Feb. 18, 1964 R. BECKMAN ETAL 3,121,588

SEATING

Filed July 13, 1962 3 Sheets-Sheet 1

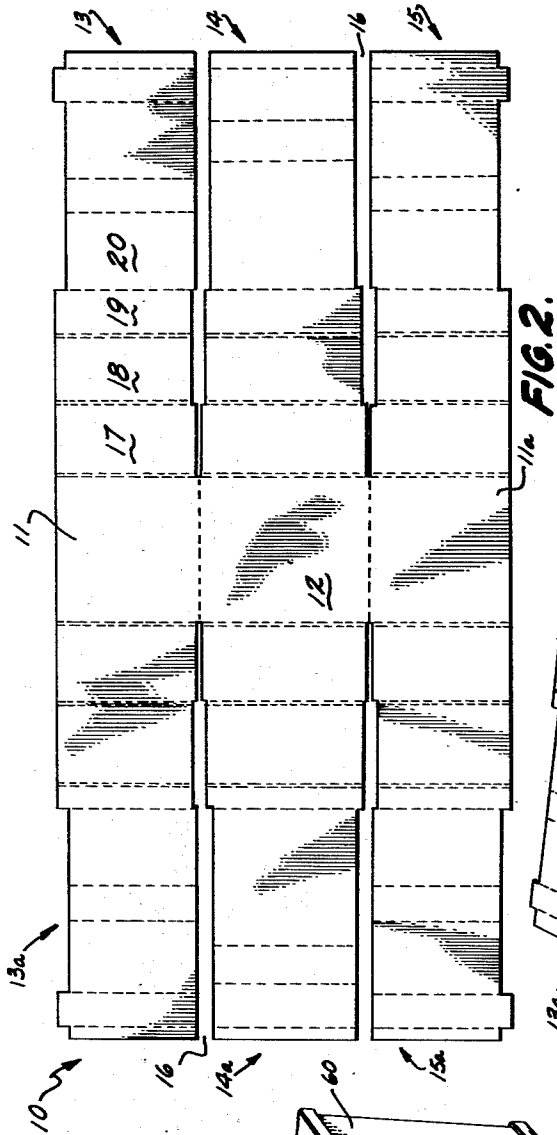


FIG. 2.

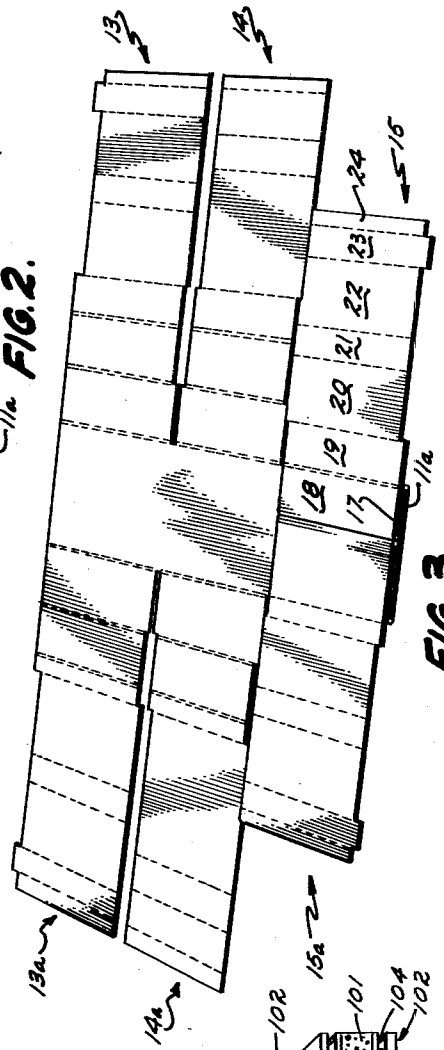


FIG. 3.

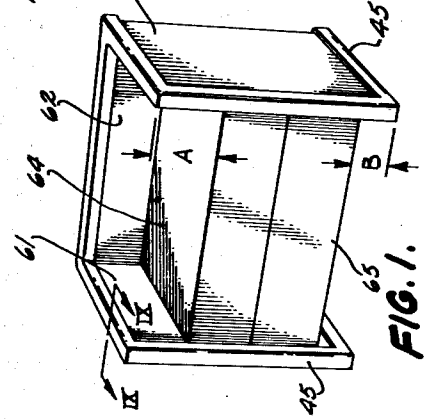


FIG. 1.

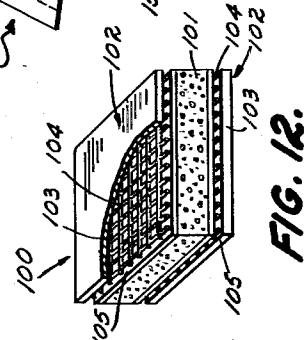


FIG. 12.

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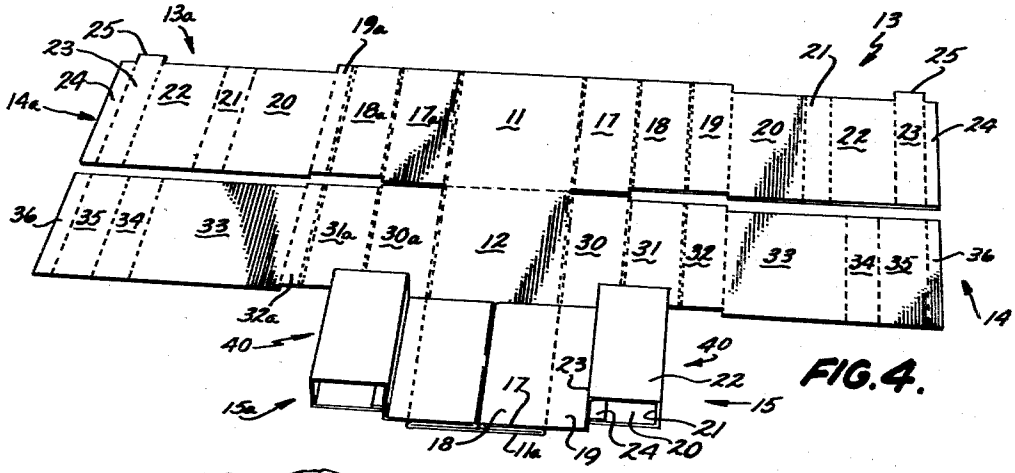


FIG. 4.

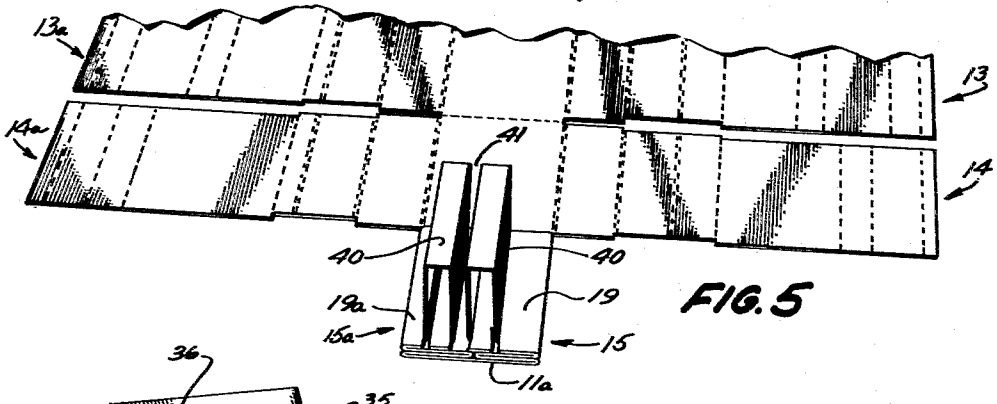


FIG. 5

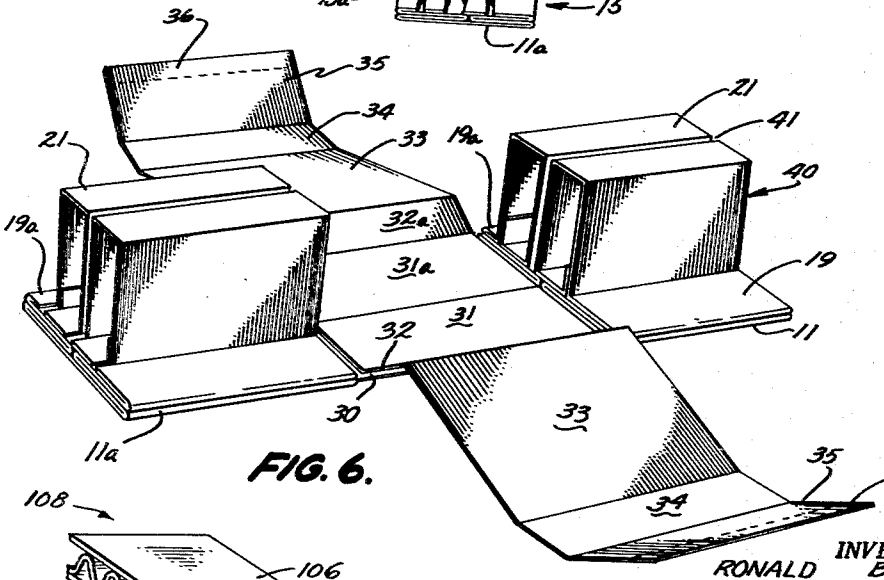


FIG. 6.

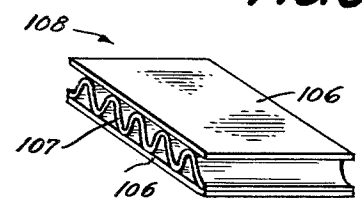


FIG. 13.

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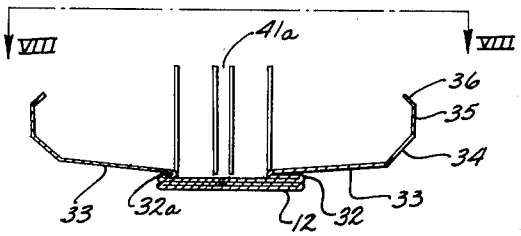


FIG. 7.

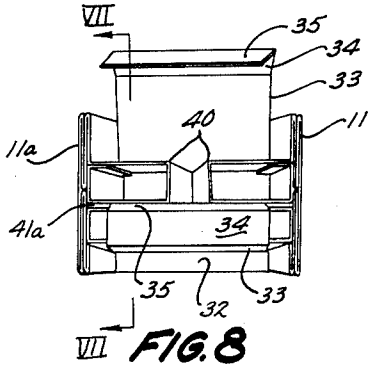


FIG. 8

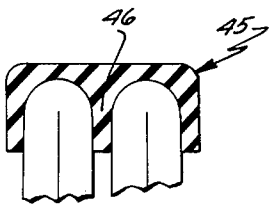


FIG. 9.

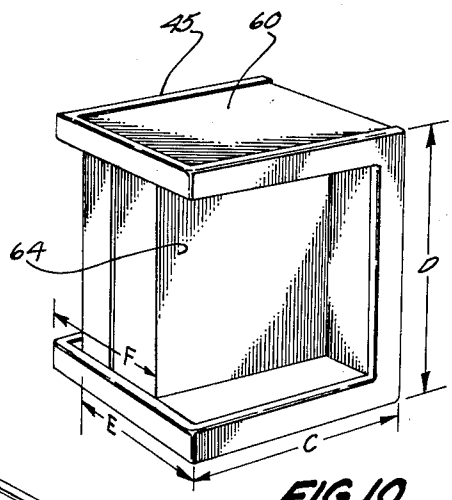


FIG. 10.

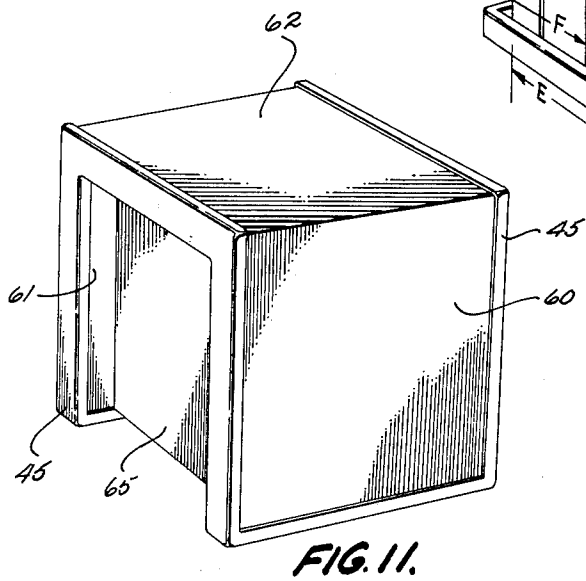


FIG. 11.

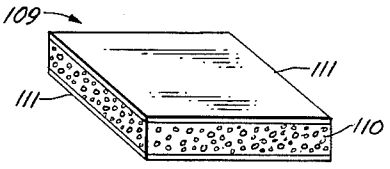


FIG. 14.

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3,121,588

SEATING

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20 Claims. (Cl. 297—1)

This invention relates to furniture and more particularly to a chair or seat which is formed from a single piece of foldable material.

This invention is designed to provide inexpensive yet durable seating for those situations necessitating the use of inexpensive, readily available materials and production machinery which materials are both comparatively lightweight and may be transported in flat or knocked-down condition rather than as an assembled unit. This invention also provides seating which may be assembled without tools by relatively unskilled personnel.

The seating unit of this invention may be fabricated from paper board or various types of thin sandwiched material utilizing paper as a basic facing material. The sheet material is cut to the proper shape and scored ready for folding. However, it is designed to be shipped as flat sheets or blanks for quick and simple erection at destinations. Such an arrangement permits the furniture to be shipped as compact bundles which are comparatively secure against injury or damage in transit. Since the erection operation is one involving merely a folding operation without mechanical fasteners, the erection can be effected by unskilled labor under generally primitive operating conditions in the absence of any tooling. If desired, the blank at the time of manufacture may be coated on appropriate panels with a suitable contact type adhesive. Such coated surface will be protected during storage and shipment with a suitable discardable protective film such as paper.

The invention provides a seat of multiple usage. It is so designed that a single seat unit will provide four different seating heights merely by rotating the unit from one face to another. At the same time it is strong, lightweight, and durable. It also has a neat, clean and efficient appearance.

These and other objects and purposes of this invention will be immediately understood by those acquainted with the design and usage of folded thin sandwich type materials upon reading the following specification and the accompanying drawings.

In the drawings:

FIG. 1 is an oblique view of a seat embodying this invention;

FIG. 2 is a plan view of a blank from which the seat of FIG. 1 is made;

FIGS. 3 through 6 are oblique views showing progressive steps in the folding of the blank of FIG. 4;

FIG. 7 is a sectional view taken along the plane VII—VII of FIG. 8 showing the seat laid on its back panel with the side panels omitted to illustrate the seat just before the seat facing panels are folded into position;

FIG. 8 is a view taken along the plane VIII—VIII of FIG. 7 showing one of the seat panels folded into position with the other one ready to be folded and the side slightly spread apart to illustrate the construction of the seat itself;

FIG. 9 is an enlarged, fragmentary, sectional view taken along the plane IX—IX of FIG. 1;

FIG. 10 is an oblique view illustrating the seat rotated for use with one of the sides serving as the base;

FIG. 11 is an oblique view showing the seat rotated with the front face serving as the base;

FIG. 12 is a partially fragmentary oblique view of a sheet of material suitable for this invention;

FIG. 13 is an oblique view of another material suitable for this invention;

FIG. 14 is an oblique view of a further material suitable for this invention.

In executing the objects and purposes of this invention, there is provided a panel of foldable material of such consistency that, except where folded, it is rigid in compression. This blank consists of three basic strips; a middle one and a pair of outer ones. The outer strips are rolled up to form tubes which become the basic internal structure of the seat while the middle strip is folded up to enclose the tubes and form the surface of the seat, locking the assembly together. The strips are all integral with each other being connected through the series of central panels which form the side and back panels of the chair when erected.

Referring specifically to FIG. 2 of the drawings, the numeral **10** indicates a blank having a pair of wing panels **11** and **11***a* which are spaced apart by a central panel **12**. One edge of each of the wing panels **11** and **11***a* is integral with an adjacent edge of the central panel **12** forming a continuous band crosswise of the blank. Extending from opposite side edges of the wing panel **11** are strips **13** and **13***a*, from opposite side edges of the central panel **12** are strips **14** and **14***a* and from opposite side edges of the wing panel **11***a* are strips **15** and **15***a*. The strips are separated from each other by generally parallel slots **16** which extend in from the ends of the blank to the fold lines which define the side edges of the wing and central panels.

In progressive order outwardly from the wing panel **11**, the strip **13** has a first infold panel **17**, a second infold panel **18**, a spacer panel **19**, a first tube face panel **20**, a first tube side panel **21**, a second tube face panel **22**, a second tube side panel **23**, and a tube flap **24**. Considering the strip extending in the opposite direction from the wing panel **11**, it will be noted that the same number of panels are provided. However, the spacer panel **19***a*, corresponding to panel **19** is substantially narrower than panel **19** on the right-hand side of the wing panel. Also, the panels **17** and **18** are of a different width than the panels **17***a* and **18***a* respectively with the panels **17***a* and **18***a* being wider than the corresponding panels **17** and **18**. The panels in the strips **15** and **15***a* correspond exactly to the panels in the strips **13** and **13***a* respectively. It will be noted that each of the second tube side panels **23** has an outwardly projecting filler tab **25**. It will also be noted that each of the second tube side panels **23** has an outwardly projecting filler tab **25**. It will also be noted that laterally of the blank the panels **20**, **21** and **22** are offset slightly toward the center of the blank. These irregularities in edge construction are to provide room for the multiple thicknesses of material as the blank is folded into the finished article.

Extending to the right as illustrated in FIG. 2 of the central panel **12** the strip **14** consists of the following panels, a first infold panel **30**, a second infold panel **31**, a spacer panel **32**, a seat surface panel **33**, a seat edge panel **34**, a flap insert panel **35**, and a flap guide panel **36**. The strip **14***a* has the same number of panels, but the spacer panel **32***a*, corresponding to the spacer panel **32**, is narrower than the spacer panel **32**. Also, panels **30** and **31** are of a different width than panels **30***a* and **31***a* respectively with the panels **30***a* and **31***a* being wider than the corresponding panels **30** and **31**. Each of the panels is separated from each of the adjacent panels by a fold line. The fold lines are indicated in FIGS. 3, 4, and 5 by broken lines. Where the panels are folded over upon themselves, the fold lines are indicated by double broken lines.

Referring now to FIG. 3, it will be seen that the panel **17** is first folded over against the upper face of panel

11*a*, and then the panel 18 is folded flat on the outer surface of the folded panel 17. The panels 17 and 18 are of identical width. Also, the panels 17*a* and 18*a* are similarly folded. These also of identical width. This provides a triple thickness of material. This is done with both the strips 15 and 15*a*. The differential in width between the panels 17 and 18 and the panels 17*a* and 18*a* offsets the line at which the panels abut. This offset is to the right as the invention is illustrated.

The next step is illustrated in FIG. 4. Starting with the tube flap 24, the panels 23, 22, 21 and 20 are rolled up into a rectangular tube 40. While in FIG. 4 this operation is illustrated as performed only on the strips 15 and 15*a*, it is also performed on the strips 13 and 13*a*. Next, the spacer strips 19 and 19*a* are folded over on top of the panels 18 and 18*a* and the two tubes 40 into position on top of the panel 11*a*. It will be noted that by reason of the differential in width of the spacer panels 19 and 19*a*, the tubes 40 are offset to the left side of the panel 11*a*. The strips 13 and 13*a* are also folded up into tubes which are similarly positioned on the panel 11 and are offset in the same direction and the same amount.

As shown in FIG. 6, the center strip 14 is folded in a rather similar manner. The first infold panel 30 being initially laid over the central panel 12 and then the second infold panel 31 being seated on top of it. This forms three layers of material at the panel 12. Because of the width differential between each of the infold panels 30 and 31 and the panels 30*a* and 31*a* the separation line between the folded panels is offset to the left. With the blanks so folded, the panels 11 and 11*a* are folded into erected position pivoting the tubes 40 to seat their open ends on the infolded panels 31 and with their second end panels 21 in abutting relationship. This also aligns the gaps 41 between the pairs of tubes to form a continuous gap 41*a* (FIG. 8) parallel with the joint formed between the infolded panels 31.

Referring now to FIG. 7, it will be seen that the spacer panels 32 and 32*a* are now folded in on the infold panels 31 and the panels 33 folded up to bear against the faces of the tubes 40. The seat edge panels 34 are then one-by-one seated over the ends of the tubes and the flaps 35 inserted into the gap 41*a* between the tubes. This operation is suggested in FIG. 8. The fold line between the panels 35 and 36 facilitates this operation by permitting the guide flap 36 to be bent to serve as a lead for inserting the insert flap into the gap.

This final operation not only forms the seats but locks the entire assembly together. Once the flaps 35 are inserted and pressed tightly into place, the side panels 11 and 11*a* cannot be opened as suggested in FIG. 8 because of the bind between the seat edge panels 34 and the ends of the tubes 40. At the same time the tubes form a strong supporting structure for the face panels 33 of the seat while the face panels 33 form continuous panels extending lengthwise of the tubes to reinforce them and thus provide the necessary structure to support the weight of people utilizing either of the face panels as a seating platform. The first tube side panels 21 of the tubes 40 provide rigid supporting columns at the center of the seat, bracing the seat structure against deflection at the center.

In the erected chair, the wing panels 11 and 11*a* become the outer faces of the side panels 60 and 61 respectively while the central panel 12 becomes the outer face of the back panel 62. The panels 60, 61 and 62 form the U-shaped frame of the chair. After erection of the unit, the free edges of these panels are now enclosed in a suitable beading 45 (FIG. 9). In the particular form illustrated in FIG. 9, the beading 45 is of generally W-shape having a pair of sides and a central tongue 46. It is mounted over the doubly folded panels forming the free edges of the side and back panels both to protect them and to keep them in permanent assembly. It also serves the purpose of further reinforcing the structure and keeping it in assembled condition. This edging strip 45 may be made of any suitable material. Preferable material includes an extruded vinyl or an extruded natural or synthetic rubber. It will be recognized that, if desired, it may be bonded to the panels and at the same time the central tongue 46 may be omitted.

The sheet material from which this invention is made can be of several types. It must however be a material which can be creased or scored and then folded yet at the same time have appreciable strength both in compression and in bending. The preferred material for this purpose is a sandwich of ⅛ inch to a ¼ inch in thickness consisting of a central core of foamed rigid polystyrene, faced on both surfaces with a heavy duty kraft paper. Another material is a sandwich of similar construction having the rigid, foamed in-place, polystyrene core faced on one or both faces with a sheet which in itself is a sandwich having a woven steel mesh core faced on both sides with kraft paper. Where the material is faced only on one side with the paper and wire mesh material, the other face would be formed of a heavy duty kraft paper. In the foaming in place procedure, a strong, permanent bond is formed between the core material and the facing sheets. A third material, but somewhat less desirable than the other two because of its characteristic mono-directionalism, is corrugated sheet material having a core of corrugated paper faced on both sides with a heavy duty kraft paper. It will be recognized that for purposes of improving the ornamental finish of the article and to increase its resistance to water and other environmental conditions, one or both faces of the material may be coated with a suitable finishing laminae such as a sprayed-on vinyl or a sheet of vinyl or polyester type synthetic resin materials. It is also possible to apply such a finish film as a thin sheet bonded to the kraft paper. Lacquers and other materials may also be applied with some of the same results. Since the article is intended to be completely factory finished with only erection to occur at the point of use, it is considered important that the materials be finished before shipment rather than the finishing coats applied at the point of erection.

These materials are illustrated in FIGS. 12, 13 and 14. FIG. 12 illustrates a portion of a sheet 100 consisting of a sandwich having a rigid, foamed polystyrene core 101 enclosed on each face with an envelope-like facing sheet 102. The facing sheet consists of a surface lamina 103 of kraft paper bonded to a layer of steel mesh 104 which in turn is bonded to an intermediate lamina 105 of kraft paper. The facing sheets 102 are bonded to the core 101.

FIG. 13 illustrates a corrugated core construction in which a pair of paper facing sheets 106 are bonded to a corrugated core 107 to make up the sheet material 108.

FIG. 14 illustrates a sheet 109 having a rigid, foamed polystyrene core 110 enclosed by a pair of paper facing sheets 111.

It will be understood that those portions of the blank which will make face-to-face contact in the erected chair may be coated with a suitable contact adhesive. This coating can be protected by a suitable pull-off film which will be removed at the time of erection. The use of such an adhesive will greatly strengthen the chair making it rigid and locking it against any possible unfolding during usage.

Referring to FIG. 1, it will be noted that dimension A is greater than dimension B. This results from the offsetting of the tubes 40 due to the differential in size between the spacer panels 19 and 19*a* and the spacer panels 32 and 32*a*. The result of the difference between the dimensions A and B is that the seat 64 is recessed further into the unit than the seat 65. Thus, the unit may be inverted to provide a difference in seating height. At the same time, as shown in FIG. 10, the transverse dimension of the back D is greater than the width dimension C of the side panels. Thus, when the unit is placed on its side, it will provide a seat of a different height than when it is placed with its open face or front down, as

suggested in FIG. 11. Further, both the C and D dimensions are different from the dimensions E and F which control the height of the seats **64** and **65**. Thus, this single unit will provide four different heights of seating, depending on the position in which it is placed. This gives it great versatility. The design and strength of the unit is such that the unit is equally strong irrespective of the position in which it is used.

When it is used in the position shown in FIG. 1 or inverted from this position, the seat panels **64** and **65** are supported by the tubes which extend into the seat portion from both of the sides. When the unit is positioned as illustrated in FIG. 10, the seat portion forms a solid support or beam extending from the side panels **60** to the side panels **61**, assuring rigid support for the side panel positioned upwardly and thus used as the seat. When the unit is rotated so that its open face is down as suggested in FIG. 11, the back panel **62**, which then serves as the seat, is firmly supported on each end by the side panels **60** and **61**. Between these side panels the seat structure acts as a beam supporting the back panel then being utilized as the body support.

It will be recognized that this invention provides an inexpensive, easy to erect, durable and highly versatile seating unit. It also provides a unit which may be completely fabricated and prefinished at the factory. Only erection is required in the field. At the same time, it may be shipped flat, in compact bundles of flat sheets which are both economical to transport and capable of being packaged to prevent damage. The unit is also lightweight since a minimal amount of material is used in each seating unit and the materials themselves are low density. This also contributes to economy in shipping, and ease of handling.

While a preferred embodiment of this invention has been illustrated, and described, it will be recognized that various modifications of this invention may be made. Such of these modifications as embrace the principles of this invention are to be considered as included in the hereinafter appended claims.

We claim:

1. A chair formed by folding from a single sheet of material, said chair having a back panel and a pair of side panels formed into a U-shaped member open on both ends and at one side and a seat member of substantial thickness; said seat member projecting from said back panel toward said open side and being between and secured to a pair of said panels; said seat being spaced from both of said open ends and offset toward one of said ends to form a body receiving recess at said one end which is shallower than at the other of said ends for alternately forming seats of two different heights upon inversion of said chair.

2. A chair as described in claim 1 wherein the width of said back panel between said side panels is greater than the heighth of said back and side panels measured between said ends for forming a seat of a third heighth when said chair is placed with one side panel down.

3. A chair as described in claim 2 wherein the width of said side panels measured between said open side and said back panel is different from the width of said back panel and the spacing between either of the faces of said seat and the remote one of open ends of said U-shaped member for forming a seat of a fourth heighth when said chair rests upon the ends of said side panels at said open side.

4. A chair as described in claim 1 wherein said sheet material has a corrugated paper core sandwiched between a pair of paper facings.

5. A chair as described in claim 1 wherein said sheet material has a rigid foam core sandwiched between a pair of paper facings.

6. A chair as described in claim 1 wherein said sheet material has a rigid foam core faced on one side with a wire mesh enclosed in a paper envelope and faced on the other side with a paper sheet.

7. A chair as described in claim 6 wherein said core is a polystyrene.

8. A chair as described in claim 1 wherein said sheet material has a rigid foamed core faced on both sides with a wire mesh enclosed in a paper envelope.

9. A chair formed from a single sheet of foldable material, said sheet being characterized by a pair of panels and a central panel integral with each other and collectively extending laterally of the sheet as a continuous band; an elongated strip extending lengthwise of said sheet from opposite ends of each of said panels, each of said strips being integral with one of said panels; each of said strips integral with said wing panels being folded into a rectangular tube, each pair of said tubes being positioned within the margins of the wing panel to which they are attached and being spacer apart to form a gap therebetween; said wing panels being folded to parallel position with said tubes of one wing panel juxtapositioned to the tubes of the other of said wing panels and said gaps aligned to form a continuous narrow central opening; the strips integral with said central panel being folded in and about said tubes with their free ends inserted into said central opening and wedged between said tubes; when folded, said central panel forming the back panel of said chair and said wing panels the sides of said chair, said panels being arranged as a U-shaped member open at both ends and along one side; said tubes and the strips folded thereover forming the seat of said chair.

10. A chair as described in claim 9 wherein said tubes are offset toward one of the edges of said wing panels to which said strips are integral to offset said seat toward one of said open ends of said member; said seat being usable as a body support on both faces to form a seat of one heighth when said chair is upright and a seat of a different heighth when said chair is inverted.

11. A chair as described in claim 9 wherein the folding of said strips provides several thicknesses of said sheet material in face-to-face relationship on the inner side of each of said panels for providing each of said panels with sufficient rigidity to act as a body support with the load applied normal to the face of the panel.

12. A chair as described in claim 9 wherein the free ends of said back and side panels, after said chair is folded to shape, are enclosed in a reinforcing strip of generally U-shape.

13. A chair formed by folding from a single sheet of material, said chair having a U-shaped body member formed of a back panel and a pair of side panels, said body member being open on both ends and at the front; a seat of substantial thickness made up of multiple layers of said sheet of material, certain of said layers being integral with said side panels and the remainder of said layers being integral with said back panel; said seat being characterized by a pair of opposite faces each usable as a body support with the load normal to the face; each of said faces being spaced a different distance from the adjacent open end of said body member to form seats each of a different heighth when said chair is inverted.

14. A chair as described in claim 13 wherein each of said side and back panels is formed of multiple layers of said sheet material.

15. A chair as described in claim 13 wherein the free edges of said back and side panels are enclosed in a generally U-shaped edging strip.

16. A chair as described in claim 13 wherein said sheet is basically tubular in construction and each of said faces is formed of multiple layers of said sheet material; each of said side and back panels also being formed of multiple layers of said sheet material; the free edges of said back and side panels being enclosed in a generally U-shaped edging strip of firm, resilient, synthetic resinous material.

17. A chair formed by folding from thin sheet material, said chair having a U-shaped frame open at both

ends and at the front, said frame forming the back and side panels; a tubular extension projecting into the central opening of said frame from each of said side panels, said tubular extension abutting each other in said central opening and each being integral with one of said side panels; enclosure panels extending from said back panel and enclosing said tubular extensions for locking them together and forming a surface for the seat of said chair.

18. A chair formed by folding from thin sheet material, said chair having a U-shaped frame open at both ends and at the front, said frame forming the back and side panels; a pair of parallel tubular extensions projecting into the central opening of said frame from each of said side panels, said tubular extensions abutting each other in said central opening and each being integral with one of said side panels; enclosure panels extending from said back panel one above and one below said tubular extensions and enclosing said tubular extensions for locking them together and forming a surface for the seat of said chair, the ends of said enclosure panels being inserted between the tubular extensions of each of said pairs thereof.

19. A chair as described in claim 18 wherein said thin sheet material is of sandwich construction having a rigid foam synthetic resin core enclosed in paper facings.

20. A chair as described in claim 19 wherein at least one of said paper facings incorporates a layer of strand-like reinforcing material.

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