July 6, 1965 W. P. BAERMANN 3,193,328

FOAM CUSHIONS AND SEATING STRUCTURES

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FIG. 1

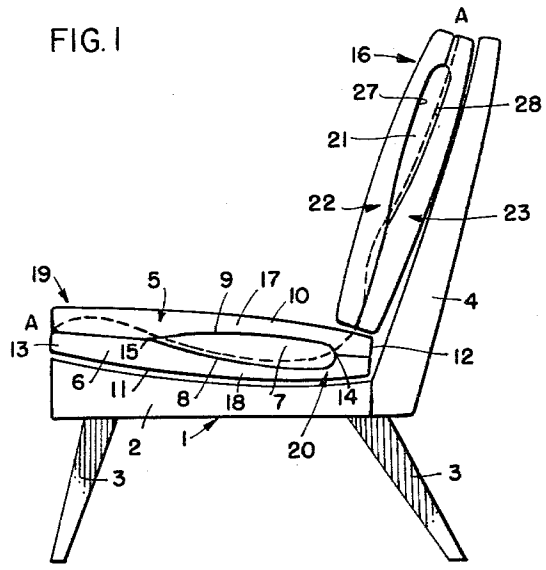
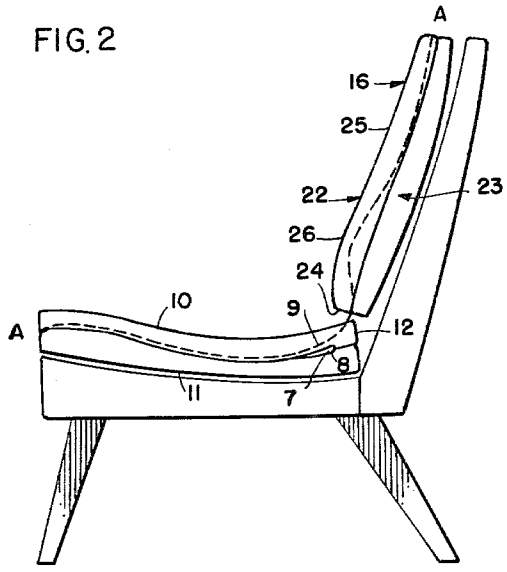


FIG. 2



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FIG. 3

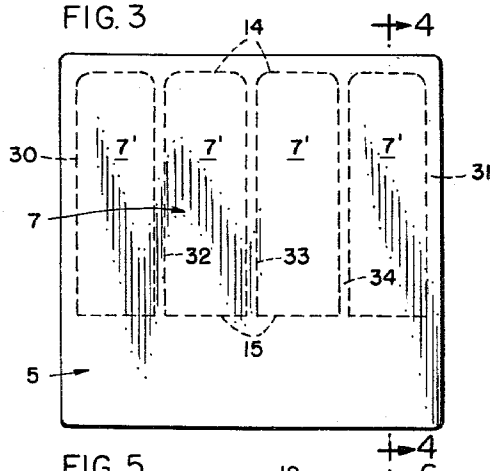


FIG. 4

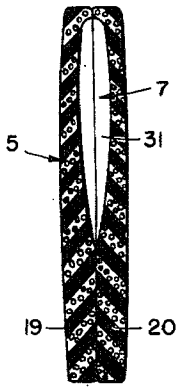


FIG. 5

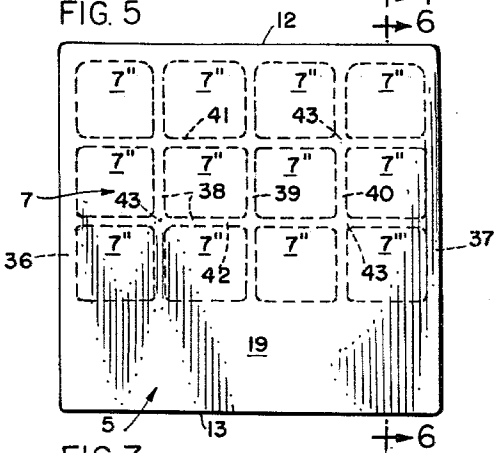


FIG. 6

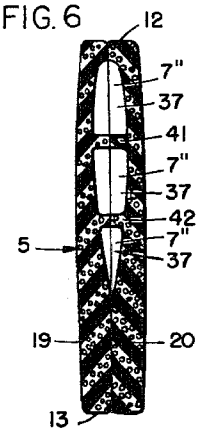


FIG. 7

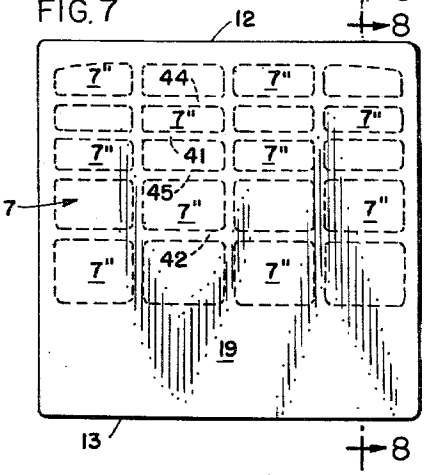
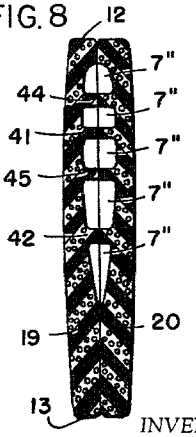


FIG. 8



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FIG. 9

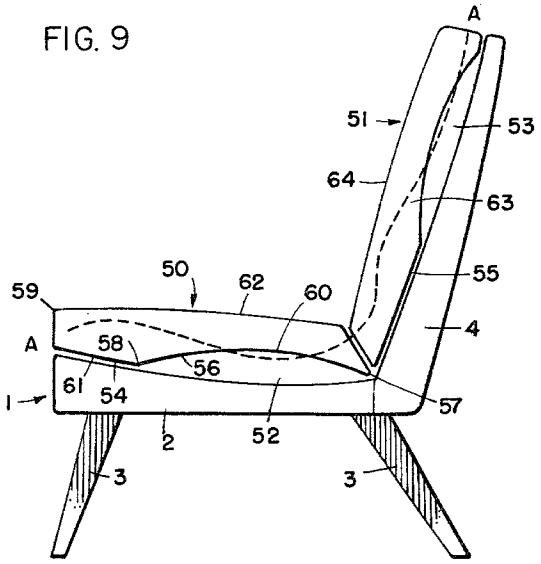
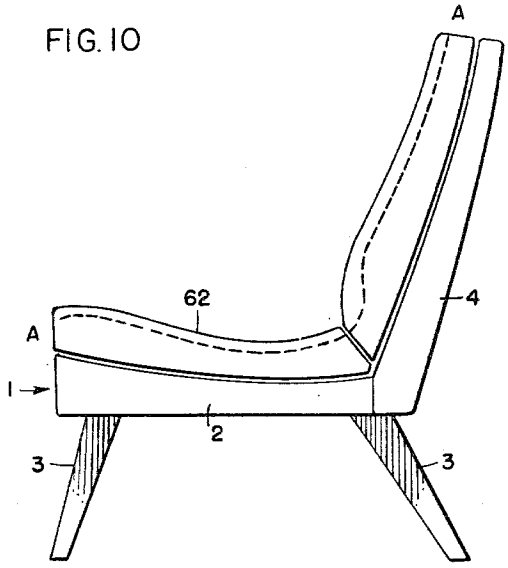


FIG. 10



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FOAM CUSHIONS AND SEATING STRUCTURES

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Filed June 10, 1963, Ser. No. 286,549

10 Claims. (Cl. 297—456)

This invention, in general, relates to articles of furniture and to cushions useful therewith and more particularly pertains to foam cushions, especially seat and/or back rest foam cushions for seats, chairs, sofas and the like, the upper side or face of which cushions depress in approximate conformity to the human anthropologic curve when a human is seated thereon.

Research on seating and its relationship to human anatomy has resulted in better understanding of the requirements which a seating piece should meet in order to fulfill its proper function. From the consideration of such factors as seat height, depth, pitch and contour, as well as lower back, shoulder, and neck support, a series of anthropologic curves have been established which provide proper body support and posture control or, in general, eliminate those fatigue producing factors which ultimately cause seating discomfort.

However, it is not alway aesthetically desirable that the seat and back surface contours follow these anthropologic curves, and in cases where reversible cushions are desired, surface contouring would be impossible because of the necessity for cushion symmetry.

This invention achieves proper anthropologic seating in upholstered furniture pieces without the necessity of contouring seat and back surfaces. Essentially this system proposes a cavity, or cavities, within the cushioning material, contoured in such a manner that when the weight of a seated individual is placed on it, the resultant compressed cushion contours are those desired. The contours of these cavities or cores depend upon the shape, position, and material density of the cushioning material in the particular seating piece, as well as the method and materials used in supporting the cushions.

Seats, chairs, sofas and the like, cushioned and uncushioned, have been contoured so that the upper surface of the seat and front surface of back support follow the approximate anthropological curve in order to provide a comfortable low fatigue support for a human seated thereon. These anthropologically curved seats on articles of furniture, however, have practical disadvantages and are not aesthetically appealing to many persons.

The seating surfaces of foam cushions of this invention, which are nonanthropologically curved, have a normal shape such as convex, flat, or even slightly concave, etc. When a person is seated thereon in the normal seating position, however, the supporting surfaces of the cushions depress unevenly to form substantially an anthropologic curve support. The anthropologic curve-producing structures of the foam cushions of the invention may be so situated in the cushion that they provide the anthropologic curve support when either face of the cushion is up.

The anthropologic curve is the curved line A—A shown in the side views of the drawings. Starting with the front edge of a seat (corresponding approximately to the knees of a seated person) it may arch upwardly for a short distance and then assumes a longer, concave, relatively deep reverse bend turning upwardly at the rear portion of the seat. The anthropologic curve continues its concave curvature relatively sharply into the lower part of the back support member wherein it assumes another reverse bend of convex shape in the lower portion of the back rest member. The curve may again reverse at about the mid-back support area of the back rest and continue through

the remainder of the back rest in a slightly concave (or straight) path.

Briefly, the foamed elastomer cushions herein contemplated comprise foamed elastomer, three dimensional bodies such as foamed polyurethane bodies wherein the cushion is provided with a hollow core or cavity, the wall or walls of the cavity defining a collapsible pocket or pockets in the foamed elastomer. In preferred embodiments of the invention, the cavities are substantially symmetrical at least in vertical section and are located approximately equidistant from the upper and lower sides of the cushion. Such structure allows the cushion to be used with either side facing up, either side of which yields under the weight of a person resting thereon to provide the anthropologic curve support. The cavities may be tapered in both directions from their widest point toward opposite edges of the cushions.

The generic principles of the invention, and practical applications thereof, will be further explained with regard to several preferred embodiments of the invention which are illustrated in the drawings wherein:

FIG. 1 is a side elevation of an embodiment of the invention, i.e., center-cored, reversible seat and back support cushions, on an article of furniture with the cushions in the relaxed, normal state;

FIG. 2 is a side elevation of the embodiment of FIG. 1 with the supporting surfaces of the cushions depressed into the anthropologic curve support surface, as would occur when a person is seated in normal position on the article of furniture;

FIGS. 3 and 4 are, respectively, a top plan view and a section on section 4—4 of FIG. 3 of an embodiment of a center-cored cushion of the invention;

FIGS. 5 and 6 are, respectively, a top plan view and a section on section 6—6 of FIG. 5 of another embodiment of a center-cored cushion, while FIGS. 7 and 8 are similar views, the latter taken on section 8—8 of FIG. 7, of still another embodiment of a center-cored cushion embodied by the invention;

FIGS. 9 and 10 are, respectively, side elevations of another cushion embodiment, i.e., a bottom cored cushion, on an article of furniture with the cushions in the relaxed, normal state and in a depressed state as would occur when a person is seated normally on the article of furniture.

Referring to the drawings, there is shown in FIGS. 1 and 2 a chair 1 comprising a seat frame of any desired construction, on which seat frame are mounted chair legs 3. The seat frame 2 and legs 3 are shown as merely illustrative of one style of seat frame and leg structure. The seat frame may be deeper as in overstuffed chairs, sofas, sectionals, etc., and may have one or more arm rests of any desired construction. The cushion supporting means of the seat frame may be a nonyielding type, e.g., a rigid, solid web, board, etc. or an open, slat-type support, or it may be a resilient type such as a coil spring support, a spring supported, open, wire network support, foam elastomer block support, etc. The back support frame 4, may be attached to the seat frame in any suitable manner and may have any of the aforementioned types of construction, i.e., the nonyielding or rigid types or the resilient types.

A seat cushion 5 (or a series of side-by-side seat cushions) lie on the seat frame 2. The seat cushion 5 is of the reversible type and hence will most advantageously be unattached or detachably connected to the seat frame and/or back frame. It may, however, be used on furniture of tight-seat construction, i.e., furniture with the seat cushion or cushions attached to a frame supported on the seat frame or to the seat frame itself so as to be nonreversible in the sense that the cushion or cushions are not readily removed and turned over to face the other side upward.

The seat cushion 5 comprises a foam elastomer body portion 6 which has a cavity 7 in the rearward portion of the cushion. The lower and upper walls 8, 9 of cavity 7 define the double taper air cavity or pocket 7 in the cellular, foam elastomer cushion. For a reversible cushion, the horizonal mid-plane of the cavity 7 should be about midway between the outer, weight supporting surfaces 10, 11 of the cushion. The curved walls 8, 9 of cavity 7 are curved substantially symmetrically with reference to said horizontal mid-plane.

When a person is seated on cushion 5, the upper surface 10 of the cushion is depressed unevenly under the person's weight whereby the upper surface 10 assumes a curvature of the anthropologic curve type in the seat cushion. The cavity 7 collapses under weight of the seated person and expands to normal size upon removal of weight.

The dimensions of the cavity 7 and its location relative to the rear edge 12 and front edge 13 of the cushion, as well as the particular curvature and double taper of walls 8 and 9, depend upon the thickness of the cushion 5, normal shape of the weight supporting surfaces or major walls 10, 11, e.g., flat, convex, etc., position of the cushion 5 relative to the back supporting cushion 16 and density of the foamed elastomer as it relates to amount of give under given compression or weight conditions, as well as upon method and materials used to support the cushion 5, e.g., rigid vs. resilient support frame structure and character of the latter. As a general rule, however, the front edge 15 of cavity 7 is located nearer front edge 13 than to rear edge 12 of cushion 5; the rear edge 14 of cavity 7 is near, or may even intercept in some cases, the rear edge 12 of cushion 5; the taper and curvature of upper and lower walls 8, 9 is substantially symmetric with reference to the horizontal mid-plane of cushion 5 for a cushion capable of providing substantially the same anthropologic curve support regardless of whether surface 10 or surface 11 is facing upwardly; and the point of greatest divergence of walls 8, 9 of cavity 7 is nearer the rear edge 12 than to the front edge 13 of cushion in order to allow surface 10 (or surface 11 when the cushion 5 is turned over) to collapse to the greatest degree at the point of lowest curvature of the anthropologic curve A—A, which point is closer to rear edge 12 than to front edge 13.

The function of cavity 7 is that of varying the wall thickness of the foamed elastomer cushion 5 and hence varying the depth of depression of the major wall or upper surface 10 (or surface 11 when the cushion is turned over) under the weight of a person sitting thereon. The wall portion 17 between the upper surface 10 and upper wall 9 of cavity 7 will collapse under weight comparatively easily as compared with the collapsibility of the frontal portions of the cushion wherein the foam elastomer is continuous over the entire thickness of the cushion. As air in the cavity 7 escapes to the atmosphere, the cavity 7 collapses easily until upper wall 9 contacts lower wall 8 of the cavity. Upon complete or substantially complete collapse of cavity 7 (FIG. 2), the upper and lower walls 8, 9 are in contact and the wall portions 17 and 18 (the latter lying between cushion surface 11 and cavity wall 8) coact to resist further easy depression of surface 10. At this stage, contacting wall portions 17, 18 behave as if they were a single thickness of foam elastomer and further compression thereof under a person's weight is governed by the inherent compressibility of the particular foam elastomer.

The ultimate curvature of the surface 10 of seat cushion 5, under the weight of a person seated normally thereon with his back resting against cushion 16, is a curvature corresponding substantially to the seat portion of anthropologic curve A—A. The same result would be achieved with the surface 11 in the event the cushion were turned over.

The cavity 7 may extend between and intercept opposite side edges of the cushion 5, i.e., a cavity open at both ends. It may have, on the otherhand, one or more narrow, divider walls of foam elastomer extending thereacross in a direction from front to rear so as to divide the cavity 7 into two or more side-by-side compartments and/or to close off the ends of the cavity 7. The foam elastomer divider walls may be interlinked by laterally extending, foam elastomer walls which together divide cavity 7 into a series of rows of side-by-side compartments. These variations of the invention are further discussed with reference to FIGS. 3–8, infra.

A convenient method for manufacture of foam elastomer cushions 5, with or without said foam elastomer divider walls and/or cross walls, is to mold the expandable elastomer composition, which includes the blowing agent which foams the elastomer compositions into cellular, elastomer form, in a blowing mold in the form of upper and lower half sections 19, 20, which half sections may have the same shape and dimensions and hence may be blown into foam elastomer half sections in the same or an identical blowing mold. The mold is shaped to provide the wall 8 or wall 9 of the blown, molded half section. When the two half sections are joined together as shown, the cavity 7 is formed by walls 8, 9. When one or both ends of the cavity 7 are open, whole cushion 5 may be blown in a single mold in which is mounted a mold core shaped like cavity 7. After molding, the outer forms of the mold may be retracted, and the molded cushion may be drawn sideways off the mold core. In another type of molding technique, the mold core is detachably mounted on the mold, is detached and removed from the mold with the molded cushion, and is then removed therefrom and remounted in the mold for the next molding operation.

The foam elastomer, back support cushion 16 is similar in structure to seat cushion 5. It has a double taper cavity 21 of similar, though not necessarily identical, shape, location, and dimensions to cavity 7. It may also be made from two half sections 22, 23 bonded together like the sections of cushion 5 or as a unitary molding.

The front, lower corner 24 of foam elastomer cushion 16 ordinarily will yield a sufficient amount to allow the lower edge of the back supporting surface 25 to depress sufficiently to assure an approximately smooth continuation from the upper surface 10 of cushion 5 of the anthropologic curve A—A onto the surface 25 of cushion 16. The surface 26 of cushion 16 just above the lower edge should be convexly arched when a person's lower back is resting thereagainst to provide a support area corresponding to the lower back curvature. This convex arch is relatively sharp. The convex or arched surface segment 26 results from the relatively greater resistance to compression of the unbroken foamed elastomer body portion behind the arched surface 26 as compared with the more easily distorted lower corner 24 and the body of the foamed elastomer in the area of the lower portion of cavity 21. The cavity 21, when fully or substantially fully collapsed with cavity wall 27 pressed against cavity wall 28, causes the upper portions of surface 25 to assume a substantially straight or slight concave configuration corresponding to the upper portions of the anthropologic curve A—A (FIG. 2).

The variables such as foam density, type of cushion support, etc., enumerated supra with regard to cushion 5, should also be considered in determining the specifications for the back cushion 16 and its cavity 21 to obtain the optimum anthropologic curve for surface 25 of cushion 16. Cushion 16, like cushion 5, because of the symmetry of walls 27, 28 of cavity 21 relative to the mid-plane thereof, is reversible without loss of the anthropologic support qualities of the cushion.

Several embodiments of cavities with previously discussed foam elastomer wall divider walls and cross walls are shown in FIGS. 3–8 for seat cushion 5. Though not illustrated, these walls may also be used in the cavity 21 of

back rest cushion 16. Referring first to FIGS. 3 and 4, the ends of cavity 7 are closed by foam elastomer walls 30, 31. The cavity 7 is further subdivided into four, side-by-side compartments or pockets 7' by the foam elastomer divider walls 32, 33, 34 extending from front edge 13 to rear edge 14 of cavity 7 and also from lower wall 8 to upper wall 9 of cavity 7. The walls 30, 31, 32, 33, 34 are sufficiently narrow so that they are flexible enough to readily collapse, partly by compressing and partly by bending, under weight. They have, however, sufficient recovery, resiliency or strength so that they tend to return to their normal, straight wall form when the weight is removed. The primary function of walls 31–34 is to provide collapsible, resilient support members for the wall portions 17, 18 so that they retain their normal shape and do not sag under their own weight.

In the embodiment of FIGS. 5 and 6, the cavity 7 is subdivided into a greater number of smaller pockets 7'' by cavity end walls 36, 37, front to rear divider walls 38, 39, 40 and intersecting cross walls 41, 42, all being narrow walls of foam elastomer and of the character of walls 30–34. The walls 36–40 and walls 41, 42 may be joined together at their respective junctures 43, or, if greater flexibility of collapsibility of the cavity at these junctures is desired, the walls 36–42 may be split at the junctures whereby each segment of walls 36–40 (or only walls 38–40) and/or walls 41, 42, is not joined to an intersecting wall segment, whereby each wall segment is collapsible independently of an intersecting wall segment—thereby eliminating the less flexible and more difficultly collapsible junctures 43.

The embodiment of FIGS. 7 and 8 is similar to that of FIGS. 5 and 6 and like numerals have been used to designate like parts. The essential difference is that the embodiment of FIGS. 7 and 8 has two more cross-walls 44, 45, dividing cavity 7 into even more compartments or pockets 7''. The spacings between walls 41–45 are considerably less toward the rearward edge 12 of the cushion in order to impart greater closer support members toward the rearward end of cavity 7, where the greater portion of the weight of a seated person is concentrated. As in FIGS. 5 and 6, the walls may be split to avoid the wall junctures. In the embodiments of FIGS. 5–8, the cross-walls 41–45 may be the only flexible walls employed as support walls, if desired; the divider walls 32–35 may be omitted in such case.

The foam elastomer walls 31–45 may be molded integrally with only one cushion half section 19 or 20 and may, upon assembly of the half sections, have their free edge bearing freely and unattached to the cavity wall of the other half section. As an alternative, the free edgees of walls 31–45 may be bonded to the said cavity wall of the opposite half section when the sections are assembled to form cushion 5. As still another alternative, the walls 31–45 may be molded as half walls on the cavity walls 8, 9 of sections 19, 20 and the free edges of the half walls may be bonded together when the sections are assembled.

Many foam elastomers have sufficient gas permeability so that air can escape readily from cavity 7 when it is closed by end walls or from the cavity pockets or compartments 7'' when they are collapsed under weight and so that air can be drawn readily into the cavity 7 or pockets 7' or 7'' when the wall portion 17 or 18 springs back to normal position upon removal of the weight thereon. In the event the particular foam elastomer employed, however, has a relatively low gas permeability, the escape and return rate for the air can be augmented by providing air vent holes in wall portions 18, 19 or end walls 31, 32 or 36, 37 to vent the cavity 7 or individual pockets 7' or 7'' to the atmosphere. The pockets 7' and 7'' may also be intercommunicated by air vent holes through the wall portions therebetween.

The cushion structure of the embodiment of FIGS. 9 and 10 is somewhat different from that previously described. There is illustrated in FIGS. 9 and 10 an article of seating furniture like that of FIGS. 1 and 2. The seat cushion 50 and the back support cushion 51 are of the nonreversible type in the sense that the anthropologic curve support character of the cushions is realized from only one side of the cushions. The embodiment of FIGS. 9 and 10, therefore, may be used primarily on seating structures where nonreversible cushions are called for in the seating structure design. In FIGS. 9 and 10, the cushions 50 and 51 each have a transverse cavity 52, 53 in the surface 54, 55 lying against the seat frame 2 and back support frame structure 4 supporting each respective cushion. Cavity 52 is defined by a transverse, arched wall 56 arching from the lower, rearward edge 57 of cushion 50 toward the frontal portion of the cushion. Its forward edge 58 is closer to the front edge 59 than to the rear edge of cushion 50. The highest point 60 of arched wall 56 corresponds substantially with the deepest dip in the seat portion of the anthropologic curve A—A.

The cushion 50 in its normal, relaxed state rests on the cushion support structure of seat frame 2 at its rear edge and the frontal undersurface 61, the upper surface 62 of cushion 50 being flat, slightly convex or other nonanthropologically curved shape, as desired. When a person is seated on cushion 50 with his back resting against cushion 51, the cushion portion above cavity 52 collapses readily until the cavity wall 56 contacts the seat cushion support structure on seat frame 2. The maximum collapse occurs substantially at the highest arch point 60 with progressively lesser degrees of collapse on either side thereof, the relative amounts being a function of the shape of arched wall 56. The ultimate result is that the arched wall 56 of cavity 52 substantially completely collapses and the cushion assumes the shape shown in FIG. 10 wherein the upper surface has a curvature corresponding to the seat portion curvature of anthropological curve A—A.

The cavity 53 of back rest cushion 51 behaves in a similar fashion when a person rests his back thereagainst. Its arched wall 63 collapses against the cushion support structure of the back rest frame member 4 so that the surface 64 assumes a curvature corresponding with the upper and lower back portions of the anthropologic curve. The cavities 52 and/or 53 may have front to rear foam elastomer divider walls and/or transverse walls of like chracter to the walls of FIGS. 3–8 to add resilient intermediate or end support members to the cushion wall portion between cavity wall 56 and upper wall 62.

It will be appreciated that the generic principles of the the invention with reference to articles of seating furniture or other seating articles and with reference to foam elastomer cushions therefor can be practiced in a wide variety of embodiments, the specific embodiments illustrated and described being merely illustrative of practical applications of these principles.

The anthropologic curve support for seated persons can be realized by the application of the principles of the invention in seating structures such as cushioned chairs, sofas, etc., with straight backs, sloping backs, transversely rounded backs, low backs, or high backs. The seating structures may even be backless, in which case only the seating cushion portion of the invention applies, as it may also in seating structures with back cushions constructed other than as herein described. With minor modifications due to a difference in weight-support distribution and nature of the anthropologic curve, the cavity-type cushions of the invention may also be used in reclining, lounge seats and the like. It will be further understood that the foam elastomer cushion bodies usually, though not necessarily, will be covered with a flexible covering, e.g., fabric, leather, plastic film, etc.

The invention is hereby claimed as follows:

1. A seat comprising a seat supporting member with a foam elastomer cushion supported thereon, said cushion's upper, weight supporting surface being of a shape other than an anthropologically curved shape when the cushion

is in the relaxed state, said cushion further having embodied in the foam elastomer body thereof a transversely extending cavity defined by at least one arched wall having its highest point of arch substantially opposite the lowest dip of the corresponding portion of the anthropological curve of a person seated in the normal seating position on said seat, said arched wall collapsing when said person is seated in said normal seating position.

2. A seat as claimed in claim 1 wherein said cushion is reversible and has substantially flat to convex, opposite, weight supporting surfaces, and said cavity is about midway between said surfaces and is defined by substantially symmetric, oppositely disposed, transverse, oppositely arched walls formed of said foam elastomer cushion body.

3. A seat as claimed in claim 1 wherein said cushion has a substantially flat to convex upper, weight supporting surface, the opposite surface of said foam elastomer cushion body having therein a single transversely extending cavity recess in said opposite surface defined by an arched wall, said cushion in the relaxed state being supported on said supporting member with said arched, cavity wall unsupported.

4. A seat comprising a seat supporting member with a foam elastomer cushion supported thereon, said cushion's upper, weight supporting surface being of a shape other than an anthropologically curved shape when the cushion is in the relaxed state, said cushion further having embodied in the foam elastomer body thereof a transversely extending cavity defined by at least one arched wall having its highest point of arch substantially opposite the lowest dip of the corresponding portion of the anthropological curve of a person seated in the normal seating position on said seat, said arched wall collapsing when said person is seated in said normal seating position, an upwardly extending, back cushion supporting member with a foam elastomer back cushion with its back surface resting thereagainst, said back cushion's front surface being of a shape other than an anthropologically curved shape when said back cushion is in the relaxed state, said cushion further having embodied in the foam elastomer body thereof a transversely extending cavity defined by at least one arched wall having its highest point of arch substantially opposite the lowest dip of the corresponding portion of the anthropological curve of a person seated in the normal seating position on said seat, said arched wall collapsing when said person is seated in said normal seating position.

5. A seat as claimed in claim 4 wherein each of said cushions is reversible and has substantially flat to convex, opposite, weight supporting surfaces, and said cavity is about midway between said surfaces and is defined by substantially symmetric, oppositely disposed, transverse, oppositely arched walls formed of said foam elastomer cushion body.

6. A seat as claimed in claim 4 wherein each of said cushions has a substantially flat to convex outer, weight supporting surface, the opposite surface of said foam elastomer cushion body having therein a single, transversely extending cavity recess in said opposite surface defined by an arched wall, said cushion in the relaxed state being supported on said supporting members with said arched, cavity wall unsupported.

7. A foam elastomer cushion body molded with a weight supporting, major wall having a shape other than an anthropologically curved shape when said cushion is in the relaxed state, a second major wall shaped and dimensioned similarly to said first-mentioned major wall and located on the side of said cushion opposite said first-mentioned major wall, whereby said cushion body is a reversible type, said foam elastomer body having therein a transversely extending cavity about midway between said major walls and defined by oppositely disposed, transverse, oppositely arched walls of said foam elastomer cushion body, which arched walls are substantially symmetric with reference to the mid-plane between said major walls, one of said cavity substantially completely collapsing when a person is seated on a major wall in a position wherein the lowest dip in his anthropologic curve is substantially opposite the point of greatest divergence of said arched walls.

8. A cushion body as claimed in claim 7 wherein said cavity contains at least one narrow wall of foam elastomer in said cavity extending from one arched wall of said cavity to the other arched wall thereof.

9. A cushion body as claimed in claim 7 wherein said cavity contains a plurality of narrow walls of foam elastomer extending from one arched wall of the cavity to the other arched wall thereof.

10. A cushion body as claimed in claim 9 wherein there is also at least one, narrow wall of foam elastomer extending between said plurality of walls and extending from one arched wall of the cavity to the other arched wall thereof.

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