

March 27, 1962

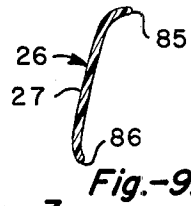
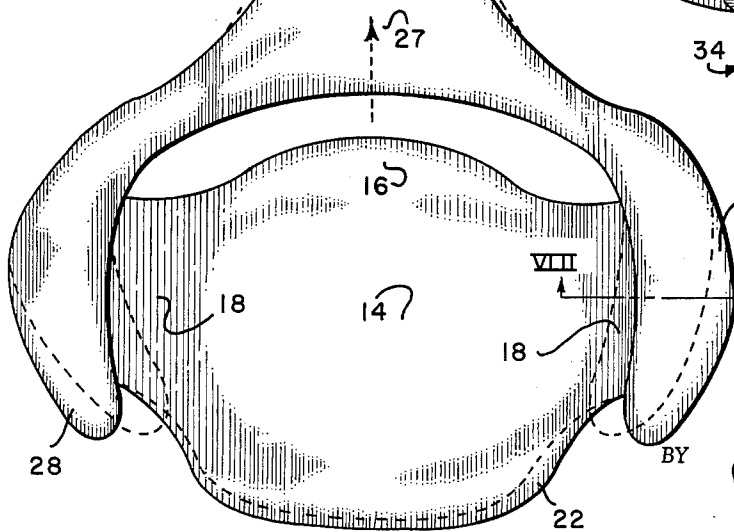
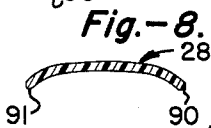
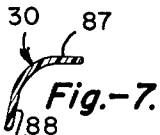
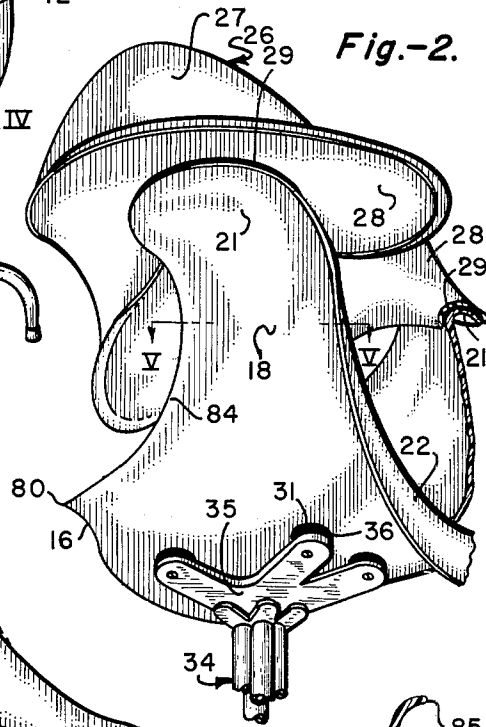
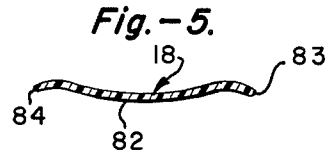
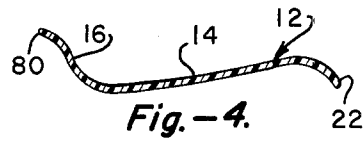
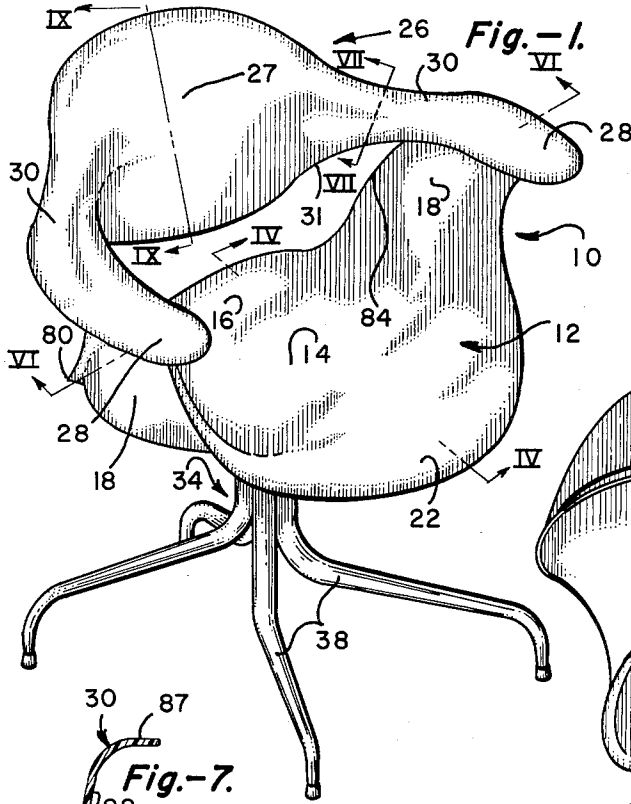
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MULTI-PIECE FORMED FURNITURE CONSTRUCTION

Filed Dec. 1, 1958

2 Sheets-Sheet 1



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MULTI-PIECE FORMED FURNITURE CONSTRUCTION

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2 Sheets-Sheet 2

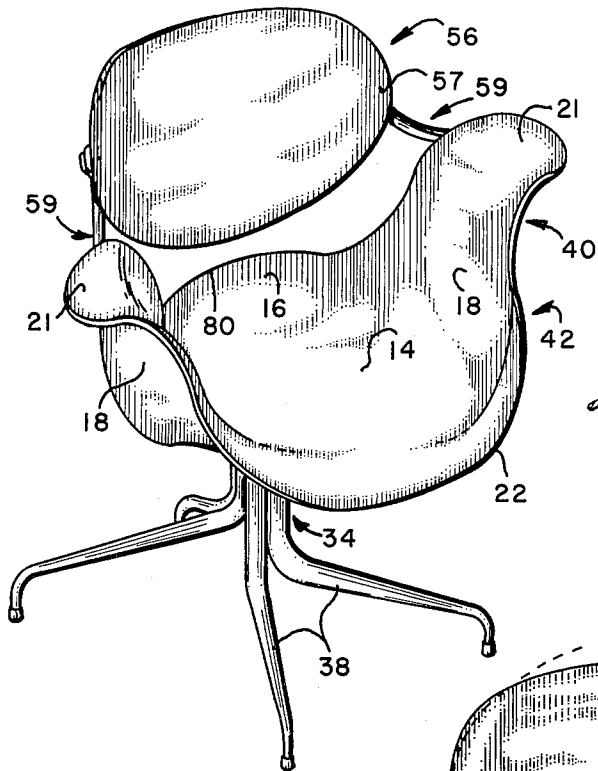


Fig.-10.

Fig.-6.

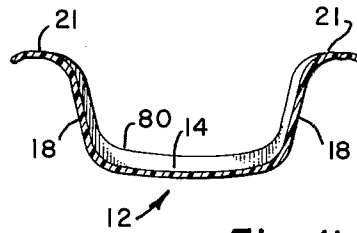


Fig.-11.

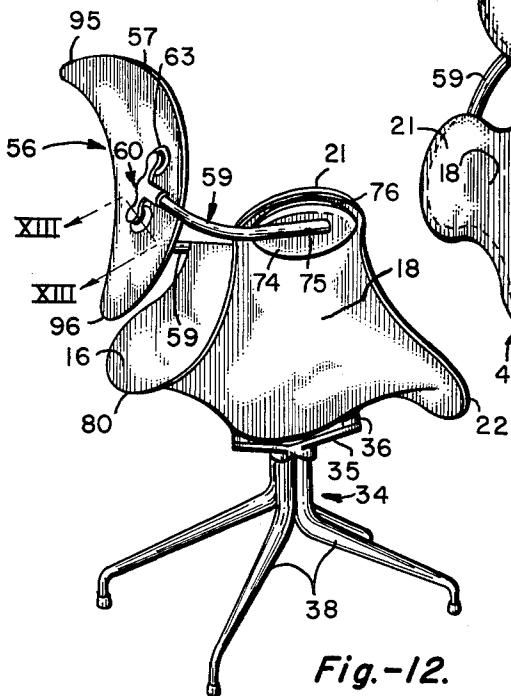


Fig.-12.

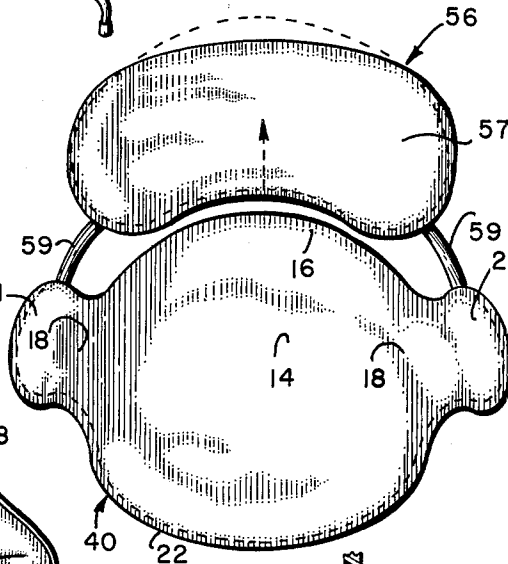
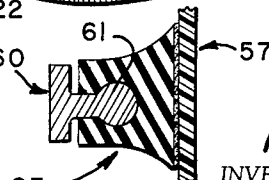


Fig.-13.



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**MULTI-PIECE FORMED FURNITURE  
CONSTRUCTION**

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7 Claims. (Cl. 297-418)

This invention relates to articles of furniture. More particularly, it relates to molded resin, shell type chairs.

Molded resin, shell type chairs have achieved considerable popularity in the furniture art because of the ease and cost of manufacture. They are readily adaptable to contemporary design. Such chairs are characterized by lightness of the finished product and ease of cleaning and maintenance. However, a problem in the art has been to find a molded resin, shell type chair construction which will adequately support a person and yet be comfortable to the user over a long period of time. Stated another way, it has been a problem of long standing in this art to construct a molded resin, shell type chair which will have the proper amount of yield or flexibility under use conditions and yet be sufficiently sturdy and rigid to support the user comfortably and in good posture.

The primary object of this invention is to provide a molded resin, shell type chair which has the proper amount of yield or flexibility under use conditions and yet be sufficiently rigid and sturdy to adequately support the user comfortably and in good posture.

Another object of this invention is to provide a molded resin, shell type chair which minimizes cramping and a feeling of hardness on the part of the user.

These and other objects which may appear as this specification proceeds are attained by this invention which will be described in relation to the drawings wherein:

FIG. 1 is an oblique, elevational view of a preferred embodiment of this invention;

FIG. 2 is an oblique bottom view of the chair of FIG. 1 with a portion thereof broken away to reveal internal structure;

FIG. 3 is a plan view of the chair of FIG. 1;

FIG. 4 is a sectional view taken along the plane IV-IV of FIG. 1;

FIG. 5 is a sectional view taken along the plane V-V of FIG. 2;

FIG. 6 is a sectional view of the seat member taken along the plane VI-VI of FIG. 1;

FIG. 7 is a sectional view taken along the plane VII-VII of FIG. 1;

FIG. 8 is a sectional view of the arm rest taken along the plane VIII-VIII of FIG. 3;

FIG. 9 is a sectional view taken along the plane IX-IX of FIG. 1;

FIG. 10 is an oblique elevational view of another embodiment of this invention;

FIG. 11 is a plan view of the chair of FIG. 10;

FIG. 12 is a side elevational view of the chair of FIG. 10;

FIG. 13 is an enlarged fragmentary sectional view taken along the plane XIII-XIII of FIG. 12.

It will be observed that, broadly, the drawings illustrate a molded resin, shell type chair. This chair has a generally U-shaped molded resin, shell type seat member with an ascending side portion on each side thereof. Each side portion has an outwardly flaring somewhat horizontal section at arm rest height. A molded resin, shell type back rest member is spaced apart from the seat member. The back member is secured to the flared sections of each arm rest by a high strength, resilient connecting means capable of at least limited twisting or deflection. These connections, in part, give the back the

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ability of controlled, body conforming yield without loss of firm, posture aiding support. This shell assembly is supported by any suitable base or pedestal structure.

In somewhat greater detail, and with reference to the embodiment of FIGS. 1 through 9, it will be observed that the drawings disclose a chair 10 having a molded resin, shell type seat member 12. The seat member is of generally U-shape, having a central, body receiving portion 14 and a pair of ascending arm portions 18, one on each side.

Laterally, the central portion 14 of the seat member 12 is generally flat throughout its midsection. However, its rearward section 16 is curved sharply upwardly, terminating in a rearwardly flaring, generally horizontal, reinforcement flange 80 (FIG. 4). This section 16 is arcuate in plan view with the flange 80 tapering into and becoming the marginal reinforcement flanges 84 of the ascending arm portion 18.

The forward section of the seat's central section is smoothly curved or rolled over, downwardly, to form a front reinforcement lip 22 of substantial depth. In plan view, this lip 22 is arcuate but is generated about a radius of greater magnitude than the rear section 16. This structure gives the seat, in a fore and aft direction, a structural section having the general properties of a Z-bar. This stabilizes the seat forwardly and rearwardly and enables it to support severe loadings applied both statically or by shock with the center of load shiftable along the entire fore and aft axis of the seat. This type of loading must be taken into consideration because people may sit firmly back in the chair or merely on its front edge. Further, they may not exhibit due respect for the chair when descending into it.

This Z-bar shape also provides lateral stability. Thus, the body receiving or midsection of the chair becomes a stable platform about which the rest of the seat and back structure are supported. Also, the stability of this area provides a suitable zone in which to secure the chair shell to a base or pedestal. This connection results in a stress concentration and the design of this midsection is particularly adapted to withstand this condition.

The ascending arm portions 18 are also particularly designed to have high strength characteristics. In addition, they are designed to withstand high side loading whether in a lateral or fore and aft direction. Of equal importance in their construction is ability to withstand substantial torsional loadings either alone or in combination with the other types of loads imposed. For this purpose the arms 18 in horizontal cross section are curved outwardly at the center at 82 (FIG. 5). Thus, they are characterized by a vertically extending central shallow concave trough 82. Their edges are also rolled or curved outwardly, forming a front reinforcement rib 83 and a rear reinforcement rib 84. The lower end of the front rib is gradually flared and flows into and becomes an extension of the front lip 22. The lower end of the rear rib 84 blends into and becomes an extension of the rear flange 80. Thus, the high stresses generated in these ribs are discharged to and dissipated by the lip 22 and rear flange 80.

The lower ends of the arm portions, at the rear, curve inwardly and rearwardly and become an extension of the rear section 16 of the seat's central portion. This construction further reinforces the arms 18 and distributes their loads into the midsection of the seat.

The combination of the outwardly bowed center 82 of the arms and the marginal or edge ribs 83 and 84 give the arm portions a substantial moment of inertia displaced throughout most of the arm's cross section from the shell forming the arm. This strengthens the arms 18 and affords them great resistance to buckling despite the relatively thin section of the shell material itself.

The upper ends of the arms are flared outwardly to

form attachment pads 21 for the hereinafter described back. The pads 21 are joined to the arm portions 18 through a section of appreciable radius so substantial loads may be interchanged between the two portions.

The back rest member 26 is also of molded resin in the form of a shell. It has a central portion 27 and a pair of outwardly and forwardly extending arm rests 28. The arm rests 28 are each joined to the central portion 27 by torsional sections 30. The central portion 27, torsional sections 30 and arm rests 28 are all a single, integral molding symmetrical about its vertical centerline.

The central section 27, in front elevation, flares both upwardly and downwardly toward the center to form a structure of substantial vertical section at the center. At its center in vertical section, the back 26 has a substantial area of general flat configuration flanked on each edge by a rearwardly rolled or projecting rim. The upper rim 85 is of appreciably greater depth and is more pronouncedly curved than the lower rim 86 (FIG. 9). Extending away from the center of the back on each side, the rims 85 and 86 are of increasing depth and of more sharply pronounced curvature. This gradual change in configuration continues until these rims become the flanges or walls of the torsional sections 30. The upper rim 85 becomes the top flange 87 and the lower rim 86 becomes the generally vertical flange 88 of the torsional sections respectively (FIG. 7). Thus, the stresses generated in the center area of the back are discharged through the torsional sections 30 to the ascending arm portions 18 of the seat 12.

Loads imposed on the back are normally greater at the upper portion of the back. Thus, the upper rim 85, by being of substantially greater depth than the lower rim 86 is particularly designed to withstand these loads. This arrangement also gives the back greater freedom to flex into a shape conforming to the demands of the user. This is accomplished without sacrifice of the firm support required to give the user a feeling of security. Both yield for shape adaption and firm support are necessary to provide comfort.

The torsional sections 30 are generally L-shaped in the zone of greatest stress concentration, that is, where the stresses are applied not only in tension and compression but also in torsion. This imparts to these sections a high resistance to buckling or other high shear failure. Yet by reason of the nature of the material, appreciable yield is obtained, thereby not only affording comfort to the user but preventing the build up of high stress concentrations.

The torsional sections 30 taper into and become the arm rests 28. These are of shallow, inverted U-shape with a depending rim 90 on one side and a depending rim 91 on the other side (FIG. 8). The outer rim 90 is a continuation of the top flange 87 and the inner rim 91 is a continuation of the vertical flange 88. The inner and outer rims merge at the end of the arm rest. This particular shape affords both high tensile and compression strength and high resistance to buckling. The generally flat area between the rims 90 and 91 provides a large area for bonding to the pads 21 of the arm portions 18 of the seat. The layer of adhesive forming this bond is identified at 29 (FIG. 2).

The chair has a chair leg support means 34 (FIG. 2). A spider bracket 35 has attached at the end of each spider a resilient mount 36 (see U.S. Patent No. 2,649,136—Eames). The resilient mounts 36 are located at the ends of the arms of the spider bracket 35 and are bonded to the lower surface of the seat member 12 by a layer of adhesive 31. Attached to bracket 35 are leg supports 38.

FIGS. 10, 11 and 12 illustrate a slightly different embodiment of this invention. It will be observed that these drawings display a chair 40 having a molded resin, shell type seat member 42 identical to the seat portion 12 of the chair illustrated in FIGS. 1 through 6.

The chair 40 of FIGS. 10-13 is provided with a back rest member assembly 56 having a back shell 57 of molded resin, shell type construction. The construction of the back shell 57 is very similar to the central section of the back 26. It has a more pronounced upper rim or flange 95 than lower rim 96. This produces the same general results as have been explained as occurring in the case of the back 26. Since the back shell 57 is generally oval or oblong in shape, the rim extends around its entire periphery creating a unified structure.

The back shell 57 is supported on each side by a rod assembly consisting of a rod member 59 (FIG. 12) curving outwardly and forwardly from the back shell 57. Each of the rod members has a terminal fitting 60 on its rear end situated behind the back shell 57 and spaced appreciably inwardly from the side margin of the shell. The terminal fittings 60 are firmly secured to the rods against torsional or axial movement with respect to the rods.

The terminal fittings 60 each have an upwardly and downwardly projecting finger terminating in a ball-headed prong 61 extending toward the back shell (FIG. 13). Each of these prongs is received in the socket 62 of a resilient cup-like mount 63. The mounts 63 are in turn bonded to the back face of the back shell 57. The construction of this amount is such that its walls will flex under a predetermined load to release the ball prong 61 thus preventing unusual or excessive loads applied to the back shell from building up to a magnitude capable of either rupturing the back shell 57, bending the rod members 59 or causing damage at the joint between the rods and the arm portions 18.

It will be noted that the mounts 63 for each of the terminal fittings 60 are vertically spaced and the lower ones are located somewhat further inwardly than the upper ones.

Each rod 59 is connected to the under side of the corresponding pads 21 of the side portions 18 of the seat member by means of a rigid block 74 (FIG. 12). The blocks 74 cover substantially all of the surface of said under side and are contoured to wrap downwardly over a portion of the vertical face of the arm portions. A layer of adhesive 76 bonds each of the blocks 74 to the under side of pad 21 and arm section 18. The blocks 74 each have means for securing fasteners 75 such as threaded openings. Alternately, fasteners may be embedded in them for securing the rod 59. At least two spaced fasteners are used for each rod. It will be observed that the rod assemblies are the sole means of support for the curved, back rest portion 57.

As in the case of the preceding embodiment, the chair 40 is supported by a base 34 secured to the seat portion by a spider bracket 35. The base 34, spider bracket 35 and the means of attachment to the under side of the seat section are identical to that described in connection with FIGS. 1 and 2.

Conventional materials of construction may be used in both of the described embodiments of this invention. Thus, the seat members 12 and 42 and the back rest members 26 and 57 may be formed from fiber reinforced, synthetic resins which may be molded under heat and pressure to the desired shape. Preferably, the peripheral edges of the seat member and the peripheral edges of the back rest members are additionally reinforced to prevent splitting and to provide structural strength under load conditions. The resins most conventionally used are polyesters containing desired pigments. Fiber glass is commonly used as the reinforcing material. Acrylic resins are also useful. The shell material may also be molded of plywood. Although this latter is both expensive and is less desirable from the standpoint of its weight to strength ratio, this invention should not be considered as limited to molded resin materials. In general it is preferred that the material form-

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ing the shell should be relatively light, should have high flexural stiffness, should have high tensile and compression strength so as not to be readily subject to damage or breakage. It should have high impact and surface abrasion resistance and should not be affected by changes in humidity. It should be vermin proof and capable of being readily cleaned with the usual cleaning agents and water or a damp cloth. All portions of the shell should preferably be constructed to withstand at least 200-300 pounds of compressive loading.

The adhesive used in both embodiments between the horizontal extensions of said back rest member and said horizontal sections of said side portions of the seat member may be a conventional epoxy resin type adhesive. The adhesive between the mounts 63 and back shell 57 may also be of the same type.

The materials used in the chair leg support means 34 and the support rod assemblies of the second described embodiment are conventional. The shock cups are of rubber. The spider brackets are normally metallic. The chair legs and rods 59 may be fabricated from tubular metal and the like. The rigid block 74 may be a rubber covered metal plate with drilled or punched bolt holes therein.

As constructed, the chair in both embodiments has the characteristic of functioning as a structural spring. When a person sits in chair 10, for example, and leans back into the back rest member 26, the load imposed on the chair members is distributed over both the seat member and the back rest member. More particularly, however, as the person leans back into the chair 10, the forces thus produced on the back rest member 26 are discharged through the torsional sections 30 to the side portions 18 of said seat member 12. Because of the rigid connection between said arm rest portions of the back member and the side portions of the seat, the forces are distributed to the side portions. The visual effect, accordingly, is that the side portion tends to flex backwardly, while the front portion 22 of the seat member 12 tends to flex downwardly. This is illustrated by the broken outline and arrow in FIG. 3. A similar effect occurs with respect to the embodiment of FIGS. 10-13 and is illustrated by the broken outline and arrow in FIG. 11.

The chairs 10 and 40 are each responsive to the various forces of a person sitting in them which tend to make the sitter uncomfortable if not absorbed by the chair. It is important that the construction of the chair is such as to permit limited flexure for contour adaption to make the user comfortable. At the same time the arrangement of the reinforcement structure is such as to create no unyielding or rigid areas resulting in areas of concentrated bearing against the user's body. The arrangement of the structure for intercooperation between each of its various sections and areas is such as to produce a unified response to loadings throughout the entire chair. This materially increases the chair's strength by elimination of stress concentration. At the same time, both constructions for the chair give adequate and healthful support to the load bearing portions of the sitter's body and tend to promote good sitting posture.

While the embodiment of FIGS. 10-13 is based upon the same concept as the embodiment of FIGS. 1-9, it nevertheless has a disadvantage over the embodiment of FIGS. 10-13 in that structural parts of materials having different yield and bearing characteristics are required. In other words, the embodiment of FIGS. 1-9 has an advantage over the latter embodiment in that the back rest member and its means of attachment are a single integral unit.

As this invention may be embodied in several forms without departing from the spirit or essential characteristics thereof, the embodiments just described are therefore illustrative and not restrictive, since the scope of the invention is defined by the appended claims rather than

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by the description preceding them, and all changes that fall within the metes and bounds of the claims, or that form their functional as well as conjointly cooperative equivalents, are, therefore, intended to be embraced by those claims.

We claim:

1. A chair comprising: a single piece, molded resin, flexible shell type seat member; said seat member being of generally U-shape in transverse direction, the sides thereof being the arm portions of said seat member; the upper ends of said arm portions extending outwardly and generally horizontally; an initially separate, integral, molded resin, flexible back member; a narrow torsional portion extending between and connecting the sides of said back member and said upper ends of said arm portions of said seat member; said torsional portion having an area substantially narrowed with respect to both said arm portions and said back member, said narrowed area being substantially spaced from both the top and bottom margins of said back and permitting said back member limited rotational movement by torsional twisting of said narrowed portion about a horizontal axis located generally midway between the top and bottom of said back member and simultaneously drawing said arm portions of said seat member toward each other when loads are applied to said seat member and said back member; and leg means for supporting said seat member and said back member.

2. A chair as defined in claim 1, wherein said torsional portions are integral with said sides of said back member and rigidly connected to the upper surface of said upper ends of said arm portions of said seat member.

3. A chair as defined in claim 1 wherein said torsional portions are integral with the sides of said back member and are bonded to the upper surface of said upper ends of said arm portions of said seat member and at said narrow area are generally L-shaped in cross section each having a generally horizontally extending leg and a generally vertically extending leg, said legs being movable toward and away from each other under torsional loading to effect and control said rotational movement of said back member.

4. A chair as defined in claim 1 wherein said torsional portions are integral with the sides of said back member and are bonded to the upper surface of said upper ends of said arm portions of said seat member and at said narrow area said torsional portions in cross section having walls diverging from each other at an angle, said walls being movable toward and away from each other under torsional loading to effect and control said rotational movement of said back member.

5. A chair as defined in claim 1, wherein said torsional portions include a pair of horizontally disposed rods; means attaching said rods to the back of said back member, said rods extending from the sides thereof; and means for attaching said rods to the underside of said upper ends of said arm portions of said seat member.

6. A chair as defined in claim 1, wherein said seat member has a rear portion, a front portion and a middle portion; said middle portion disposed at a slight angle of inclination from the rear to the front thereof; said front portion gradually curving outwardly and downwardly from said middle portion; said rear portion curving upwardly and backwardly from said middle portion; the distance from the front to the back of said arm portions being substantially less than the distance from said front portion to said rear portion.

7. A chair as defined in claim 1, wherein said back member has a vertically expanded central portion; said central portion having upper and lower rearwardly extending flanges; said torsional portions having arm rests integral with one end thereof and their other ends integral with said central portion; said torsional portions intermediate said ends having a generally horizontal flange

and a generally vertical flange to form a torsionally deflectable connection.

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