United States Patent

Bereday

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[45] **July 11, 1972**

[54] SEAT CONSTRUCTION

[72] Inventor: **Sigmund Bereday,** 11 Suchville, Bayamon, P.R. 00619

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[21] Appl. No.: **10,257**

[52] **U.S. Cl.** **297/452,** 297/456, 297/458, 5/345

[51] **Int. Cl.** **A47c 7/20,** B60n 1/00

[58] **Field of Search** 5/345, 353.1–353.5; 297/218, 219, 232, 445, 452, 454–459

[56] **References Cited**

UNITED STATES PATENTS

1,752,368	4/1930	Brunn	297/378 X
2,824,602	2/1958	Collins et al.	297/456 UX
2,949,956	8/1960	Harris	267/81
3,070,402	12/1962	Stanton	297/421
3,083,496	4/1963	Feinerman	297/455 X
3,101,218	8/1963	Baermaun	297/455
3,102,755	9/1963	Wilfert	297/229
3,266,066	8/1966	Bereday	297/452 X
3,291,530	12/1966	Harrison	297/456 X
3,233,253	2/1966	Cauvin	297/218 X
3,363,949	1/1968	Getz et al.	297/452

FOREIGN PATENTS OR APPLICATIONS

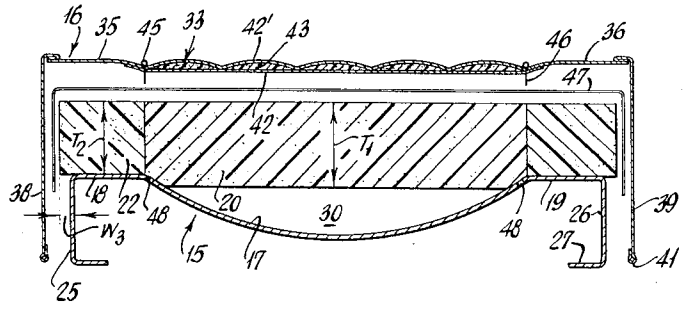
1,018,951	2/1966	Great Britain	297/458

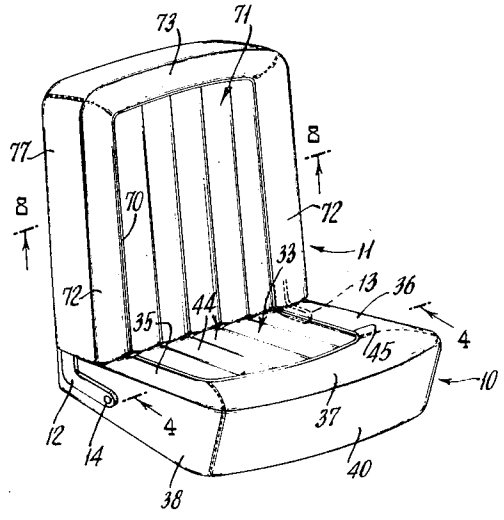
Primary Examiner—Carmir A. Nunberg
Attorney—Sandoe, Hopgood & Calimafde

[57] **ABSTRACT**

The invention contemplates a seat comprising rigid structure and yieldable padding beneath a desired upholstery covering. The frame is of stamped sheet material or of plastic laminate and defines an elongated concavity between spaced elongated shoulders. The padding may be molded foamed material, but important economies are realized by using slabbed stock of uniform thickness; different seat and back-support objectives are achieved by selection of slab thickness and/or slab density for each of several slab parts forming the padding of any particular seat element. The upholstery compressionally loads foamed material against the concavity in such manner that a body load on the seat is sustained primarily by the foamed material in its progressive reaction to the centering support afforded by convergent locales of the concavity.

20 Claims, 21 Drawing Figures





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SHEET 1 OF 5

Fig. 1.

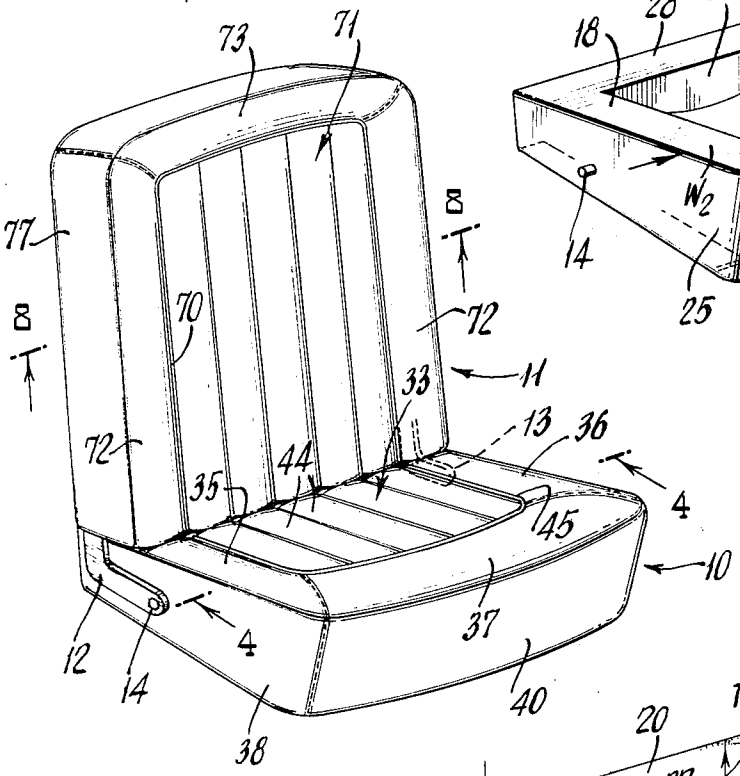


Fig. 2.

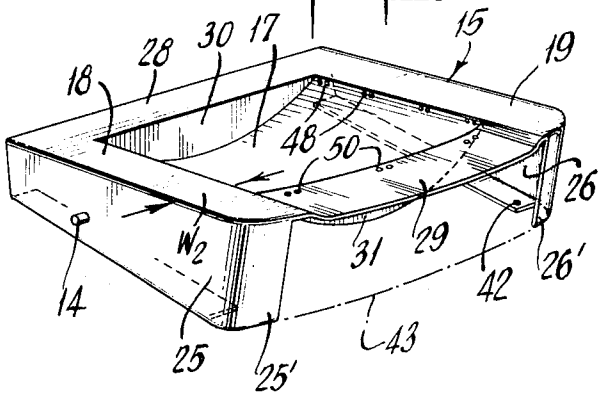
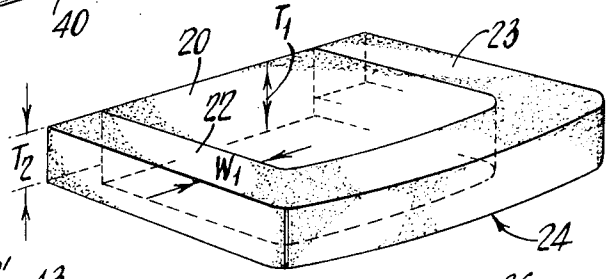


Fig. 3.



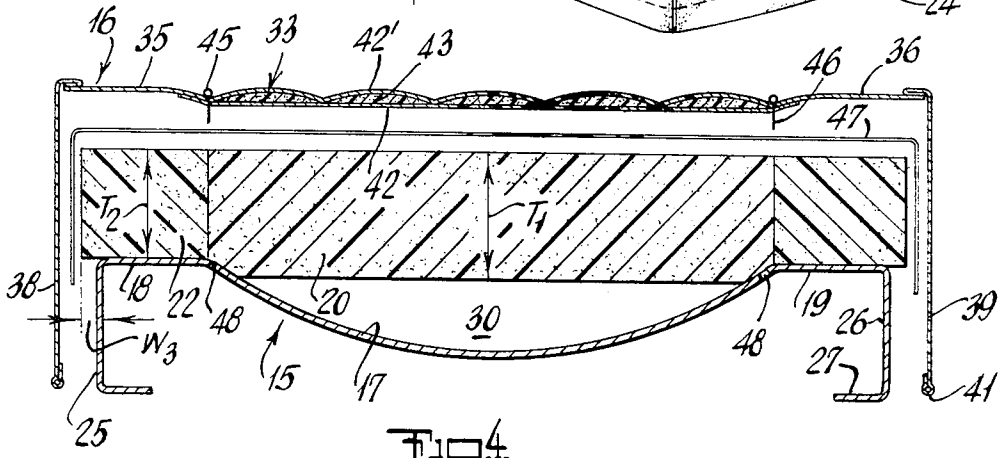


Fig. 4.

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Fig. 4A.

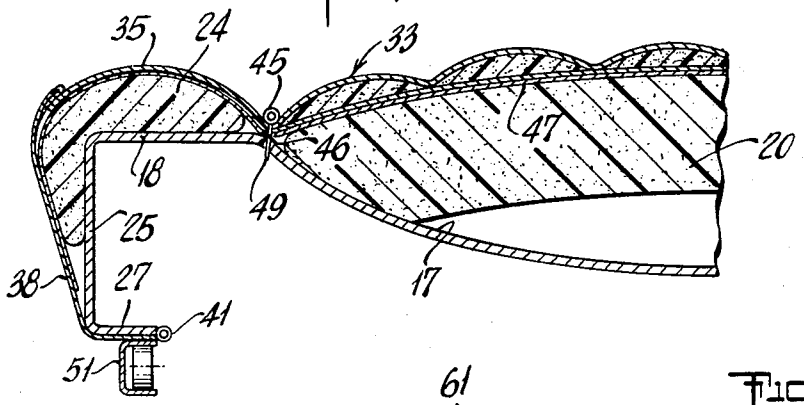


Fig. 5.

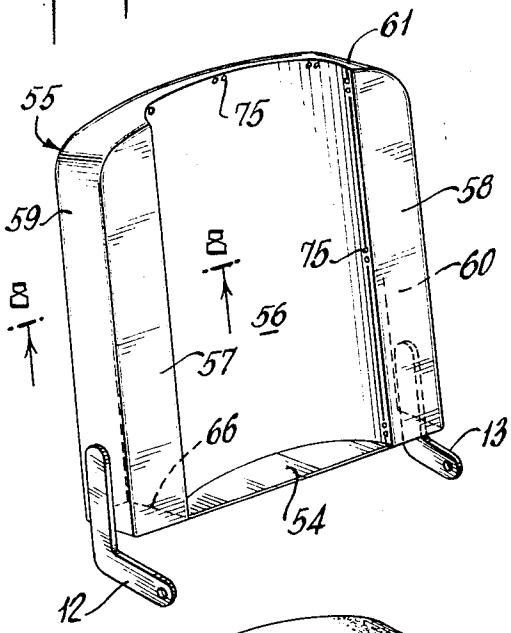


Fig. 6.

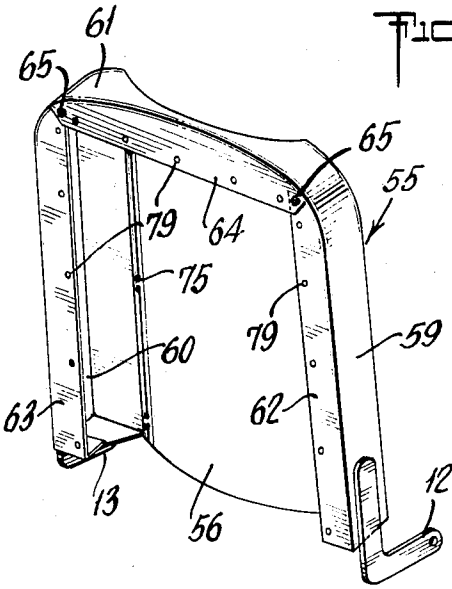
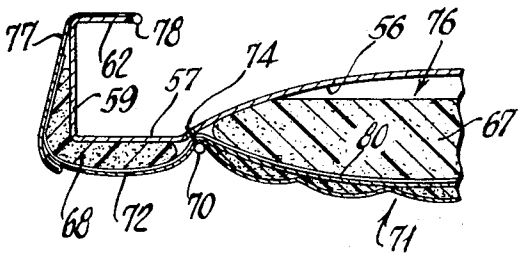


Fig. 8.



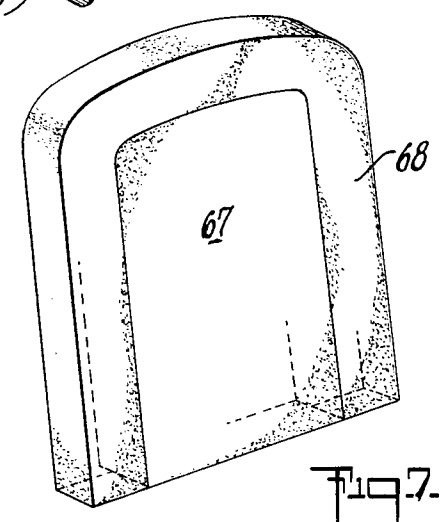


Fig. 7.

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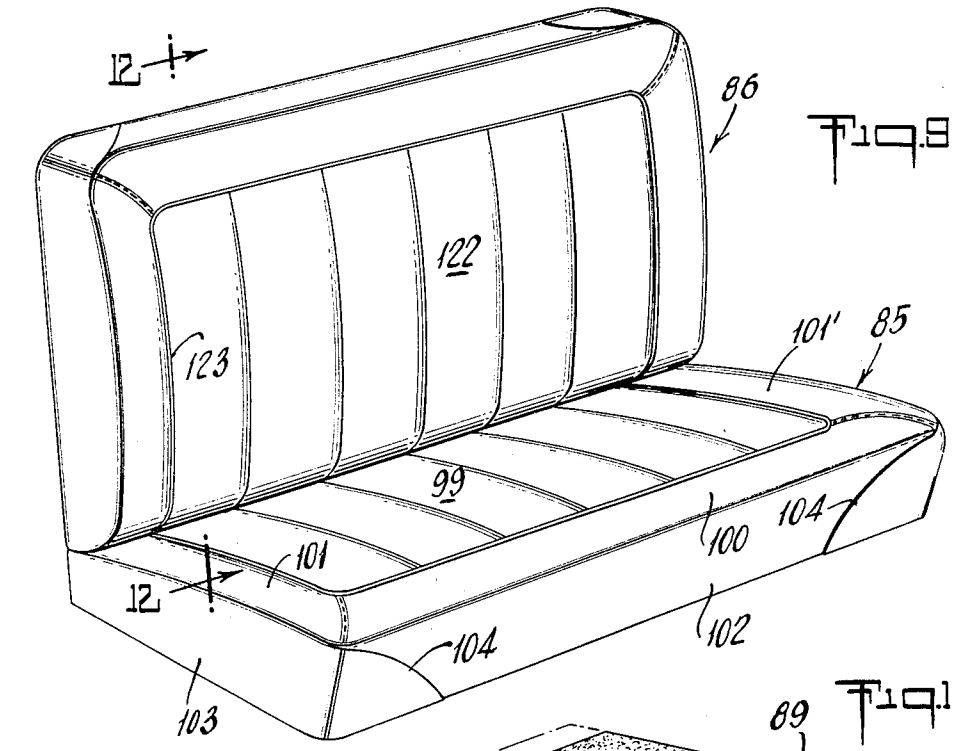


Fig. 9.

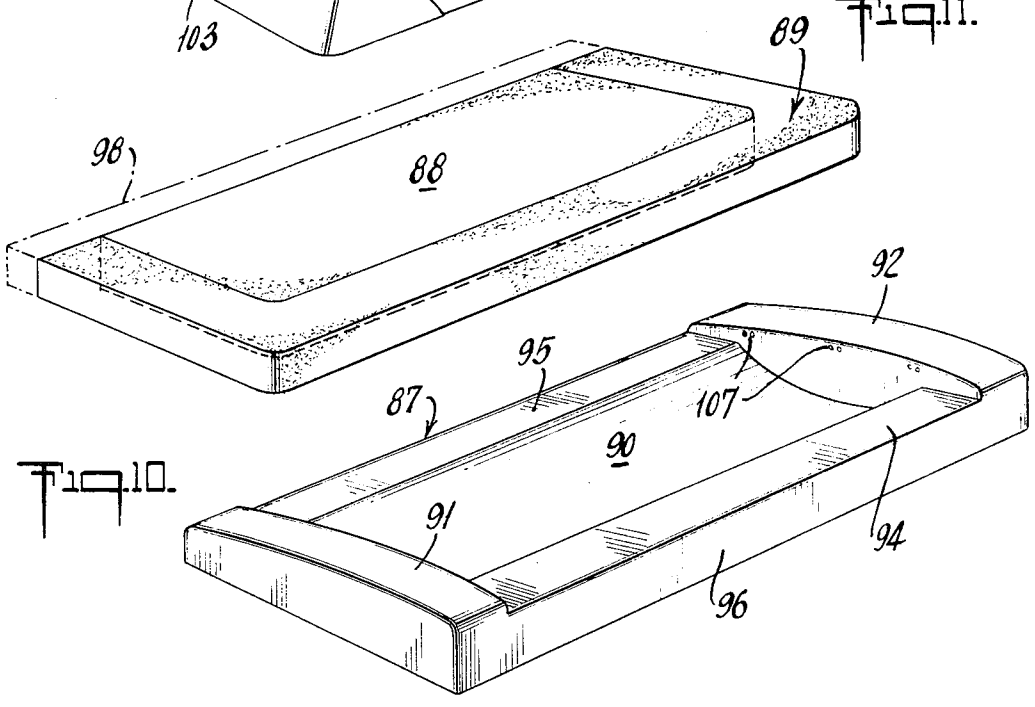


Fig. 11.

Fig. 10.

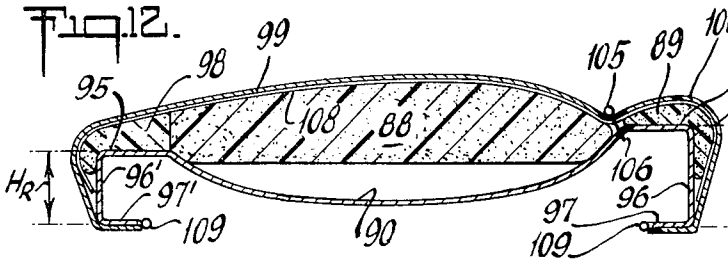


Fig. 12.

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Fig. 13.

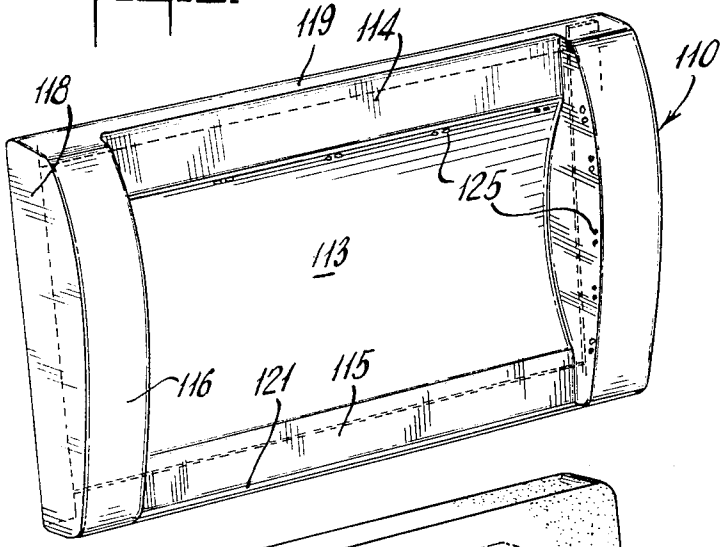
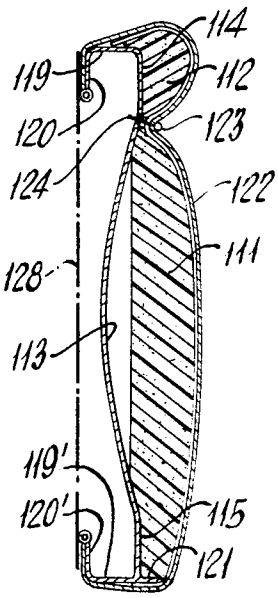


Fig. 15.



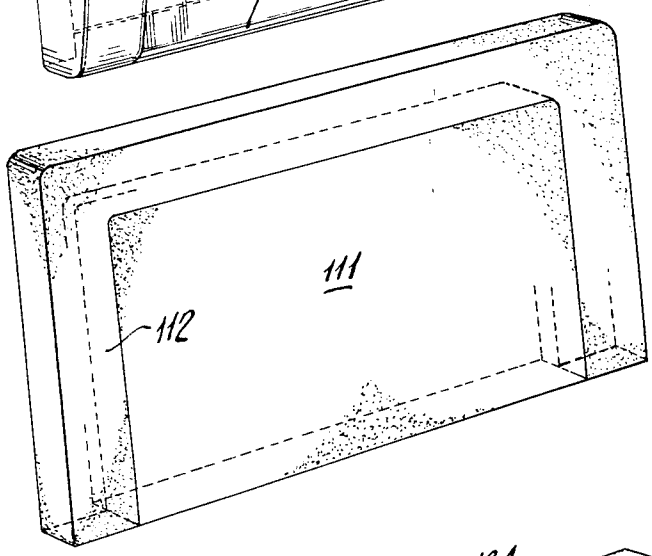
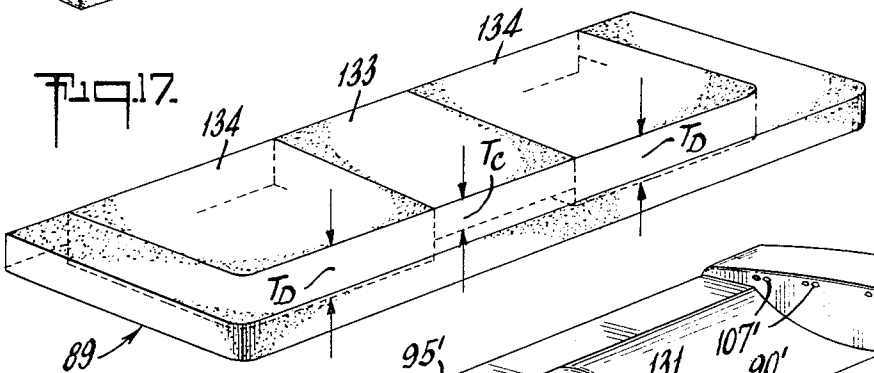


Fig. 14.

Fig. 17.



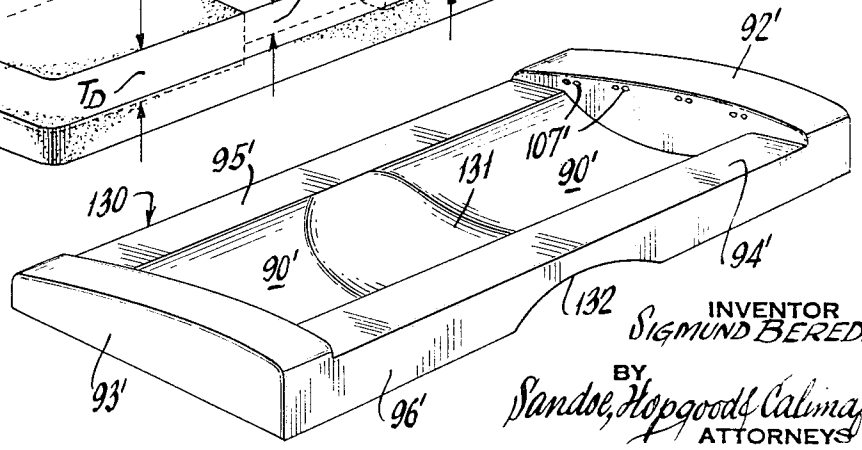


Fig. 16.

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Fig. 18.

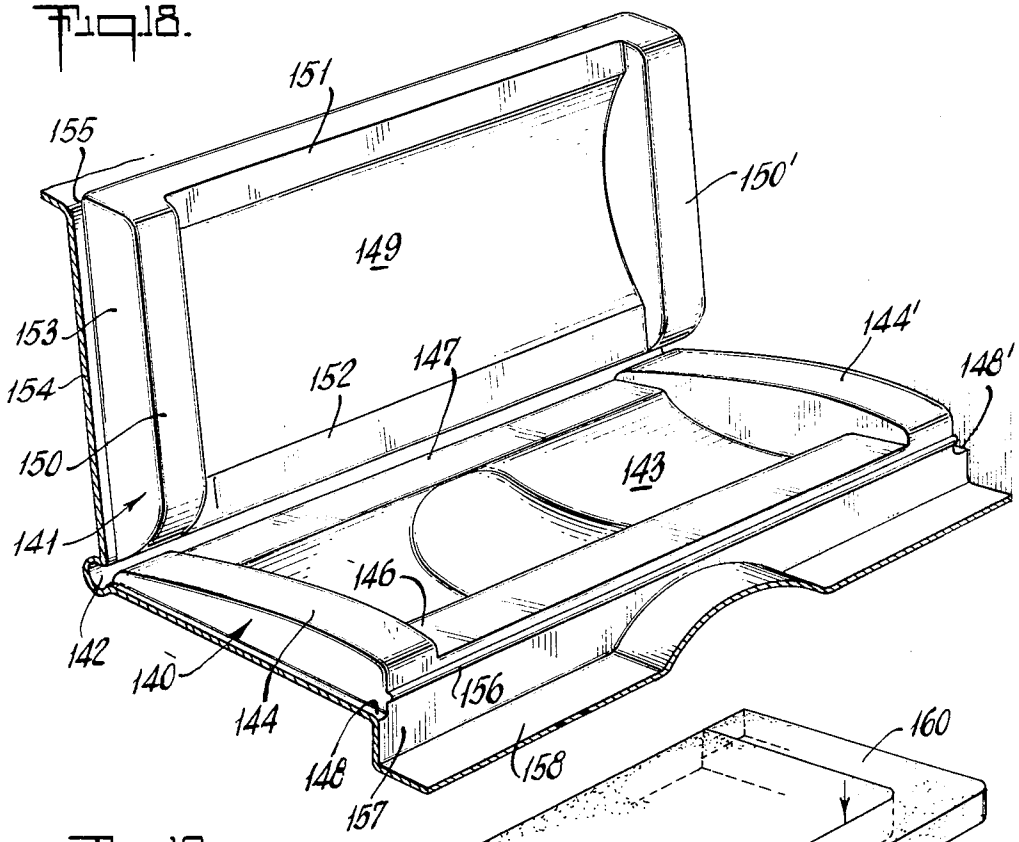


Fig. 19.

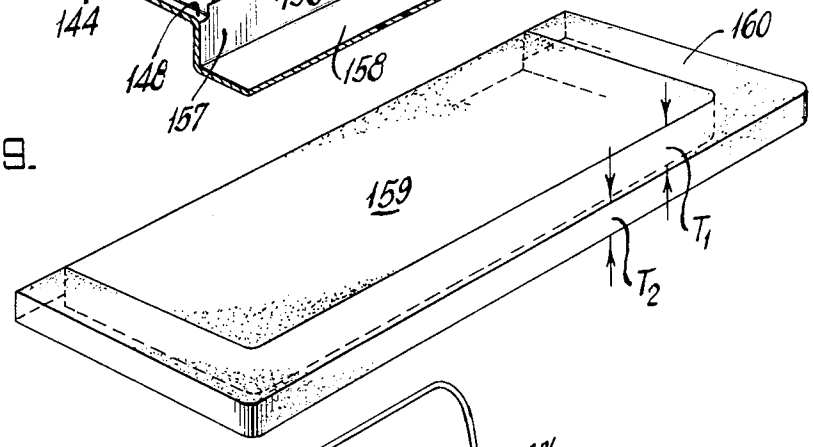
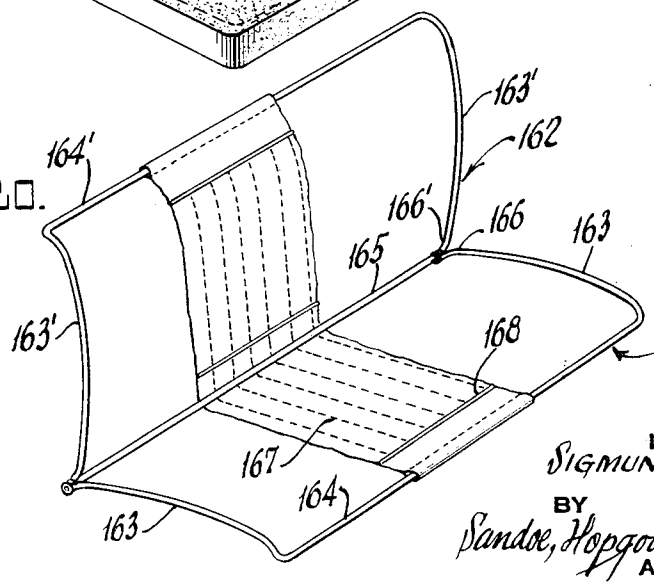


Fig. 20.



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SEAT CONSTRUCTION

The invention relates to seat constructions utilizing resilient padding, such as foamed plastic material, between an outer upholstery covering and a supporting frame. The invention is applicable to vehicle-seat constructions and to seats, cushioning pads, rests and the like, for vehicular or other purposes; the invention will, however, be described in the particular context of automobile seats.

Conventional construction of automobile seats involves a steel frame which importantly includes a network of compliant members or springs, upon which the padding is carried, and upholstery covers the padding and the sides of the frame so as to hide the springwork. In other words, reliance is placed on the yieldability of springs to obtain a comfortable isolation of one's body from the road shocks to which the seat frame is subjected. Of course, the padding serves a function of adapting the spring action to the contour of the body of the person using the seat.

While the art of making such seats has advanced to the point where the person senses comfort and good support, the fact remains that the cost of such a seat reflects the use of many individual parts in the frame and its spring, not to mention the cost of performing the padding to a prescribed contour distribution, and anchoring the upholstery to many individual parts of the frame. Furthermore, if foamed plastic has been used for the padding, this has had to be specially molded for each variety of seat.

It is an object of the invention to provide an improved seat of the character indicated.

Another object is to provide an improved seat of the character indicated and involving substantial reduction in the number of parts.

A further object is to provide an improved seat construction in which the seat frame does not require springs.

It is also an object to provide an improved seat construction having substantially greater inherent resistance to "bottoming out", when taking unusual bumps.

It is a general object to meet the above objects with a construction that is basically simpler and less costly to produce and yet inherently provides superior seating, with enhanced comfort and safety features.

Other objects and various further features of novelty and invention will be pointed out or will occur to those skilled in the art from a reading of the following specification in conjunction with the accompanying drawings. In said drawings, which show, for illustrative purposes only, preferred forms of the invention:

FIG. **1** is a perspective view of an automobile bucket seat, with an upholstered back-cushion element articulated to seat-cushion element, both elements being constructed according to the invention;

FIG. **2** is a perspective view of a rigid seat-cushion frame, forming part of the construction of FIG. **1**;

FIG. **3** is a perspective view of resilient padding, used in the seat-cushion construction of FIG. **1**;

FIG. **4** is a sectional view, taken in the plane **4—4** of FIG. **1**, with certain parts separated to illustrate their relationship prior to compression by the upholstery;

FIGS. **4A** is an enlarged fragmentary sectional view in the plane **4—4** to show the parts in assembled relation;

FIGS. **5** and **6** are respectively front and rear perspective views of the back frame in the construction of FIG. **1**;

FIG. **7** is a perspective view of resilient padding, used in the seat-back element of FIG. **1**;

FIG. **8** is an enlarged fragmentary sectional view similar to FIG. **4A**, but illustrating the seat-back parts in assembled relation;

FIG. **9** is a perspective view similar to FIG. **1**, to illustrate an automobile bench seat incorporating features of the invention;

FIGS. **10** and **11** are, respectively, perspective views of the frame and padding used in the construction of the seat-cushion element of FIG. **9**;

FIG. **12** is an enlarged sectional view of the seat-cushion element at the transverse vertical plane **12—12** of FIG. **9**;

FIGS. **13** and **14** are, respectively, perspective views of the frame and padding used in the construction of the back-cushion element of FIG. **9**;

FIG. **15** is an enlarged sectional view of the back-cushion element at the transverse vertical plane **12—12** of FIG. **9**;

FIGS. **16** and **17** are, respectively, perspective views of the frame and padding used in construction of the seat-cushion element of a modified bench seat; and

FIGS. **18**, **19** and **20** are, respectively, perspective views of structural parts for another bench-seat construction of the invention.

Briefly stated, the invention contemplates a seat comprising rigid structure and yieldable padding beneath a desired upholstery covering. The frame is of stamped sheet material or of plastic laminate and defines an elongated concavity between spaced elongated shoulders. The padding may be molded foamed material, but important economies are realized by using slabbed stock of uniform thickness; different seat and back-support objectives are achieved by selection of slab thickness and/or slab density for each of several slab parts forming the padding of any particular seat element. The upholstery compressionally loads foamed material against the concavity in such manner that a body load on the seat is sustained primarily by the foamed material in its progressive reaction to the centering support afforded by convergent locales of the concavity.

Referring to FIGS. **1** to **8** of the drawings, the invention is shown in application to an automobile bucket-seat comprising a seat-cushion element **10** and a back-cushion element **11**. The back element **11** includes spaced offset brackets or arms **12–13** which allow the back element to pivot on studs or pins **14** carried by the seat element **10**. In the raised position of FIG. **1**, it will be understood that suitable coacting abutments, at the rear of seat element **10** and at the bottom of the back element **11**, determine and retain the desired normal erection of the back element **11**.

Basically, the seat-cushion element **10** comprises a relatively rigid frame **15** (FIG. **2**), resilient padding (FIG. **3**) carried by frame **15**, and covering such as pliant upholstery **16** compressing the padding in assembled relation to the frame. The frame is characterized by a dished concavity **17**, which may be cylindrically arcuate, extending between spaced elongated shoulders **18–19**; the span between shoulders **18–19** is preferably **12** to **20** inches, being desirably slightly in excess of the span between those parts of the buttocks that are relied upon to sustain the major body-support load of a seated person of ample proportions. The padding relied upon for primary support of the seated person comprises a single block or slab **20**, having a planform sized to substantially match that of the concavity **17**. Further padding **22–23** is shown adjacent the slab **20** and overstanding the shoulders **18–19**; preferably, the padding **22–23** constitutes opposite arms of a single U-shaped slab **24**, wrapped continuously around the lateral sides and front of the slab **20**, as shown in FIG. **3**.

The described concavity **17** may be a single sheet secured to spaced bars which define shoulders **18–19**, but in the form shown the seat frame **15** is a single unit-handling element, of molded plastic laminate or of formed sheet metal. The shoulders **18–19** are the upper edges of side walls **25–26**, for which the bottom edge (as at **27**, for wall **26**) is inwardly flanged or otherwise suitably formed for attachment to conventional seat-adjusting slide-track or other mechanism. Structural integrity of the seat frame **15** is enhanced by back and front rim or flanged formations **28–29**, contiguous to the shoulders **18–19**. The rear flange **28** is shown in the plane of shoulders **18–19** and may serve as an abutment reference, for the elevated position of the seat-cushion element **11**, as will be understood; the front flange **29** is shown depressed below the plane of shoulders **18–19** to provide more comfortable support of the legs of the occupant. Flanges **28–29** define the upper edges of walls **30–31** which form the longitudinal limits of the concavity **17**.

It will be appreciated that for purposes of clearly identifying specific elements of the seat frame **15**, resort has been made to

the terms "wall", "shoulder", "flange", etc. in the context of generally flat, angularly related surfaces. In practice, however, it is preferred to employ more rounded junctures between contiguous surfaces, to the end that no annoying edges will project their contour through the padding and to the seated person. Such rounded formation is shown, for example, at 25'–26a⅔ for the forward ends of walls 25–26.

The padding 20 may be of molded foamed rubber or plastic, such as foamed polyurethane, in which case its upper surface may be characterized by ribbing consistent with the tufted pattern shown in FIG. 1 at the central region of seat-cushion element 10. However, I prefer to use a simple cut from slab stock, i.e., an elongated slab of uniform thickness T_1 from which the planform of slab 20 is cut. When cut, slab 20 bears directly upon and nests substantially at or within outer limits of the concave surface 17, with its bottom side edges slightly locally compressed by spaced opposite slopes of surface 17. The outer padding 24 may also be cut from slab stock, as a straight piece which is bent around slab 20 to define the horseshoe shape of FIG. 3; the thickness T_2 of slab 24 may be less than that of slab 20, so that slabs 20–24 may combine to present a substantially smooth upper surface, in their unstressed condition prior to assembly. Generally, the density of foamed material at 20 will have to be appropriate to the thickness T_1, to the span of the concave surface 17, and to the comfort preference of the user; however, it can be stated that the stiffness and density of slab 20 preferably exceed that of slab 24. In any case, a substantial pocket volume or space is deliberately left between slab 20 and almost all the area of the concave surface 17. As will later be made clear, the remaining area of surface 17 is relied upon to progressively sustain increments of seating load, with such efficacy that the seated person never "bottoms out" to the surface 17, even for the roughest ride. Also, generally speaking, the unstressed thickness T_1 of the slab 20 is in the range of one-half to one-fifth the width which spans the arced concavity 17; for example, for a foamed latex slab 20 of the density used as padded covering over seat springs of conventional construction, a thickness T_1 of 5 inches has been satisfactory for a span width of 14 inches.

The upholstery 16 may be of essentially conventional construction and configuration, being a single subassembly in readiness for assembly of the combination of FIG. 4. It is shown to include an inner panel 33, joined at a welt 34 to a top perimeter of side panels 35–36 and a front panel 37, the latter in turn being continuously seamed to corresponding side-wall panels 38–39–40. The depending edges of the latter panels are welted, preferably with stiff wire-reinforced welting 41, so that hog-ring techniques may be employed to secure the welted edges 41 at openings 42 formed at suitably spaced intervals along bottom flanges, such as the flange 27. It will be understood that frame 15 may include a front wall, suggested at 43 in FIG. 2, with a bottom flange of the nature of flange 27, to provide anchorage for the welted bottom edge of the front wall panel 40.

As shown, the center panel 33 is preformed with tufting, as may be desired for appearance effects. Such tufting is produced by constructing panel 33 of a sandwich of three layers, namely, an inner flexible sheet 42, an outer flexible sheet 42', and an intermediate layer 43 of soft foamed material; tufts or ribs 44 result from the pattern of stitching of these three layers, and in the form shown the pattern is one of longitudinally extending stitch alignments, in laterally spaced array, to produce the five ribs 44 shown. The outer margin of center panel 33 is preferably defined by a single U-shaped welt 45, extending continuously along adjacent edges of the top perimeter panels 35–36–37. Welt 45 may also be reinforced, as with a tempered steel rod, and welt-tensioning anchoring means 46 extends inwardly (downwardly) at suitable spacings along the length of welt 45.

To enable a pleasing fit of the described parts, upon assembly, the unstressed width W_1 of slab 24 preferably exceeds the effective width W_2 of shoulders or flanges 18–19–29, so that there remains an extent W_3 by which the unstressed composite slab means 20–24 extends or projects beyond the vertical walls 25–26–43 of the frame. Also, preferably, a slippery interface is provided between the upholstery 16 and the padding 20–24. Such an interface may be achieved by choice of material or treatment for the inner surface of the upholstery, or for the upper surface of the slab stock from which padding 20–24 is cut, but in the form shown a separate interlayer 47 is indicated, being inexpensive and completely adequate. The interlayer may be any of a variety of sufficiently tough, flexible, and lubricious materials, ranging from certain plastic films to silken fabrics; and I have found polyethylene film of 2-mil thickness to be most satisfactory.

To assemble the seat-cushion element 10, the slab 24 is wrapped around the side and front edges of slab 20 as shown in FIG. 3, being temporarily held in this relation by means of pressure-sensitive adhesive tape. The thus-combined slab 20–24 is then placed on frame 15, with the downwardly projecting part of slab 20 nested in cavity 17, as shown in FIG. 4. Thus nested, the outer edges of slab 24 will substantially uniformly project by the margin W_3 beyond outer edges or walls 25–26–43. The slippery interlayer 47 is placed over the slabs 20–24 and allowed to drape into overlap with the upright walls 25–26–43. Next, suitable tooling compressionally depresses the welt 45 toward frame 15, causing welt-tensioning anchor means 46 to locally pierce the slippery interlayer 47 in local registration with spaced pairs of hog-ring holes 48 (FIG. 2) formed in the concavity 17, near shoulders 18–19; in FIG. 4A, a hog ring 49 is shown holding the tensioning means 46 in this compressed relation. When all hog rings have been thus secured at their corresponding welt-tensioning connections 46, welt-compression may be relieved and the tensioning connections 46 will hold the upholstery in compressionally preloaded relation with the slab 20. It will be understood that hog-ring holes 48 may alternatively be provided in shoulders 18–19 near juncture with the concave surface 17, in the manner shown for the hog-ring holes 50 along the front flange 29. Thus compressionally preloaded, the lower lateral edges of slab 20 have been forced into greater areas of supporting contact with the concave surface 17, but a substantial space or volume remains beneath slab 20 and most of the area of surface 17, as shown in FIG. 4A. Finally, the welted edge 41 of the outer skirt of the upholstery is tightly drawn around the sides and bottom flanges 27 of frame 15, being there secured by further hog-ring means (not shown) or by clamped placement of a plate or rail; in FIG. 4A, the channel 51 of a roller-track assembly is shown as the clamping means for the welted edge 41, along the bottom flange 27 of side wall 25.

It will be understood that in the course of stretching the side panels or skirt of the upholstery, the softer slab 24 is resiliently deformed around the frame 15 into substantial, downwardly extending overlap with the side walls 25–26–43, to produce a soft and pleasing rounded contour for the resulting upholstered product. The compression of slab 24 may be to a lesser extent, in registry with the forward or depressed flange 29, so that a soft action may characterize support for the underside of one's legs in the knee region, while at the same time an appearance is presented that the top-perimeter panels 35–36–37 are all in substantially the same plane.

In use, a body will derive a feeling of comfortable seat support by reason of the symmetrically distributed progressive sharing of the load, at laterally spaced locales. Symmetry of support follows from the spaced footings of slab 20 along its bottom lateral edges, in conjunction with the contour of concave surface 17, shown to be generally cylindrically arcuate about an axis that is aligned in the direction of vehicle movement. As the static body load is assumed, the spaced locales of slab support widen, symmetrically converging toward the central axis, but a substantial central region remains in which to absorb the added transient loads occasioned by rough riding of the vehicle. Regardless of the static or dynamic load condition, the fact remains that the body load is sustained primarily at laterally spaced locations. This produces the security and comfort that flow from wide-based support which inherently

hugs and "centers" the body-seating region, and by selecting the material of slab **20** with sufficient density and stiffness there will never be occasion for the occupant's spine to take a shock load ("bottoming out") that is not well cushioned by the most unloaded region of the slab **20**. The feeling of comfort is further enhanced by action of the slippery interlayer **47**, which so reduces friction that dynamic support of the body is substantially entirely the result of the non-linear reaction of slab **20** to the curved surface of support at **17**, unfettered by hysteresis effects which might otherwise result from the natural sliding friction of direct contact between upholstery **16** and slab **20**. The expression "non-linear" is believed to be appropriate to describe the nature of this slab reaction to progressive loading, in that the normally linear character of load absorption by slab **20** against a flat plate is modified by the circumstance of a curved or concaved support surface **17** with its progressively larger distribution of slab support, for increased load, and by the fact that the incrementally added area of frame support for the slab is always the least loaded region of slab **20**.

FIGS. **5** to **8** illustrate application of substantially the same structural features to the construction of the back-cushion element **11** of FIG. **1**, an important difference of course residing in the fact that load normal to the upstanding plane of back support is small compared to that taken by the seat-cushion element **10**. FIGS. **5** and **6** show a back frame **55** much like the seat frame **15**. Frame **55** is shown as unitary and characterized by an elongated generally arcuate concavity **56**, rising from a closed bottom end wall **54** and between spaced upstanding shoulders or lands **57–58**. Side walls **59–60** and a top end wall **61** define body thickness to receive the full concavity **56** and to position integral overlapping back flanges **62–63–64** along the sides and top end. When formed of sheet metal, the overlapped flanges are preferably secured as by welds **65** to maintain structural integrity and shape, and the hinge arms **12–13** are carried by the side walls **59–60**. In-turned bottom flanges, as at **66**, provide suitable reference for adjustable stop mechanism to abut flange **28** of the seat frame **15** (FIG. **2**), for retaining the desired upright setting of the back-cushion element **11**.

Pre-cut center and outer slabs **67–68** of resilient padding, such as foamed plastic, are again used as the cushioning means, the same being proportioned as previously described, except that the thickness differential need not apply, as between slabs **67–68**. As before, the inner slab **67** is of stiffness and density greater than that of the outer slab **68**, and in the unstressed condition outer slab projects (as at W_3 in FIG. **4**) beyond the side and end walls **59–60–61** of the frame **55**.

The back cushion **11** is assembled as described for the seat cushion **10**. The upholstery **69** matches as to panelling and proportions, and a steel-reinforced welt **70** defines the seam between a center panel **71** and surrounding side and top panels **72–73**. Hog-ring fastenings **74** connect welt **70** to the concavity **56**, at suitably spaced pairs of holes **75**. Compressional preloading at **70–74** forces slab **67** into firmly rooted laterally spaced supporting contact with the concave surface **56**, leaving a central clearance or at least a lightly compressionally loaded central region **76** within which the deflections occasioned by static and dynamic back-loading forces may be accommodated, in the symmetrically distributed and non-linear fashion already described. The hem of the upholstery skirt **77** is again terminated by a reinforced welt **78**, which may be anchored by hog-ring means (not shown) at spaced openings **79**, in back flanges **62–63–64**. In the course of securing the hem welt **78**, the softer padding or slab **68** is body deformed around the frame into substantial overlap with side walls **59–60**, and a slippery interlayer **80** between upholstery and padding enables prompt and uniform assumption of smoothly rounded upholstery contours. To complete the back-cushion construction an upholstered flat or otherwise contoured back panel (not shown) may be applied to close the opening seen in FIG. **6**; this closure panel may be secured, as by self-tapping screws, at spaced openings along flanges **62–63–64** at the overlap of the back-closure panel therewith.

In FIGS. **9** to **15**, the principles of the invention are shown in application to a seat construction in which the elongation axis of the rigid concavity of the frame member extends transverse to the longitudinal axis of the vehicle, as distinguished from FIGS. **1** to **9** wherein the axes of the concavities **17–56** are in a plane substantially parallel to the longitudinal axis of the vehicle. The particular embodiment of FIGS. **9** to **15** is illustrative of a bench seat, for two or more persons. In FIG. **9**, the seat appears to be conventional, employing a seat-cushion element **85** and a back-cushion element **86**, secured to each other in the relation shown.

The seat-cushion **85** is seen to comprise a unitary frame structure **87** (FIG. **10**) on which inner and outer padding elements **88–89** (FIG. **11**) are supported. The frame **87** is characterized by a concavity **90** which extends between spaced shoulders **91–92**, and upstanding side walls **93** define the opposite ends. Front and rear flanges or rims **94–95** are contiguous to the front and back limits of the concavity **90** and are shown depressed below the general level of the adjacent end shoulders **91–92**. Front and back upstanding walls **96–96'** are contiguous to the depressed rims **94–95**, and all walls **93–96–96'** will be understood to be suitably flanged at their bottom edges, as at **97–97'** for the walls **96–96'** (see FIG. **12**). As best seen in FIG. **12**, the height H_F of the forward wall **96** exceeds that (H_R) of the rear wall **96'**, to provide a comfortable slope or pitch for the assembled seat-cushion element **85**. Again, all sharp corners will be understood to be shown only for simplified drawing and for ready identification of surfaces; the preferred junctures of these surfaces is characterized by gently rounded curvatures.

The central padding **88** may again be a single cut from slabbed foamed plastic stock, as may also the outer padding **89**; and the relative thickness, stiffness and density considerations discussed above are also applicable. Thus, the assembly of seat-cushion element **85** involves first assembling the pads **88–89** to the frame **87**, with the greater-thickness projection of pad **88** nested between shoulders **91–92** and deriving bottom-corner edge support from widely spaced convergent locales of the concavity **90**. Provision of a small filler slab **98** of relatively low-density padding is optional, along the back rim **95**. The upholstery is prefabricated, comprising an elongated central panel **99** contiguous to front and side peripheral panels **100–101–101'**; in turn, these peripheral panels are contiguous to upstanding front and side panels **102–103**, shown decoratively lapped and seamed at **104**, for the front-corner finish. A single, continuous, reinforced welt **105** is part of the seam connection of central panel **99** to its adjacent peripheral panels **100–101–101'**, and hog rings **106** applied at pairs of openings **107** in frame **87**, along the alignment of welt **105**, provide tensed anchorage of the welt to the frame, thereby preloading the foamed padding **88–89** in compression. Also as previously described, a slippery interlayer **108** preferably isolates all padding **88–89** from the upholstery, and welt-reinforced hems **109** are fastened at flanges **97–97'** to hold the upholstery under such tension as will deform the low-density pad **89** into substantial overlap with the upstanding side walls of the frame **87**.

In FIGS. **13** and **14**, the back cushion **86** is seen to employ a unitary frame **110** and center and peripheral pad or slab elements **111–112**, respectively. As with frame **87**, the back-cushion frame **110** is characterized by a concavity **113** having an elongated axis of curvature extending transverse to the vehicle axis. The curvature of concavity **113** blends smoothly with upper and lower ledges or rims **114–115**, and the transverse limits of the concavity **113** terminate at upstanding shoulders **116–117**. Contiguous side walls **118–119–119'** are terminated by rear flanges **120–120'**, analogous to the flanges **62–63–64** of FIG. **6**. A bottom ledge **121**, adjacent the lower rim **115** provides vertical positioning support for the foamed pad **111**. The central upholstery panel **122** is seamed at a reinforced welt **123** to the adjacent peripheral panels, matching the pattern of the seat-cushion upholstery, and hog rings **124** anchor the welt **123** at spaced pairs of openings **125**. Again, a slippery interlayer **126** is preferred, between the upholstery

and the slabbed padding **111–112**, and welt-reinforced hems **127–127'** help anchor the tensed upholstery skirt at flanges **120–120'** A back panel **128** may close the back of the structure, as suggested by heavy phantom outline in FIG. **15**, being secured at flanges **120–120'** by means not shown.

It will be seen that the assembled seat-cushion and back-cushion elements **85–86** of FIG. **9** embody much of the technique and structure of FIG. **1**. In particular, the resilient padding **88** (**111**), although preloaded in compression, nevertheless remains spaced from the central region of the adjacent supporting concavity **90** (**113**), and in any event this central region always remains the least-loaded region, thus, in the case of the seat-cushion element **85**, affording greatest protection against damage to a person's spine, even under the most severe riding conditions. It will be understood that the rigid assembly of the back-cushion element **86** to the seat-cushion element may employ conventional techniques such as side angle brackets (not shown) bolted or otherwise fixed to adjacent sides **93–118** of the upholstered elements **85–86**, and/or the bottom wall **119'–121** of frame **110** may be bolted to the adjacent rim or ledge **95** of the seat frame **87**.

FIGS. **16** and **17** respectively illustrate seat-bench frame structure and padding for a seat-cushion element which must accommodate the floor hump or tunnel in the body of vehicles using a longitudinal drive shaft. The unitary frame **130** comprises elements already identified in FIG. **10** and therefore the same numbers are used, with primed notation. Necessarily, the elongated concavity **90** has had to be modified to accommodate the tunnel, as shown at the central region **131** of lesser depression than the remaining deeper concavities **90'**; at the same time, the front upstanding wall **96'** has had its lower edge recessed at **132** to fit in the tunnel region of the car-body floor. As to padding, the central body-supporting region is shown to comprise central slab element **133** of thickness T_c and two like primary support slabs **134** of greater thickness T_e on outer adjacent sides of element **133**. The same peripheral slab **89** may be used around the sides and front of the combined slabs **134–133–134**. As before, the thickness, stiffness and density of slabs **134** exceeds these properties of the peripheral slab **89**; by the same token, and to the extent that slab **133** is of lesser thickness than slabs **134**, the stiffness and density of the center slab **133** should exceed those of slabs **134**. Of course, if the depression at tunnel **131** is of sufficient extent, it is simpler and is preferred to use the single central pad **88** of FIG. **11** on the frame **130**. In either event, upholstery, interlayer and fastening details may be as described for FIGS. **9** to **12**.

In the arrangement of FIGS. **18** to **20**, the rigid frame structure of the seat-cushion element and of the back-cushion element of a bench seat are both integral parts of the car body itself. Thus, the seat-cushion frame member **140** and the back-cushion frame member **141** may be merely specially contoured elements of the floor and rear interior body panel. I prefer that elements **141** be separately formed and subassembled, as by welding along their juncture substantially at the bottom of an elongated trough or channel portion **142**. This preassembly is then assembled into the body shell to form corresponding integral floor and rear panel parts thereof.

As shown, the seat-cushion frame element **140** includes an elongated concavity **143** extending between spaced shoulders **144–144'** and the front and rear curved extremities of the concavity **143** terminate at ledges **146–147**. Upstanding side walls, as at **147**, rise from short flanges **148–148'** to the shoulders **144–144'**. In like manner, the back-frame element **141** comprises a concavity **149** between shoulders **150–150'** and framed by upper and lower ledges **151–152**. For shoulder **150**, the side wall **153** is seen to extend from a rear upstanding and outwardly extending short flange **154** which is continuous with the flange **148**. At its upper edge, the back frame **141** includes a top wall with a short base or flange **155** which is continuous with the flange **154**. The entire preassembly **140–141** may be united with other panel parts to become part of the car body, as by seam welding along flanges **148–154–155**, and along the alignment **156** between the front wall **145** of frame element **140** and an upstanding flange element **157** forming part of the body floor **158**.

FIG. **19** shows padding similar to that of FIG. **11** and usable with the frame of FIG. **18**. In particular, the primary higher-density slab element **159** is sized for nested support between shoulders **144–144'** and spanning concavity **143**, and a similar element **159** of lesser density, stiffness or thickness is similarly nested between shoulders **150–150'**. If necessary, small local application of pressure-sensitive adhesive tape or other holding means may temporarily hold slabs **159** in these positions while further assembly proceeds. Next, the outer slab **160** of lesser density may be applied over shoulder **144**, ledge **146** and shoulder **144'**, being temporarily held in place, for example, by double-faced adhesive tape between these frame members and the bottom surface of slat **160**; a similar slab **160** may be applied over the shoulder **150**, ledge **151**, and shoulder **150'** of the back-frame element **141**.

Next, a single sheet of slippery interlayer (as at **108** in FIG. **12**) is applied over both the seat and back areas of foam, being temporarily held by local adhesive tape.

Finally, a framed upholstery subassembly, as shown in FIG. **20**, is applied to the frame elements **140–141**, and secured over the padding and interlayer, to compressionally preload the same and to complete the entire bench seat.

In FIG. **20**, the upholstery frame comprises two hinged-bar elements **161–162**, which may be duplicates of each other. Bar **161** comprises two spaced arms **163**, intended for accommodation outside the shoulder side walls **147** and adjacent flanges **148–148'**, and joined by a front span **164**; the corresponding parts of bar element **162** are given the same reference numerals, with primed notation, and arms **163'** thereof are intended for accommodation outside the shoulder side walls **153** and adjacent the body-seam flanges **154**. Bar elements **161–162** are hinged and spaced by a center bar **165**, and small local offsets **166–166'** in connected bar ends permit bars **163–163'** to assume their primary alignments in the common vertical plane of flanges **148–154**, alongside their adjacent side walls **147–153**. Upholstery comprises a preassembly of seat-cushion and back-cushion material, shown as panels **167–167'** having sewn connection at the front to bar **164**, passing behind bar **165**, and having sewn connection at the upper end to bar **164'**. It will be understood that for simplicity of drawings, the panels **167–167'** are fragmentary, being shown broken-away at both longitudinal ends, but that their longitudinal ends may have the same kind of sewn connection to and along the arms **163–164'**. It will also be understood that the upholstery **167–167'** will be provided with the predetermined degree of slack to permit correct ultimate assembly over the padding and interlayer and to the frame means **140–141**.

Assembly is accomplished by first applying the upper bar **164'** over the top of the back frame **141** and against the flange **155**, where retaining means can be set, or where the locally recessed or beaded formation of the top wall near flange **155**, may accomplish self-retention of bar **164'** when bar **165** is pressed into the groove or trough **142** between seat and back frame regions. Such pressure causes the foamed padding and interlayer to adapt to compression applied by the tensed upholstery, establishing the desired contour of the seat-back cushion. Next, the forward bar **164** is brought down to compress upholstery panel **167** on the padding and interlayer of the seat cushion, until bar **164** passes the seam or bead **156**. Fastening means (not shown) may anchor bar **164** (to floor flange **157**) in this position, so that bar **165** is forced to stay seated in groove **142**. Thus clamped, bars **164–163** tense the upholstery against the padding and interlayer, and bars **164'–163'** perform the same function for the back cushion, and the desired ultimate contour of both cushions results from the slippery interlayer allowing both panels **167–167'** to come to an equilibrium in the distribution of tension over the entire upholstered area. It will be noted that in achieving the setting of bars **164'**, **165**, **164**, in the manner described, the marginal

slabs **160** of lesser density deform and displace readily, to substantially fillein the space which would otherwise be open at the narrow slots (alongside the side walls **147–153** and above flanges **148-154**) in which the arms **163–163'** are received and held.

It will be understood that the described upholstery **167–167'** lends itself to ready and convenient assembly to the bar frame **161–162** in that these hinged element may be laid flat on a bench, for sewing in place, or for separately threading each of the unassembled bars **161–162** through its part of the hem of the upholstery, in the manner of threading a curtain rod in a curtain; once thus threaded, the rods **161–162** are pinned in their assembly to rod **165**. Further, it will be understood that, for simplicity, the upholstery **167–167'** has not been described in detail but that it may include side-panel material as necessary to properly define front, top and side margins of the completely installed seat and back; such paneling may include welts, reinforced at **168** (as at **45** in FIG. 4A) between central and outer panels and having hog-ring or otherwise anchored reference to the frame members **140–141**.

It will be seen that I have described an improved seat construction featuring economy of parts, materials and assembly operations. At the same time, advantageous features are achieved for the better comfort and safety of the user. In forms wherein the concavity axis is longitudinal with respect to the vehicle axis, as in FIG. 1, the safety is two-fold, in that body-centering action is inherent, as is also the particular protection of the spine.

The use of a slippery interlayer, in the circumstance of preloaded compressional application of the upholstery, assures prompt restoration of full pleasing contour to the finished seat, whenever a load of any kind is removed. And this interlayer has also been found to produce particular comfort at the back cushion, in that the substantial elimination of friction between upholstery and the padding allows the upholstery to stay with the user's clothing and not to cause the clothing to ride up and bind at sleeves and shoulders.

While the invention has been shown and described in connection with preferred illustrative forms, it will be understood that modifications may be made without departing from the invention. For example, the seat and back concavities may be of the nature of wide V-grooves or otherwise different from the generally arcuate shapes shown. In either event, the same progressive take-up of load reaction will characterize the nature of wide-based support of the foam on the frame.

Also, when the "sculptured look" is not a prime factor in seat design, the foam padding may be simplified, particularly in back-cushion elements, by using a single slab of consistent thickness and density, in overlap with both the end shoulders and spanning the concavity therebetween.

In any case, regardless of whether the padding of the back comprises one or two elements, the fact remains that the requisite overall thickness of back frame and compressed padding is relatively small compared to back thickness of conventional spring-based supporting structure. The economy realized as to thickness is in the order of two inches per seat, meaning that for the conventional five or six passenger automobile, an overall gain of approximately four inches of leg room is realized without sacrificing comfort or safety.

What is claimed is:

1. A seat element comprising, in combination, a relatively rigid frame with pad-supporting means characterized by two spaced elongated shoulders contiguous to a dished elongated concave surface therebetween, a first foamed pad of relatively high-density resilient material substantially spanning the effective width of said concave surface and directly supported by said surface near the shoulder limits of said surface, foamed-pad means of relatively low-density material adjacent the supported sides of said first pad, and upholstery covering said first pad and said pad means and anchored to said frame, whereby a body load on said seat element is sustained primarily by said high-density material in its progressive reaction to the centering support afforded by spaced convergent locales of said concave surface.

2. A seat according to claim **1**, in which said upholstery is tensed in compressionally loading relation with said pad and pad means primarily in the direction against said surface.

3. A seat according to claim **31**, in which said foamed-pad means is generally U-shaped and is contiguous to said first pad along said shoulders and along one end of said first pad.

4. A seat according to claim **3**, in which said upholstery includes a reinforced welt along substantially the alignment of adjacent edges of said first pad and of said pad means, said welt being tension-connected directly to frame locations on said surface.

5. A seat according to claim **4**, in which a layer of slippery material is on one of the adjacent surfaces of one of said upholstery and pad and pad means.

6. A seat element comprising, in combination, a relatively rigid frame with a pad-supporting surface characterized by two spaced elongated shoulders and dished elongated concave-surface means therebetween, a first generally rectangularly prismatic foamed pad of resilient material spanning the effective width of said surface means and directly supported by said surface means at least near the shoulder limits of said surface means, said pad being uniformly thick in its unstressed condition, further foamed-pad means of resilient material contiguous to at least the concavity-supported sides and one of the ends of said first pad and overstanding said shoulders, said pad means being uniformly thick in its unstressed condition, a layer of self-lubricating flexible material covering both said first pad and said pad means, and upholstery compressionally covering said flexible layer and said first pad and said pad means and anchored to said frame at locations peripheral to said pad means and at locations along the interface between said pad and pad means.

7. A seat element according to claim **6**, in which said pad is of greater density material than said pad means.

8. A seat element according to claim **7**, in which said frame is a permanently fixed, integrally united, component of a vehicle body.

9. A vehicle seat, comprising a unitary seat frame, foamed resilient padding on said frame, and upholstery secured to said frame in compressionally loading relation with said padding; said frame comprising upstanding spaced side walls with mounting means near their bottom edges, spaced shoulders at the upper edges of said walls, and an upwardly facing relatively rigid dished concave surface extending between said shoulders; said foamed padding overstanding said surface and shoulders and including an element blanked from slab stock of substantially uniform thickness, said padding element deriving direct support from said surface near the side limits thereof, and said padding being compressed by said upholstery to deform said padding element into conformity with at least spaced parts of said surface and to deform the remainder of said padding at least in part around said shoulders into at least partial overlap with said side walls.

10. A vehicle seat according to claim **9**, in which said foamed padding comprises at least two separate and contiguous pieces blanked from slabbed stock, one of said pieces being said element and substantially conforming in planform area and configuration to the planform area of said surface, the other of said pieces substantially conforming in planform area and configuration to the adjacent contiguous planform area at least at said shoulders, and tensioned means securing said upholstery to said surface while also compressing said padding along an alignment substantially matching the interface between foamed pieces.

11. A vehicle seat according to claim **10**, in which the total effective planform area and configuration of blanked stock exceeds the planform area of said frame, with foamed edges projecting beyond both said sides, whereby said upholstery may deform a substantial quantity of foamed material into overlap with said side walls.

12. The seat of claim **11**, in which said unitary seat frame is formed of stamped sheet metal, at least for the shoulders and concave surface thereof.

13. The seat of claim 12, in which said unitary seat is formed of plastic laminate at least for the shoulders and concave surface thereof.

14. The seat of claim 13, and including a unitary upstanding back frame connected to said seat frame and comprising upstanding spaced side walls terminating in spaced shoulders at the forward edges of said back-frame side walls, and a forwardly facing relatively rigid dished concave surface extending between said back-frame side walls; foamed resilient padding spanning said back-frame shoulders and including an element blanked from slab stock of substantially uniform thickness and deriving direct support from said concave surface near the side limits thereof; and upholstery secured to said back frame in compressionally loading relation with said padding to an extent deforming said last-mentioned padding element into conformity with at least spaced parts of said back-frame surface and deforming at least part of the remaining padding around the adjacent shoulders into at least partial overlap with said upstanding back-frame side walls.

15. An upholstered unit, comprising a relatively rigid frame with an elongated generally cylindrically arcuate concave pad-supporting surface extending between spaced elongated sides, a pad of foamed resilient material substantially spanning the arc of said surface and deriving direct primary support from said surface near the side limits thereof, and an upholstery covering said pad and secured to said frame in compressionally loading relation with said pad.

16. A seat according to claim 15, wherein the central portion of the span of said pad is spaced from the corresponding central portion of said surface.

17. A seat according to claim 15, wherein the front and back edges of said seat extend transverse to the axial direction of said surface.

18. A seat according to claim 15, wherein the front and back edges of said seat extend substantially parallel to the axial direction of said surface.

19. A seat according to claim 18, in which the axial elongation of said surface is at least equal to the combined side-by-side seating width of two adults.

20. An upholstered unit, comprising a relatively rigid frame with depressed concave pad-supporting surface means extending between spaced outwardly diverging elongated sides, a pad of foamed resilient material substantially spanning said surface means and deriving direct primary support from said diverging sides near the side limits thereof, and an upholstery covering said pad and secured to said frame in compressionally loading relation with said pad.

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