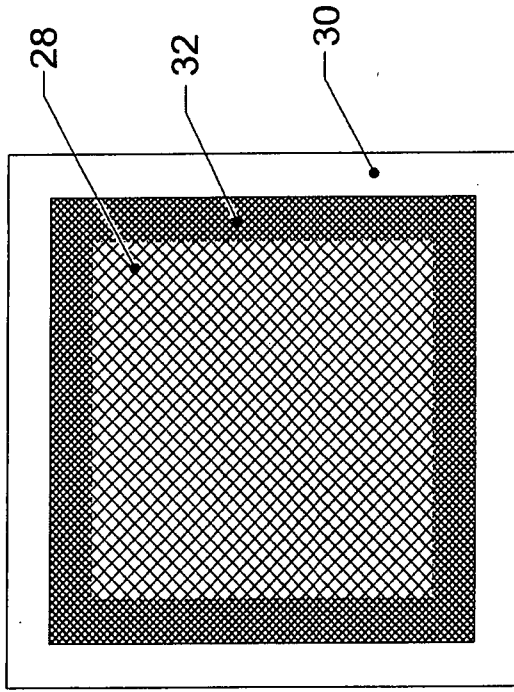


FIG. 3

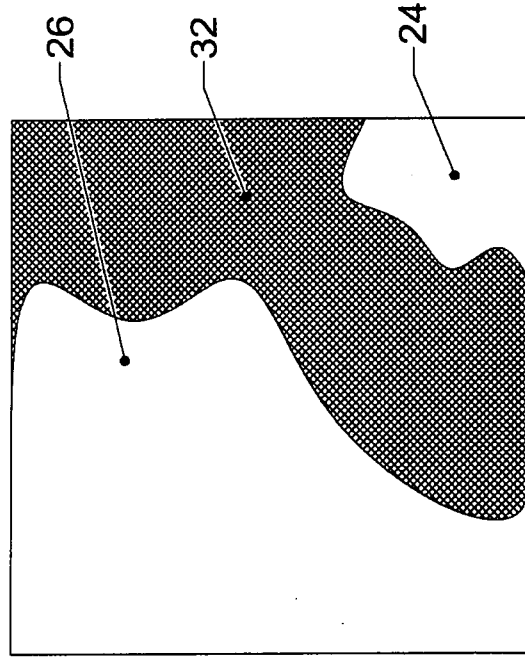


FIG. 5

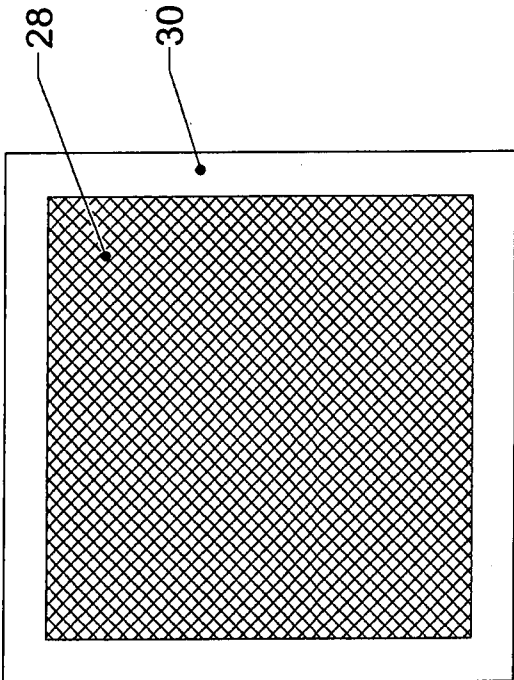


FIG. 2

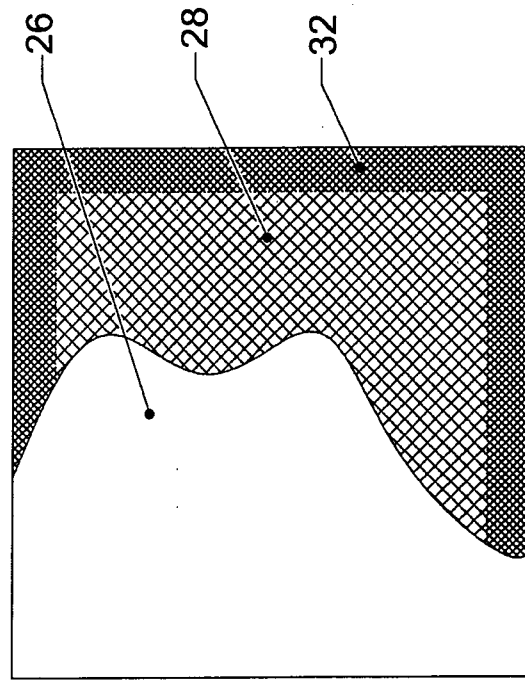


FIG. 4

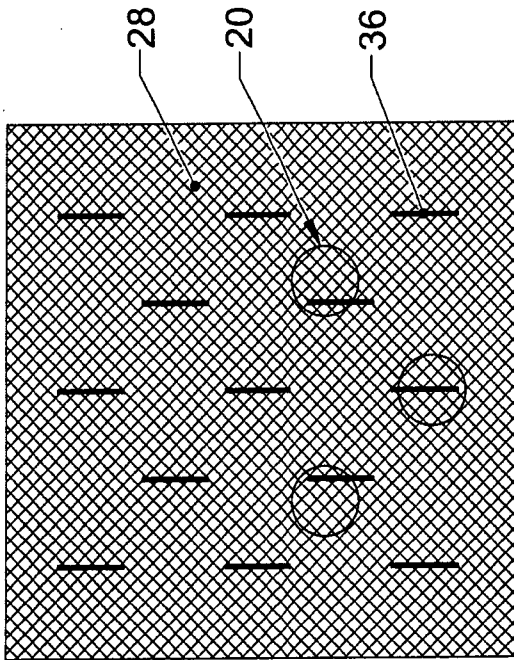


FIG. 7

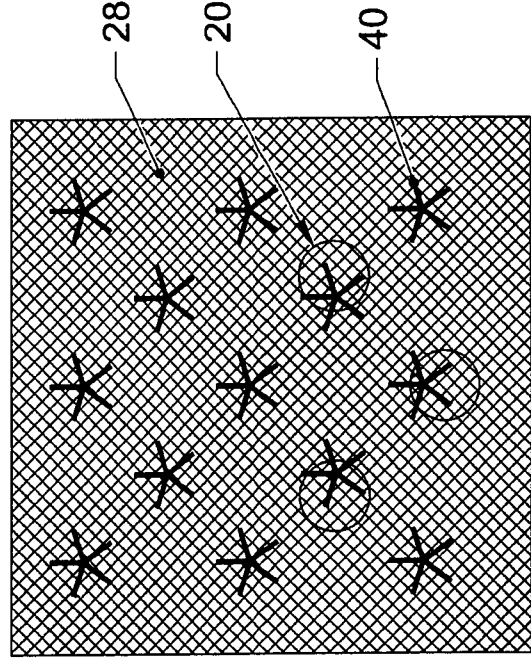


FIG. 9

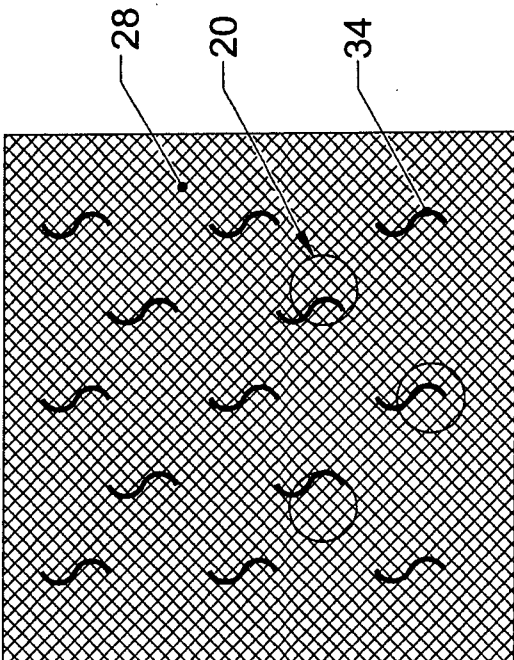


FIG. 6

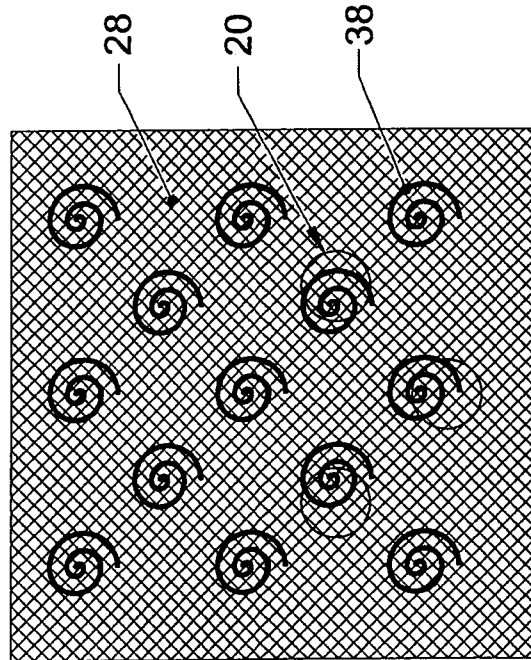


FIG. 8

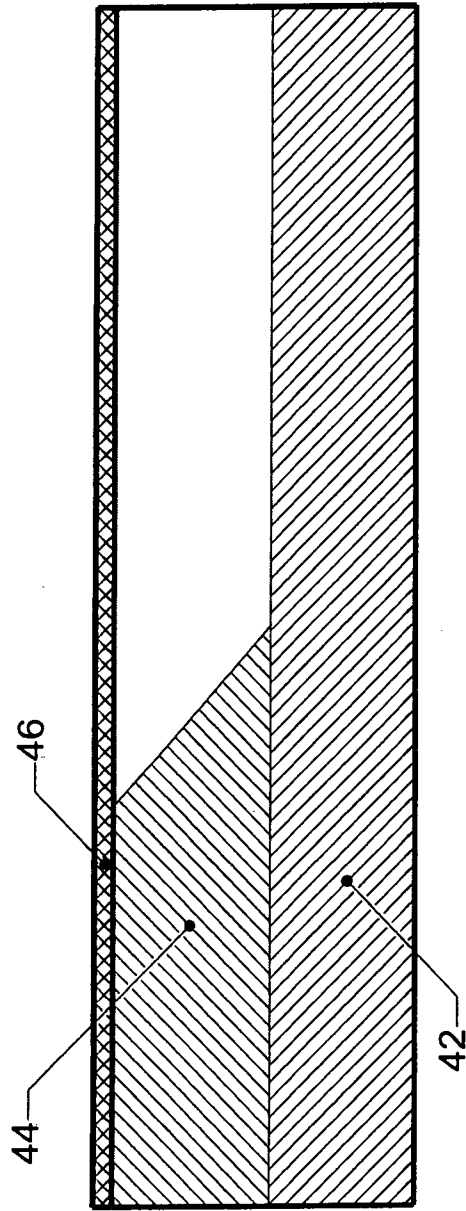


FIG. 10