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(57) Abstract: The support characteristics within a foam mattress body may be varied by inserting reinforcements into channels cut or otherwise formed within the foam.
CHANNEL-CUT CUSHION SUPPORTS

BACKGROUND OF THE INVENTION

This invention relates to mattresses and more particularly to a mattress for maximizing the comfort of a person lying atop the mattress.

Mattresses made of homogenous foam are common. As a significant disadvantage, such material does not distribute localized forces well, resulting in more-than-desired deflection in regions of greater localized force or weight. An added disadvantage to such material is the uniformity of mechanical characteristics and deflection for a given load. Thus a typical foam mattress is not well adapted to the variations in weight and shape of a human body.

There remains a need for a mattress that varies in terms of deflection to a given applied force. More particularly, it is desirable to control variations in firmness at particular regions within a mattress, in order to accommodate different body types, as well as the subjective preferences of users.

SUMMARY

The support characteristics within a foam mattress body may be varied by inserting reinforcements of various types into channels cut or otherwise formed within the foam.

BRIEF DESCRIPTION OF THE DRAWINGS

The foregoing and other objects and advantages of the invention will be appreciated more fully from the following further description thereof, with reference to the accompanying drawings wherein:
Fig. 1 is a top perspective of one mattress according to the invention;

Fig. 2 is a cross sectional view taken on line 2-2 of Fig. 1;

Fig. 3 is a cross sectional view taken on line 3-3 of Fig. 1;

Fig. 4 is an alternative embodiment of the subject matter of Fig. 3;

Fig. 5 depicts a technique for manufacturing the mattress of Fig. 1;

Fig. 6 depicts an alternative embodiment of the mattresses;

Fig. 7 depicts an overhead view of the mattress depicted in Fig. 6;

Fig. 8 depicts a cross-sectional view of a pocketed coil in a channel cut; and

Fig. 9 depicts a perspective cut away view of a mattress according to the invention.

DETAILED DESCRIPTION OF CERTAIN EMBODIMENTS

To provide an overall understanding of the invention, certain illustrative embodiments will now be described, including a foam mattress with reinforcing elements, such as pocket coils inserted into channels formed therein. It will be appreciated that the inventive concepts disclosed herein may have broad applications. The techniques may be used, for example, to provide support within seat cushions for automobiles or furniture, and may be realized with a wide variety of materials in lieu of the foam and pocket coils of the embodiments below. These and any other such modifications as would be clear to one of ordinary skill in the art are intended to fall within the scope of the systems described herein.

Like element numbers used in multiple figures herein refer to the same element, unless otherwise explicitly stated.

As used herein, the term "foam" shall mean any flexible and resilient material, including any open-celled elastomeric material, synthetic or natural foams, rubber or
plastic foams, blown or molded foams, latex, and/or other homogenous or heterogeneous materials suitable for use with the mattresses described herein.

The systems and methods described herein include, among other things, foam core assemblies and methods for manufacturing such foam core assemblies wherein voids are formed within a block of foam. In one practice the voids are routed out of the foam block or formed within the block of foam by passing a foam block into a convoluter and having the convoluter create internal or lengthwise voids within the foam core. Optionally, the voids extend the full length or width of the foam block and the foam block is dimensioned to act as a foam core for a conventional mattress such as a king, queen, Olympic Queen, California King, twin or extended twin mattress. In other embodiments, the voids formed within the foam block extend only partially along the width or length of the foam block or are discrete, such as bore holes, rectangular cut-outs, or any other geometry that might be formed by the methods and systems described herein. As further described in more detail below, the voids formed within the foam block may then be filled with other support elements, such as spring coils, foams of different density and firmness, latex, water bags, or any other kind of support element that may be fitted within the voids and capable of providing support to a user.

Figure 1 is a top perspective of a mattress. In Fig. 1, there is illustrated a mattress 10 including a body 12 formed of foam and at least one insert 20 located within the body 12. The mattress in Fig. 1 has four such inserts 20, although more or less may be conveniently used.

The mattress 10 may be parallelepiped in shape, with the body 12 having a planar top surface 14, a planar bottom surface 15 substantially parallel and substantially equal in size to the top surface 14, two planar side surfaces 16 substantially parallel to each
other, substantially equal to each other in size and perpendicular to the top surface 14 and a bottom surface 15, and two planar end surfaces 18 substantially parallel, substantially equal to each other in size and perpendicular to the top surface 14, the bottom surface 15 and each of the two end surfaces 18. The mattress 10 may be, for example, of the size and shape of any commercially-available mattress, which includes king (approximately 72-78 inch by 80-84 inch), queen (approximately 60-66 inch by 80 inch), full or double (approximately 54 inch by 75 inch), or twin (approximately 39 inch by 75-80 inch). While the embodiment in Fig.1 has a body 12 of homogenous construction, the body 12 could be formed of a combination of various types of foam with different mechanical characteristics. For example, the body 12 could be composed of multiple layers of such material, varying in respective mechanical characteristics, progressing in layer upon layer from the top surface 14 to the bottom surface 15. In addition to such top-to-bottom layering (or in substitution therefor), the body 12 could be composed of multiple layers of such material, varying in respective mechanical characteristics, progressing in layer upon layer between both end surfaces 18, and/or between both side surfaces 16.

At least one channel 19 is disposed within the body 12. An insert 20 may be located within the channel 19. The embodiment in Fig.1 has four such channels 19 and four corresponding inserts 20. Although the embodiment in Fig.1 has the channels 19 in the top surface 14, it should be appreciated that the channels 19 and inserts 20 could be placed in any orientation or multiplicity within one, or more than one, of the surfaces 14, 15, 16, or 18 of the body 12, according to the desired location and degree of reinforcement. As in the embodiment in Fig.1, the channels 19 and respective inserts 20 may be placed and distributed along the axis connecting the end surfaces 18 to provide for areas of different firmness or support characteristics along the body of one or more users lying on the mattress 10. The channels 19 and respective inserts 20 could also, or
instead, be placed and distributed along the axis connecting the side surfaces 16 to
provide for areas of different firmness or support characteristics between the two side
surfaces 16 of the mattress 10, to provide multiple comfort zones, such as for multiple
users of the mattress 10. The channel 19, and the insert 20, could be of any physical
shape and orientation within the body 12, although the embodiment in Fig. 1 shows a
linear shape parallel to the end surfaces 18.

One common measure of firmness is Indentation Load Deflection ("ILD") which
is an objective measure of firmness for foams and other sleeping surfaces that is known
to those skilled in the art. In general, the insert would provide a smaller ILD, i.e., greater
firmness, than the surrounding foam of a mattress body.

Figure 2 is a cross-sectional view of the mattress of Fig. 1. As depicted, the
channel 19 may open onto and extend from one surface, the channel surface (in the
embodiment shown in Fig. 2, the top surface 14), in a generally perpendicular direction
from the channel surface (in Fig. 2, the top surface 14). The channel 19 extends into the
body 12 for some distance from the channel surface, thus having a depth. If the channel
19 does not extend all the way through the body 12, the remaining foam beneath the
channel may improve structural integrity and increase ease in manufacturing the mattress
10. The channel 19 of Fig. 2 is generally rectangular in cross-section, however other
cross-sectional profiles may be suitably used with the mattresses described herein.

An insert 20 is located within the channel 19. The insert 20 is of a size
substantially equal to the channel 19. The insert 20 may be substantially flush with the
channel surface (in Fig. 2, the top surface 14) or it may not entirely fill the channel 19.
The insert 20 in the embodiment shown in Fig. 2 may be composed of material having
mechanical characteristics different from the mechanical characteristics of the body 12.
For example, a foam body 12 may have one or more non-foam inserts, such as loose or
pocketed springs, a string of connected pocket springs, or any other material or construction suitable for adding support to a surface of the mattress 10.

In an embodiment, the channel 19 is shaped and sized to receive a string of pocket springs, with a row of springs placed in the channel 19 to reinforce the mattress 10. More than one row of connected pocket springs may be used, such as two or three adjacent rows, with the channel 19 sized accordingly. As another example, the foam body 12 may have one or more foam inserts with mechanical characteristics, such as firmness and density, different from the characteristics of the body 12. The insert 20 may itself be an aggregation of various materials having varying mechanical characteristics, such as individual spring coils in a rectangular foam strip, or held in place by wires or other support structures. If various materials are used in the insert 20, the materials therein could vary depending on depth from the channel surface, or along either axis of the channel 19 when viewed from the channel surface (in the embodiment of Fig.2, could vary between the two side surfaces 16 and/or between the two end surfaces 18).

The insert 20 may be permanently affixed within the channel 19 by conventional means such as by adhesive, melting due to applied heat, mechanical fastner such as a hog ring, or frictional restraint. Alternately, the insert 20 may be merely placed within the channel 19 without attachment to the interior thereof, held in the channel 19 either by a customary cloth-type mattress cover placed over the mattress 10 during manufacture, or by a layer of additional material which might be added on top of the channel surface and cover the entire channel surface or that portion of the channel surface surrounding and including the channel 19. Such added material on the channel surface could be foam (identical to, or differing in mechanical characteristics from, the material of which the
body 12 is made), or any other material such as those commonly used as a mattress topper or cushion-top for mattresses, including batting, padding or quilting.

Figure 3 is a cross-sectional view of the mattress of Fig. 1. As shown in the embodiment set forth in Fig. 3, the channel 19 and the insert 20 do not extend to any of the surfaces other than the channel surface, in this embodiment the top surface 14.

Figure 4 is an alternative embodiment of the subject matter of Fig. 3. As shown in Fig. 4, the channel 19 and insert 20 could extend to one or more of the other surfaces of the body 12, i.e., those at each end 17 of the channel 19. As depicted, these ends 17 are on the left-hand and right-hand sides of the channel 19, which are perpendicular to the top surface 14 of the channel 19. In such an embodiment, a layer 40 of material could be added to the ends 17 to which the channel 19 and insert 20 extend, to add structural integrity to the body 12 and provide means for further confinement and/or attachment of the insert 20 within the channel 19. The layer 40 could be composed of any material including foam (identical to, or differing in mechanical characteristics from, the material of which the body 12 is made), or any of the materials noted above. The layer 40 may also be formed from an adhesive-backed material such as tape. The layer 40 could be permanently affixed to the surfaces to which the channel 19 and insert 20 extend (in Fig. 4, the side surfaces 16) by conventional means such as by adhesive, melting due to applied heat, or frictional restraint. Alternately, the layer 40 may be merely placed abutting the surfaces to which the channel 19 and insert 20 extend without attachment thereto, held in place by a customary cloth-type mattress cover placed over the mattress 10 during manufacture or by a layer of additional material which might be added to cover and/or surround the layer 40 and/or that portion of the body 12 closest to the layer 40 to provide some added structural integrity between the layer 40 and the body 12.

Such added material around the layer 40 and/or that portion of the body 12 closest to
layer 40 could be made of foam (identical to, or differing in mechanical characteristics from, the material of which the body 12 is made), or any of the other materials noted above.

Figure 5 depicts one technique for manufacturing the mattress of Fig. 1. As depicted in Fig. 5, the channel 19 may be cut by a cutting implement 50 inserted into the channel surface (in Fig. 5, the top surface 14). The cutting implement 50 may be any tool suitable for forming three-dimensional channels in foam, such as a foam router or other spinning or reciprocating tool. More generally, the cutting implement may employ a sharp edge, which may include teeth or serrations, or may employ heating wires or other applications of heat to melt the foam. Any other technique suitable for cutting and allowing the removal of the foam may similarly be employed. As depicted in Fig. 5, the cutting implement 50 is not as wide as the entire channel 19, and thus the entire channel 19 would be cut by directing the cutting implement across the area of the channel 19 in one or more passes. Similar affect may be achieved by repeated insertions and removals of the cutting implement 50 along the axis connecting the surfaces perpendicular to the channel surface (in Fig. 5, the top surface 14), in Fig. 5, the side surfaces 16. Alternately, the cutting implement 50 could be of the desired length of the entire channel 19 such that the cutting implement 50 would only need to be inserted into and removed from the channel surface once to cut the entire channel 19. Likewise, depending on the desired width of the channel 19 and the width of the cutting implement 50, single or multiple cuts could be made to create the final channel 19 with the desired width.

Although not depicted in Fig. 5, it will be appreciated that the channel 19 may be cut through the body 12, such as from a top surface to a bottom surface, or may be cut so that it extends to an end 17 of the channel 19, such as from a top surface to one or both of the side surfaces. Any resulting exposed end of the channel 19 created during such a
cutting operation could be covered by an extra layer of material, including foam or any other material noted above.

A mattress 10 as described herein may be produced by positioning the body 12 in a way conducive to the production steps, cutting with a cutting implement at least one channel within at least one of the surfaces of the body, and inserting an insert within such channel.

A location of the channel(s) may be selected by identifying regions within a surface of the mattress where additional support is desired. This may depend, for example, on the shape or weight distribution of a user, or, where a number of mattresses are to be made, a typical or representative user.

Channels may be formed in the mattress by cutting. The cutting may be performed by inserting the cutting implement into one surface of the body (the channel surface). The channel may open onto only the channel surface or also one or more of the surfaces perpendicular to the channel surface. Alternately, or in addition, the cutting may be done by inserting the cutting implement into the surface of the body perpendicular to the channel surface. The cutting implement may be smaller than the desired channel (or the decision may be made to cut less than the entire channel at one time with a large cutting implement), thus requiring repeatedly inserting and removing of the cutting implement to cut the entire channel. Alternately, the cutting implement could be of the desired length of the entire channel, allowing inserting of the cutting implement only once to cut the entire channel. Likewise, depending on the desired width of the channel and the width of the cutting implement, cutting single or multiple times may be required to achieve the desired width.

If it is desired or necessary for the channel to extend fully to, and thus open onto, at least one of the surfaces perpendicular to the channel surface, or if such method of
cutting is otherwise preferred, the channel may be cut by inserting the cutting implement into a surface of the body perpendicular to the channel surface. As discussed above in the context of channel length, depending on the width and depth of the cutting implement and the desired width and depth of the channel, cutting the channel may entail repeatedly inserting and removing the cutting implement. After such cutting, the exposed channel opening on the surface(s) perpendicular to the channel surface may be covered by placing an extra layer of material thereon, as discussed above herein.

As an alternative to cutting instruments, one or more channels 19 may be formed in the body 12 of a mattress 10 by molding the channels 19 into the foam of the body 12 as the body 12 itself is molded. Additionally, or instead, the body 12 may be formed of a number of rectangular foam sections assembled so that the assembled body 12 includes the channels 19.

Once a channel has been formed in the foam, an insert, such as any of the inserts described above, may be placed into the channel. The insert may be affixed to the channel using adhesives, heat, or friction or any other physical restraint suitable for maintaining the insert’s position within the mattress. These steps may be repeated for one or more channels and inserts.

Upon completion of the above steps, the mattress with inserts may be finished with any suitable padding and/or upholstery layers.

Figure 6 depicts an alternate embodiment of the mattresses described herein. Specifically, Figure 6 depicts a mattress 60 having longitudinal channels 62 formed therein, a set of support rails 64 that define each channel sidewall, a pair of side rails 68 and a pair of header/footer pieces 70. As depicted in Fig. 6, the channels 62 provide voids that extend longitudinally across the mattress 60 and may be filled with support elements such as foam columns, strings of fabric enclosed coils, individual coils, water
bags or combination thereof. Turning to Figure 7, an alternate assembly of the foam core of the mattress 60 is depicted. Specifically, Figure 7 depicts that after the foam core 80 is cut so that voids 62 appear within the foam core, support elements, such as the depicted springs 74 or foam of different ILD such as the depicted foam 66 may be inserted into the voids 62 formed within the foam core 80. As also shown in Figure 7, each of the foam core assemblies may have separate side rails 68 that can be attached, typically by glue or tape or some other adhesive process, to the side of the foam core 80. This is depicted by the arrow showing the side piece 68 being directed and joined to the adjacent side of the foam core 80. As also shown in Figure 7, the side rail 68 may be a piece of foam that has a void 62 formed therein with optional support elements, such as the depicted springs 72 placed within the void. Accordingly, it will be understood that the systems and methods described herein may be used for forming foam mattress cores as well as forming foam head-rails and side-rails and other foam bodies that might be used for other kinds of furniture, such as futons, car seats, sofas, and other kinds of furniture.

As further depicted in Figure 7, the side-rail pieces 68 may be joined as well as the head-piece 70 and the foot-piece 70. As shown in Figure 7, the head-piece 70 and foot-piece 76 may be joined to the respective ends of the foam core 80. In the embodiment shown, each of the foam head and foot pieces 70 and 76 are solid foam pieces that might be attached to extend across the width of the foam core 80 as well as the combined widths of the side-rails 68.

Turning to Figure 8, a cross sectional view is depicted of the foam core 80 having a support element, in this case, a spring coil 72 located within the channel 62 that has been formed within the foam core 80. As shown in Figure 8, the channel 62 is
dimensionally adapted to have the spring 40 fit snugly within the channel 12. Optionally, an adhesive material, such as a glue or tape, may be applied to the side edges of the spring or support element 72 and joined to the interior side-walls of the channel cut 62. In this way, the springs might be held more firmly therein. The adhesive may be applied at the bottom wall 76 of the channel 62 or to the side-walls 78 or some combination thereof.

Turning to Figure 9, one embodiment of a foam core formed according to the methods described herein is depicted. Specifically, Figure 9 depicts a foam core 10 having a plurality of voids 62. Between each void 62 is a support rail 64 that extends between a head-piece 70 and opposite a foot-piece 70. Figure 9 provides a cross-sectional view of the channel shaped voids 62 and depicts that in this embodiment the voids 62 have a v-shaped profile that extends through a portion of the length of the core 80. As further shown in Figure 9, the head-piece 70 and corresponding foot-piece 70 are integrally formed into the foam core by forming voids 62 that extend only partially across the length of the foam core. The foam core 80 depicted in Figure 9 may be made of any suitable foam material and any foam or other material selected will not depart from the scope of the invention described herein.

While certain embodiments of the invention have been shown and described, persons skilled in this art will appreciate changes and modifications which may be made without departing from the spirit of the invention. Therefore, the inventor does not intend to be limited except by the scope of the following claims:
CLAIMS

1. A mattress comprising:
   A body made of foam, the body having a top surface, a bottom surface, a first and
   second side surfaces and a first and second end surfaces, at least one of the surfaces
   being a channel surface that includes a channel extending into the body perpendicularly
   therefrom; and
   an insert affixed within the channel, the insert reinforcing the body.

2. The mattress of claim 1 wherein the insert includes one or more springs.

3. The mattress of claim 1 wherein the insert includes a row of pocket springs.

4. The mattress of claim 1 wherein the channel extends to an opening in at least one
   of the surfaces adjacent to the channel surface.

5. The mattress of claim 1 wherein the channel extends to an opening in a surface
   parallel to the channel surface.

6. The mattress of claim 1 further comprising a material that covers the channel, the
   material securing the insert within the channel.

7. The mattress of claim 6 further comprising a mattress cover surrounding the
   mattress.

8. The mattress of claim 1 further comprising a plurality of channels, each channel
   having affixed therein an insert that reinforces the body of the mattress.

9. A method of manufacturing a mattress comprising:
   providing a body of foam shaped and sized for use as a mattress;
   locating a region of the body where increased support is desired;
   forming a channel into the body within the region; and
affixing an insert into the channel, the insert having a greater firmness than the body of foam.

10. The method of claim 9 wherein forming the channel comprises cutting foam out of the body.

11. The method of claim 9 wherein forming the channel comprises molding the channel into the foam.

12. The method of claim 9 wherein forming the channel comprises assembling a plurality of rectangular foam pieces into a mattress that includes the channel.

13. The method of claim 9 further comprising covering the mattress with one or more conventional mattress covering materials.

14. A mattress comprising:
   a foam support means for supporting a person lying thereon, the foam support means including a channel within the foam support means; and
   an reinforcing means within the channel for reinforcing a surface of the foam support means.

15. A mattress comprising:
   a body made of foam, the body having at least one surface within a channel formed therein; and
   a string of pocket springs affixed within the channel, the pocket springs having a greater firmness than the foam body.