April 26, 1966 B. J. SADOFF, JR 3,247,891

FOLDING DRAPERY

Filed Feb. 26, 1963 3 Sheets-Sheet 1

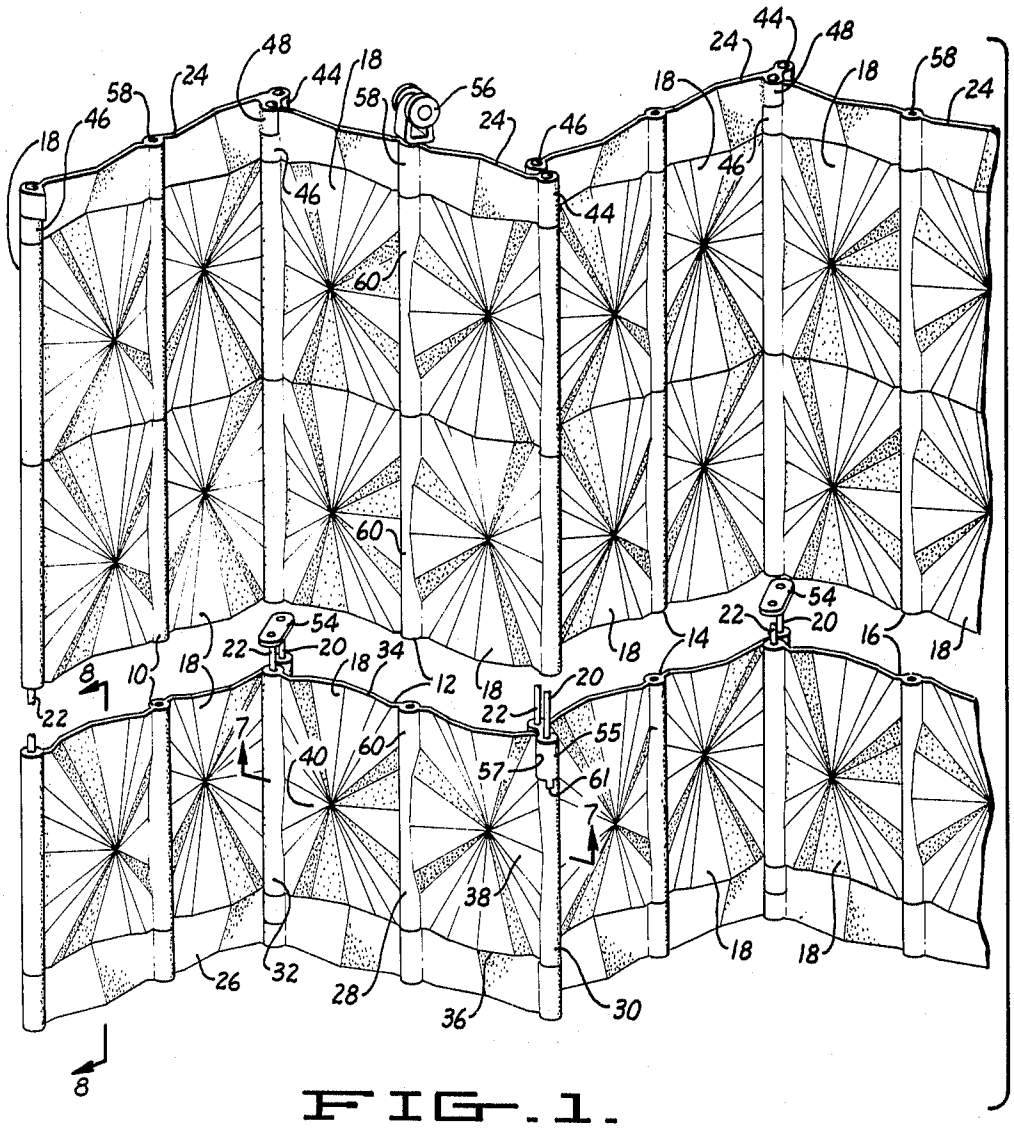


FIG. 1.

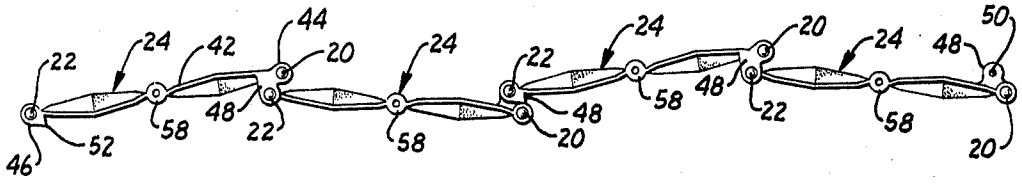


FIG. 2.

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FOLDING DRAPERY

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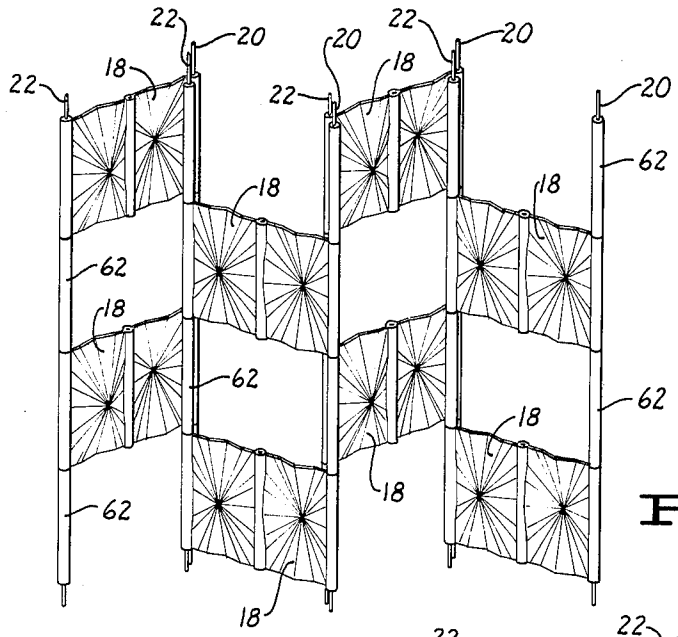


FIG. 3.

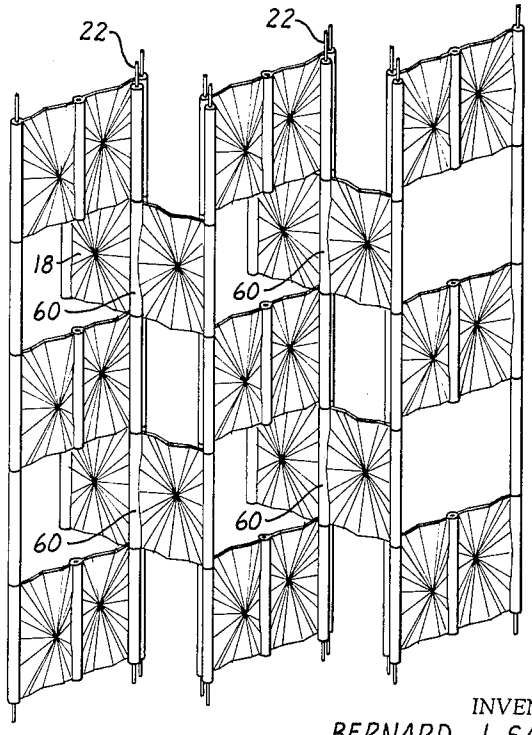


FIG. 4.

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FOLDING DRAPERY

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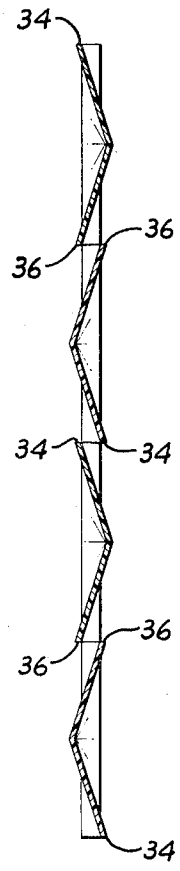


FIG. 6.

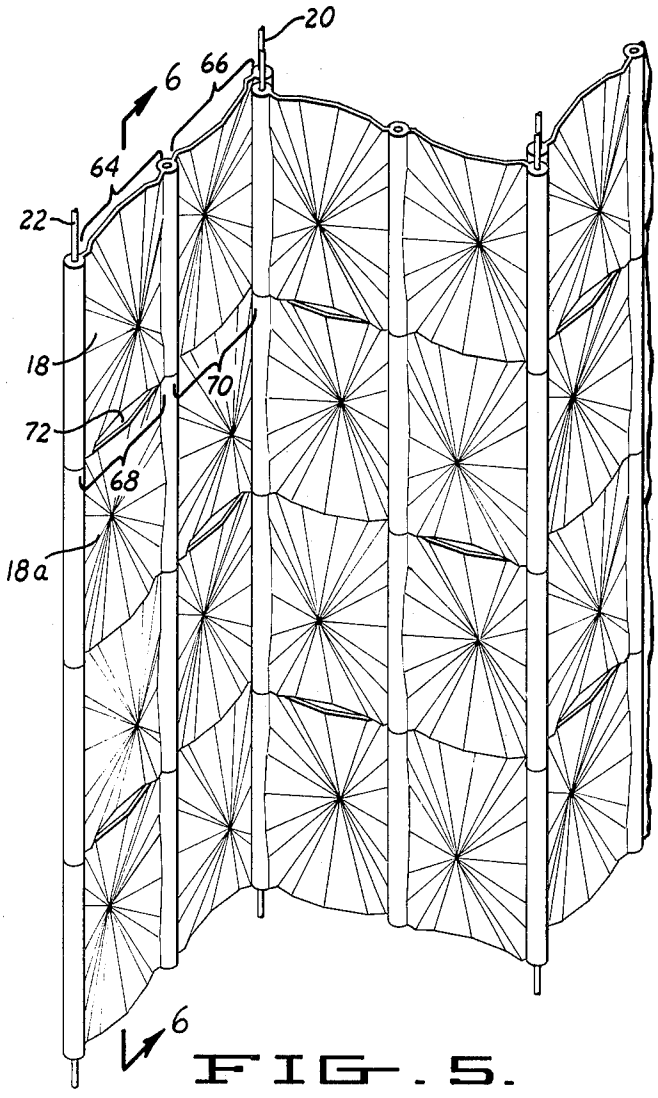


FIG. 5.

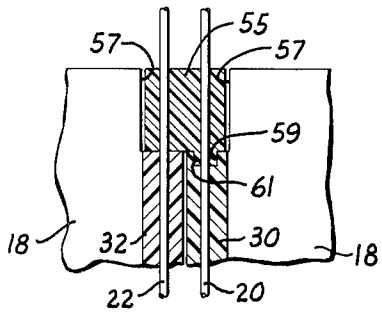


FIG. 9

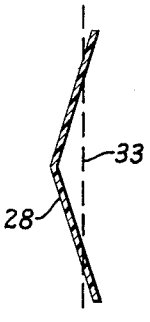


FIG. 8.

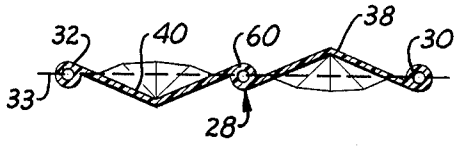


FIG. 7.

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3,247,891

FOLDING DRAPERY

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Filed Feb. 26, 1963, Ser. No. 261,037
10 Claims. (Cl. 160—183)

This invention relates to folding screens and more particularly to plastic draperies and the like made of a plurality of hingedly connected panels where each panel is made of a plurality of plastic modulator units arranged in a column.

In the construction of folding plastic draperies, vertical blinds, screen room dividers and the like, a wide variety of situations are encountered for the use of similar materials for various interior decorating and utilitarian functions. The different situations where materials are desired present many diffcult problems to the designer both in the size and shape of the curtain to be employed, in the provision of, or prevention of passage for light and air through the screen, and in the provision of desired aesthetic effects by the screen.

While the many ultimate applications for screens of these types require screens of many different sizes and with many different characteristics, it is desirable for the screen manufacturer to be able to provide screens for all applications from a minimum number of component parts so that the manufacturer's cost and inventories may be kept within reasonable limit.

It is an object of this invention to provide folding screens of these types which are adapted for simple manufacture and assembly to fit a wide variety of ultimate installations and to satisfy a wide variety of purposes and consumer tastes.

It is another object of the invention to provide such folding screens which may be assembled in a variety of alternate forms using a minimum number of component parts.

It is another object of the invention to provide modular components which may be employed in such screens in different ways in the same and different screens to provide screens of different designs and to provide screens in which identical modular units may cooperate with each other and with different modular units in different ways.

It is another object of the invention to provide such screens in which identical components can be assembled in alternate ways either to provide a screen having light and air transmitting openings therein or to provide a screen which appears to be substantially unvented.

It is another object of the invention to provide such folding screens which may be used as window draperies and the like and which may be folded to occupy a relatively small space compared to the space they cover when unfolded.

It is another object of the invention to provide such folding screens which may be made of a plurality of hingedly connected panels with each panel made of a column of modular units and with the adjacent columns of modular units connected at a minimum number of points.

Other objects and advantages of the invention will become apparent from the following description read in conjunction with the attached drawings in which:

FIG. 1 is a perspective view partially broken away of a plastic drapery constructed in accordance with the principles of this invention;

FIG. 2 is a view of the top edge of the drapery of FIG. 1;

FIGS. 3 and 4 are perspective views of alternative forms of draperies which may be made from the components of the drapery of FIG. 1;

FIG. 5 is a perspective view of a portion of drapery made from the components of the drapery of FIG. 1 but with the components arranged in a different manner than they are arranged in FIG. 1 to provide air and light transmitting passageways in the drapery of FIG. 5 where no such passageways are provided in the drapery of FIG. 1;

FIG. 6 is a vertical sectional view of the drapery of FIG. 5 taken along the plane indicated at 6—6 in FIG. 5,

FIGS. 7 and 8 are horizontal and vertical cross-sectional views of one of the modular units in FIG. 1 taken along the planes 7—7 and 8—8 respectively in FIG. 1, and

FIG. 9 is a sectional view on an enlarged scale of a portion of the drapery of FIG. 1 showing one of the connectors therein assembled.

Referring now in detail to the drawings and particularly to FIGS. 1 and 2, the drapery illustrated therein contains four hingedly connected panels 10, 12, 14 and 16 with each panel made of a column of plastic modular units 18 supported on right and left wires 20 and 22 respectively with the wires connected to upper and lower hinge pieces 24 and 26 respectively.

All of the modular units 18 are substantially identical to each other, and referring to the modular unit 18 in the lower center portion of FIG. 1, each modular unit is formed as an integral cast body of plastic material such as polystyrene, having a central web portion 28, opposite end portions 30 and 32, and upper and lower edges 34 and 36. The end portions 30 and 32 are generally cylindrical and have elongated passageways therethrough through which the wires 20 and 22 respectively extend and by which the plurality of modular units 18 in the column are mounted together one above the other. The apertures in the end portions 30 and 32 thus define a median plane 33 (see FIGS. 7 and 8) of each modular unit which will be mounted coplanar with the median planes of the other modular units in the panel when the plurality of modular units are supported together on one pair of wires 20 and 22. The central web 28 of each modular unit is undulating in shape in two directions; that is, the web portion 28 has right and left halves 38 and 40 respectively with the center of the right half 38 deformed rearwardly away from the median plane while the center of the left portion 40 is deformed forwardly from the median plane. While the center of the right half 38 is deformed rearwardly from the median plane, the right half 38 of the web crosses the median plane so that its upper and lower edges 34 and 36 lie forwardly of the median plane, and similarly the upper and lower edges of the left half 40 of the web lie rearwardly from the median plane. In this regard, the web has a horizontal cross-sectional area perpendicular to the wires 20 and 22 which has the general shape of a sine wave the axis of which extends along the median plane of the web and the period of which is 2π (360°). The vertical cross-sectional area of the web in a plane parallel to the wires 20 and 22 also has the general shape of a sine wave the axis of which extends along the median plane of the web and the period of which is 2π starting at $\pi/2$.

It will be noted that the upper and lower edges 34 and 36 of the web are generally sinusoidal with the lower edge of one modular unit in FIG. 1 contacting the upper edge of the modular unit below it so that the two units together define a continuous sinusoidal surface which extends across both modules. Similarly, the horizontal adjacent modules of the panel 10–16 define a continuous sinusoidal shape extending from left to right across the drapery with the left half 40 of each module being convex as viewed in FIG. 1 and the right half 38 concave. The upper and lower hinge pieces 24 and 26 have shapes com-

plementary to the shapes of the modular units 18 so that the sinusoidal pattern of the curtain extends continuously from its upper to its lower edges.

As indicated above, the plurality of modular units 18 in each panel 10–16 is supported on right and left wires 20 and 22; the wires 20 and 22 extend through apertures in the upper and lower hinge pieces 24 and 26 and conveniently may be deformed above and below these hinge pieces to lock the hinge pieces and the modular units 18 together to form the panels of the drapery. As indicated in FIGS. 1 and 2, each of the hinge pieces 24 and 26 has a central web portion 42 and right and left end portions 44 and 46 which are aligned respectively with the web 28 and end portions 30 and 32 of the modular unit 18 on which the end portion is mounted. Thus, the end portions 44 and 46 have apertures therethrough which receive the wires 20 and 22 and which define a median plane of the hinge piece which is coplanar with the the median plane of the modular unit 18 when the two are mounted together. As can be best seen from FIG. 2, the hinge pieces 24 and 26 are provided with lateral projections 48 thereon through which extend apertures 50 which are parallel to the apertures receiving the wires 20 and 22 but laterally spaced from the median plane of the hinge pieces by a distance approximately equal to the thickness of each of the panels 10–16. The lateral projections 48 on the hinge pieces have a height (measure parallel to the wires 20 and 22) of about half of the height of the hinge piece, and the end portions 46 of the hinge pieces also have a height of about half of the height of the hinge piece so that the end portion 46 on one hinge piece fits into alignment with the lateral projection 48 on the hinge piece adjacent thereto with the wire 22 which extends through the end portion 46 also extending through the lateral projection 48 and thereby providing pivotal connection between the adjacent panels of the screen. As can be seen in FIG. 2, the end portion 46 of the hinge piece carries a lateral projection 52 thereon projecting from the same side of the hinge piece as the lateral projection 48 and positioned to engage the end portion 44 of another hinge piece and limit unfolding of the two hinge pieces with respect to each other. The upper and lower hinge pieces 24 and 26 are substantially similar to each other and differ from each other in the twist or direction of undulation which their surfaces have so that the two pieces may have the shapes illustrated in FIG. 1 while both providing smooth continuous surfaces between themselves and the modular units 18 adjacent thereto. It should be noted that the panels 10–16 constructed as described above are pivotally connected together only at their upper and lower ends; in some installations where the length of the panels become quite large, it may be desirable to pivotally connect the panels together at a few points intermediate of their ends for instance at about four foot intervals along the lengths of the panels. Such pivotal connection may be accomplished by the use of thin apertured wafers 54 as shown in FIG. 1 or by the provision of auxiliary means, such as special pivot connectors set into or integrally formed with the modular units 18. A particularly advantageous pivotal connector is shown at 55 in FIG. 1 and illustrated in greater detail in FIG. 9. The connector 55 is a body of the same plastic material that the modular units 18 are made of and is fitted into aligned cut out portions 57 in the end portions 30 and 32 of the units 18 of adjacent panels 12 and 14 with the wires 20 and 22 extending through apertures in the connector; as indicated in FIG. 9, the cut out portion 57 in the end portion 30 has slot 59 therein which receives an ear 61 on the connector 55 and prevents rotation of the connector 55 with respect to the panel 12; these connectors are particularly desirable in preventing the center portions of the wires 20 from rotating about the wires 22 in draperies having long panels.

When the folding screen is constructed as described above and illustrated in FIG. 1, it may be mounted for overhead suspension as a folding drapery for a window or the like with a roller unit 56 mounted in a central boss in each of the upper hinge pieces 24, and if desired, the visual effect of the central boss 58 may be carried continuously along the length of each panel in the form of a cylindrical divider 60 or a portion thereof positioned centrally of the width of each modular unit 18; in this regard, it has been found desirable to employ dividers like those shown at 60 in FIG. 1 but having the shape of a hemisphere positioned at the upper or lower edge of the modular unit to provide both continuity between the shape of the web and the shape of the hinge piece and also to provide continuity between the shapes of two modular units 18 at their abutting edges.

In the form of drapery shown in FIG. 3, alternate modular units 18 are omitted and replaced by cylindrical spacer members 62 to provide a folding screen having very large air and light transmitting passages therein, and in the form of drapery illustrated in FIG. 4, a similar arrangement is employed, but additionally the left hand wire 22 on every other panel of the screen extends not through the end portion 32 of the modular units in that panel but instead through an aperture extending along the cylindrical divider 60 in each modular unit 18 in that panel to provide a vented drapery like that shown in FIG. 3 but in which the openings are half as large as the openings in the drapery of FIG. 3 and with the openings in FIG. 4 changing in areas as the drapery is folded and unfolded.

As pointed out above, each of the modular units 18 has a shape which is undulating in two directions. This shape of the modular unit is particularly desirable where the horizontal cross-sectional area of the modular unit has the general shape of a sine wave the axis of which extends along the median plane of the modular unit and the period of which a multiple of π where the modular unit also has a vertical cross-sectional area with a general shape of a sine wave and the axis of which lies on the median plane and the period of which is a multiple of π starting at an odd multiple of $\pi/2$ with at least one of these cross-sectional areas having a mid-point located at a $\pi/2$ position of the sine wave which generally defines its shape. With the modular unit constructed in this fashion, it has a pair of edge portions perpendicular to the wires 20 and 22 and positioned to provide either a vented or an unvented drapery when the modular unit is arranged in one of two alternative positions on the wire. Thus, as illustrated in FIG. 5, the drapery shown therein is constructed from the same modular units 18 as the drapery shown in FIG. 1. The drapery in FIG. 5, however, is vented instead of unvented because alternate ones of the modular units in each panel have been moved to an alternative position either by rotation through 180° in the plane of its median plane or by turning it upside down to place its edge 34 downwardly and its edge 36 upwardly so that the sinusoidal edges of adjacent modular units 18 in each panel are 180° out of phase with each other and thereby provide vent openings between the modules. Thus, and considering the upper left hand module 18 in FIG. 5, the undulating shape of the module provides it with four edge portions indicated at 64, 66, 68 and 70 where the portions 64 and 66 define the upper edge 34 and the portions 68 and 70 define the lower edge 36. It will be noted that the lower edge portions 68 and 70 define vent openings 72 with the upper edge portions of the modular unit 18A immediately below it. The modular unit 18 may, however, be moved to an alternative position in which the vent opening 72 is closed either by mounting the modular unit 18 on the wires after rotation through 180° to bring the edge portion 66 into the general location illustrated for the edge portion 68 or by replacing the module on the wires after turning it upside

down to bring the edge portion **64** into the general position occupied by the edge portion **68**. It will be noted that the vented condition of the drapery will not be changed by replacing the module **18** with the edge portion **70** occupying the position of the edge portion **68**, but other modular units could be constructed in which this was possible by forming the module with a horizontal cross-sectional area in which the mid point was located at a $\pi/2$ position of the sine wave which generally defines its shape for instance, by providing a module in which the horizontal cross-sectional area had the shape of a sine wave whose period was π or 3π. The provision of modular units in which the sine wave defining the horizontal cross-sectional area has a period of 2π is quite advantageous, however, in providing desirable aesthetic affects of the screens and in providing screens in which the concave and convex portions of the screen will nest in each other when the screen is folded to thereby provide a screen which may be stored in a minimum space when completely folded.

When it is desirable as indicated above to pivotally connect adjacent panels of the screen together at a few points intermediate of their ends, it may be desirable to employ in lieu of the end hinge pieces **24** and **26** different hinge pieces which have substantially the same shape as the modular units **18** differing therefrom in that one of the end portions of the modular unit extends only half of the length of the module, and a lateral projection is provided adjacent to the other end portion similar to the lateral projection **48** on the hinge piece and extending half the length of the modular unit, that is the hinge piece is constructed with the same shape as the modular unit and is provided with an end portion **46** and lateral projection **48** extending half the length thereof. Hinge pieces of this size and shape may be used not only at the upper and lower ends of the panels but also maybe used in horizontal lines across the folding screen to provide auxiliary points of hinge connection intermediate of the ends of the panels.

While certain specific embodiments of this invention have been illustrated and described in detail herein, it is obvious that many modifications thereof may be made without departing from the spirit and scope of the invention.

I claim:

1. A folding screen which comprises a plurality of overlapping elongated panels with each panel having generally parallel right and left edges and upper and lower ends with said edges defining median planes of said panel, hinge means connecting said panels together adjacent to their upper ends and adjacent to their lower ends for pivotal movement about first and second pivotal axes on each panel with said first axis extending along said medium plane adjacent to one of said edges and with said second axis extending generally parallel to said plane and adjacent to the other one of said edges but positioned laterally from said plane and inwardly of the width of said panel from said other one of said edges, the second axes on adjacent panels being spaced on opposite sides of the medium planes of said adjacent panels.

2. The folding screen of claim **1** in which each of said panels comprises a column of modular units with each modular unit having right and left end portions extending along said right and left edges of said panel and a pair of connecting wires extending along said median plane of said panel through said end portions of said modular units, and hinge pieces are mounted on each of said panels adjacent to its upper and lower ends with each hinge piece connected to the two wires of the panel on which it is mounted and connected to one of the wires of a panel adjacent to the panel on which it is mounted.

3. The folding screen of claim **2** characterized further by the inclusion of a plurality of auxiliary pivot connectors positioned along the length of said panels and having opposite ends pivotally connected to the adjacent ones of said wires on adjacent panels.

4. The folding screen of claim **3** characterized further in that said auxiliary pivot connectors have locking means thereon engaging a modular unit adjacent thereto in one of said panels for preventing rotational movement of said connector with respect to said one panel.

5. The folding screen of claim **2** characterized further in that each of the modular units in each of said panels comprises a web having opposite end portions through which the wires of said panel extend and a pair of parallel edge portions extending perpendicular to said wires with said end portions being removably mounted on said wires for mounting said modular unit in two alternative positions on said wires in which alternative ones of said two edge portions are positioned adjacent to a predetermined one of said edge portions of another modular unit in said panel, said two edge portions of said modular unit having substantially identical and symmertical shapes and being laterally spaced from said median plane asymmetrically with respect to each other to be positioned adjacent to said predetermined edge portion of said other modular unit with one of said two edge portions of said modular unit in one of said alternative positions positioned on the opposite side of said median plane from said predetermined edge portion and with the other of said two edge portions of said modular unit in the other of said alternative positions positioned on the same side of said median plane as, and in engagement with, said predetermined edge portion.

6. The folding screen of claim **5** in which each of said modular units has a horizontal cross-sectional area perpendicular to said wires which has the general shape of a sine wave, the axis of which extends along said median plane and the period of which is a multiple of π; each of said modular units also has a vertical cross-sectional area parallel to said wires which has the general shape of a sine wave the axis of which extends along said median plane and the period of which is a multiple of π starting at an odd multiple of $\pi/2$, and at least one of said cross-sectional areas has a mid-point which is located at a $\pi/2$ position of the sine wave which generally defines its shape.

7. A modular unit adapted to form one of a plurality of identical units arranged in a column which together define a panel of a folding screen which comprises: a web having a median plane, a pair of opposed end portions, a pair of parallel edge portions extending perpendicular to said end portions, and mounting means on each of said end portions extending along said median plane for mounting two of said modular units together with their median planes coplanar in two alternative positions in which alternative ones of said two edge portions of one modular unit are positioned adjacent to a predetermined one of said edge portions of the other modular unit, said two edge portions of said modular unit having substantially identical and symmetrical shapes and being laterally spaced from said median plane asymmetrically with respect to each other to be positioned adjacent to said predetermined edge portion of said other modular unit with one of said two edge portions of said modular unit in one of said alternative positions positioned on the opposite side of said median plane from said predetermined edge portion and with the other of said two edge portions of said modular unit in the other of said alternative positions positioned on the same side of said median plane as, and in engagement with, said predetermined edge portion.

8. The modular unit of claim **7** in which said web has a horizontal cross-sectional area perpendicular to said end portions which has the general shape of a sine wave, the axis of which extends along said median plane and the period of which is a multiple of π; said web has

a vertical cross-sectional area parallel to said end portions which has the general shape of a sine wave, the axis of which extends along said median plane and the period of which is a multiple of π starting at an odd multiple of $\pi/2$, and one of said cross-sectional shapes has a midpoint located at a $\pi/2$ position of the sine wave which generally defines its shape.

9. The modular unit of claim 7 in which said two edge portions of said web are positioned on opposite sides of said web and adjacent to opposite end portions of said web, and said two edge portions lie on opposite sides of said median plane.

10. The modular unit of claim 7 in which said two edge portions of said web are positioned on opposite sides of said web and adjacent to the same one of said edge portions of said web, and said two edge portions lie on the same side of said median plane.

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