May 3, 1966 A. G. JANUS 3,248,807

SPHERICAL PAPERBOARD DEVICE

Filed Jan. 16, 1964 4 Sheets-Sheet 1

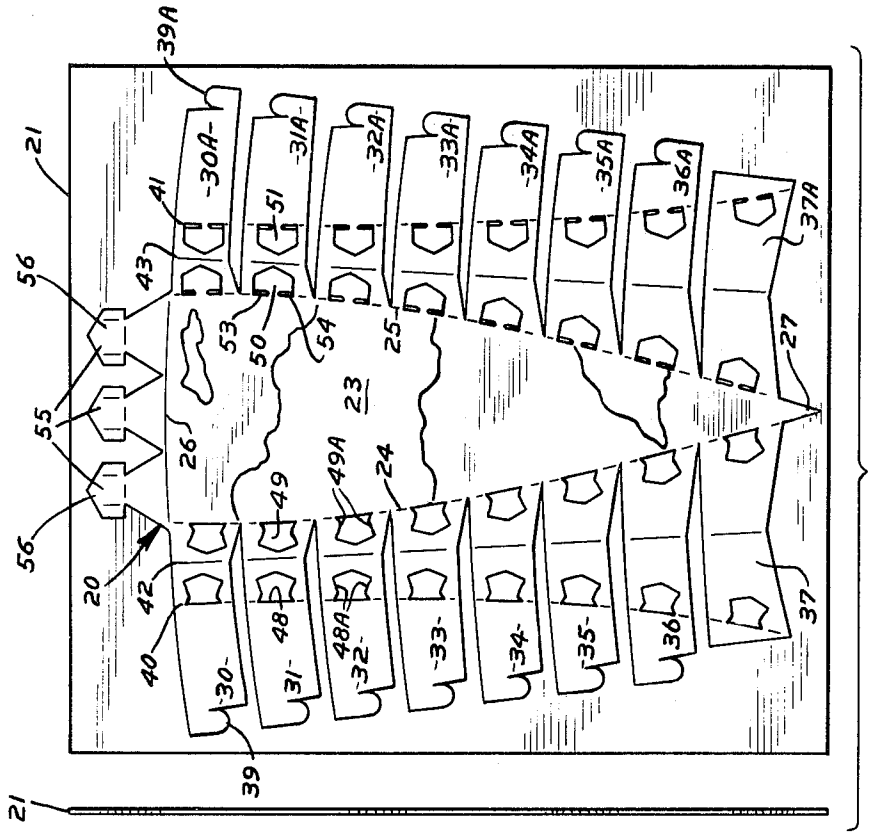


FIG. 2

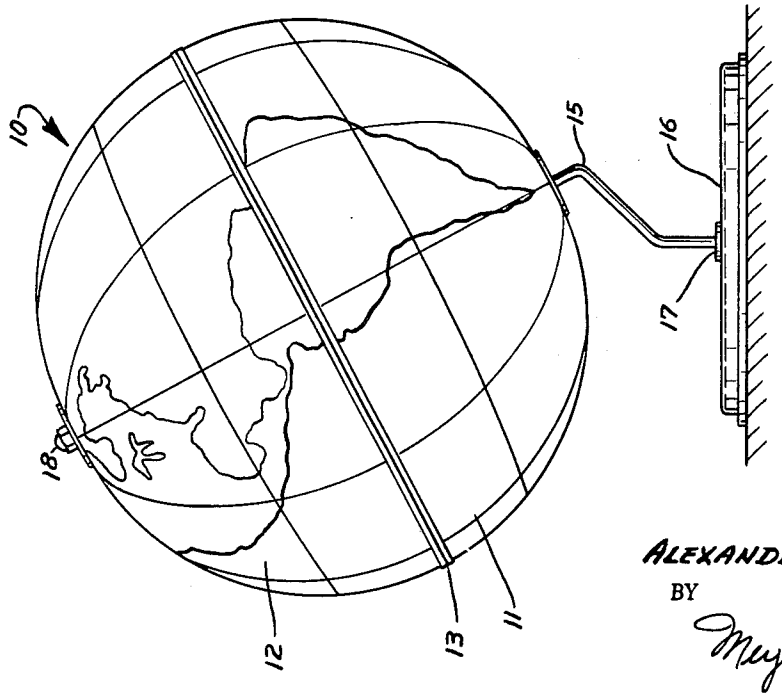


FIG. 1

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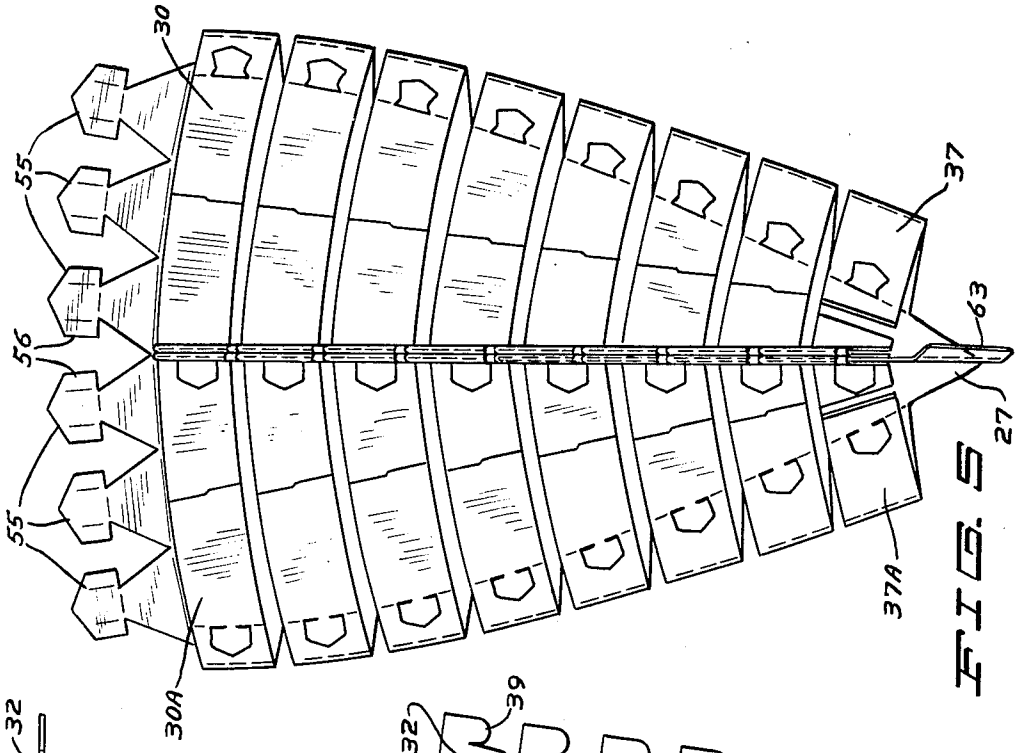


FIG. 5

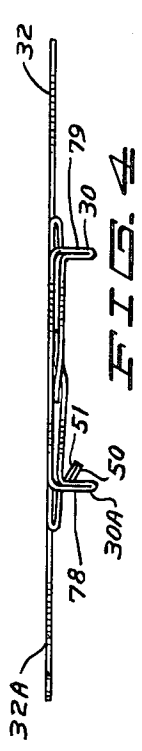


FIG. 4

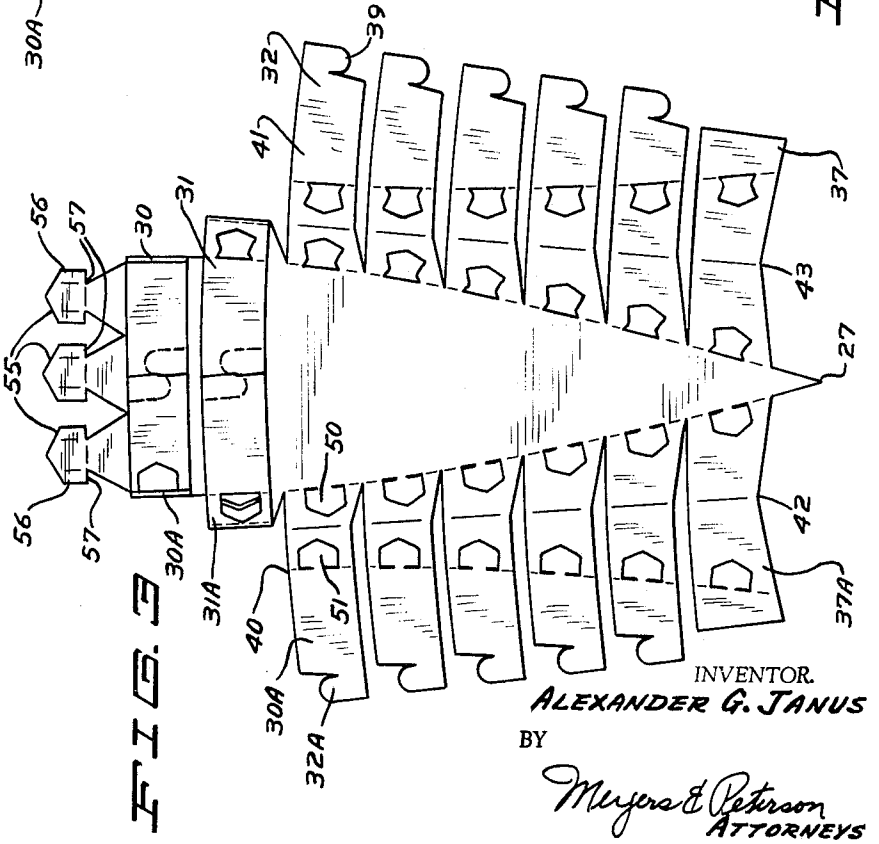


FIG. 3

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SPHERICAL PAPERBOARD DEVICE

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FIG. 8

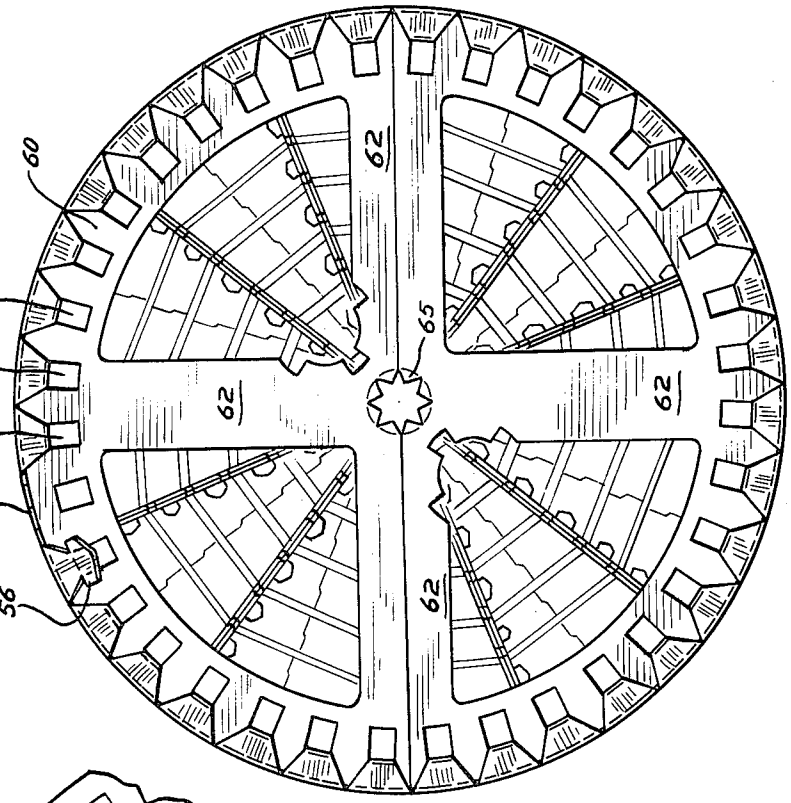


FIG. 7

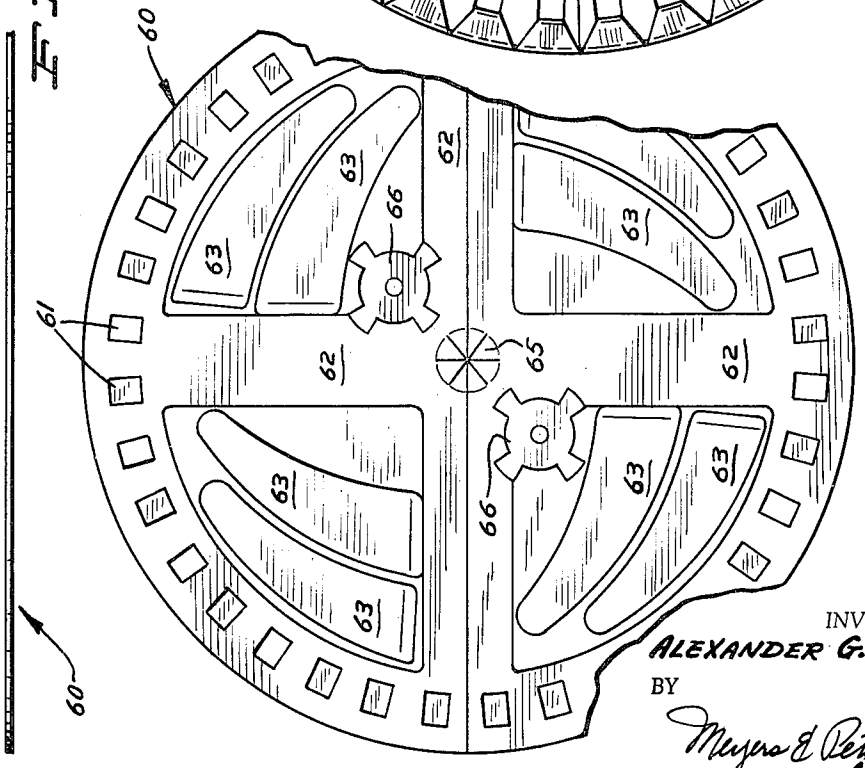


FIG. 6

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SPHERICAL PAPERBOARD DEVICE

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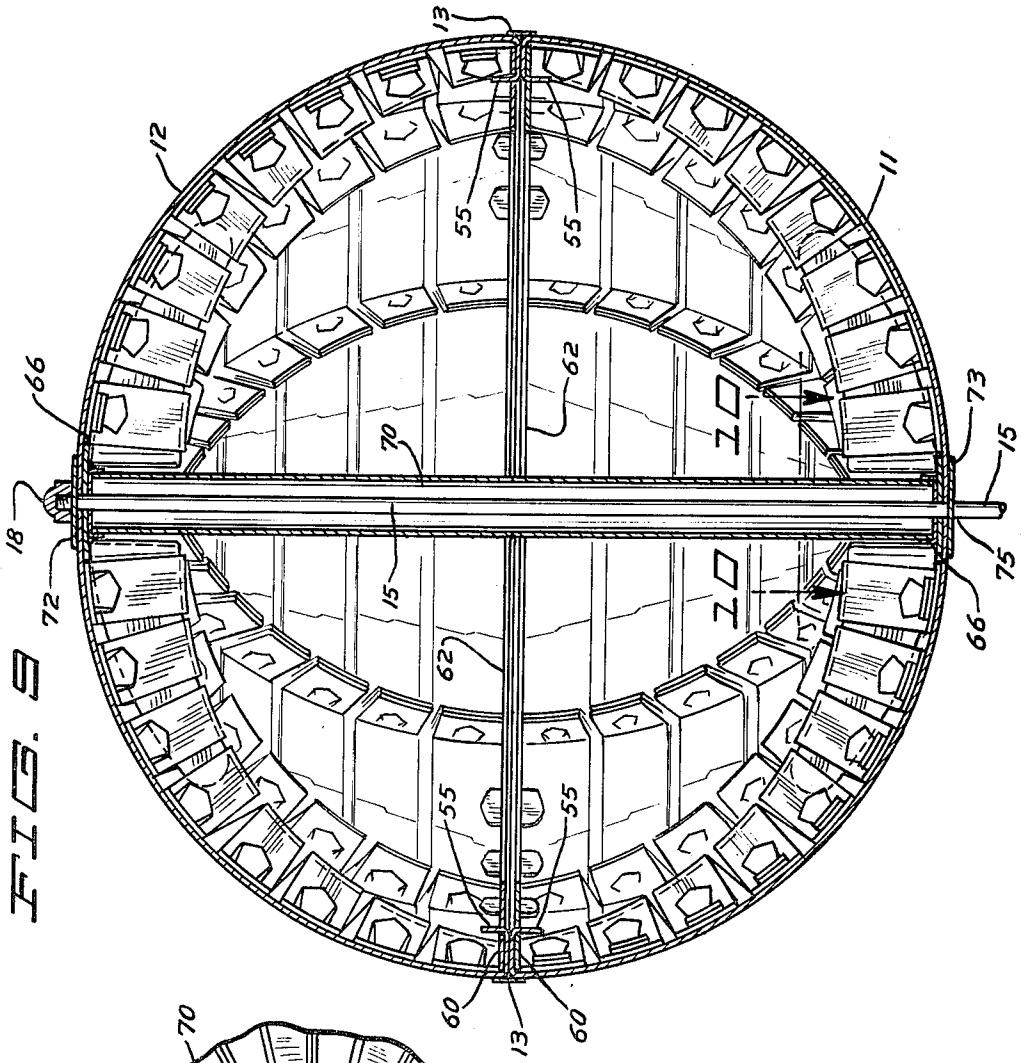


FIG. 9

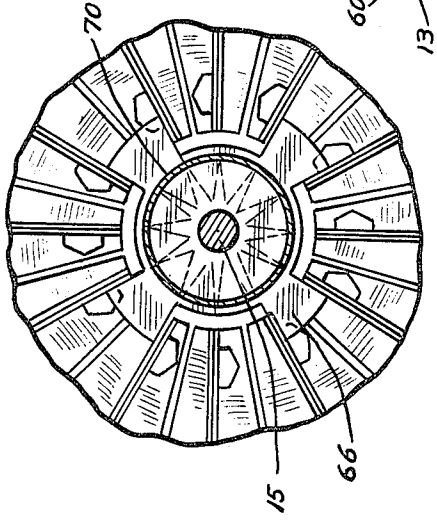


FIG. 10

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3,248,807

SPHERICAL PAPERBOARD DEVICE

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Filed Jan. 16, 1964, Ser. No. 338,233
7 Claims. (Cl. 35—46)

The present invention relates generally to an improved spherical structure, and more particularly to a spherical structure which is adapted to be fabricated from flexible sheet material, the structure being prepared from a plurality of spherical segments or gores, each gore being arranged to be serially joined to an adjacent gore to form a closed substantially spherical shell.

In the preparation of spherical or hemispherical shell structures, a manufacturer is frequently confronted with unusual shipping problems and unusual shipping volume requirements. Unless a suitable nesting arrangement can be employed, the shipping requirements for spherical shells or hemispherical shells may become unreasonable and impose a restrictive burden upon the ability of the manufacturer to properly distribute his product. In accordance with one aspect of the present invention, a substantially spherical shell is adapted to be fabricated from a plurality of essentially flat, planar segments or sectors of flexible material. Each of the segments is provided with laterally extending tabs which are specifically adapted to be interlocked both to oppositely disposed tabs from the same segment, and to corresponding or mating tabs which extend or protrude from the lateral edges of adjacent panel segments. Appropriate interlocking means are provided to join the ends of oppositely disposed tabs together, and a suitable pair of mating locking ears and locking slots are provided to secure the individual panel members, one to another. In order to provide a suitable spherical shell, two hemispheres prepared in accordance with the present invention are secured together along a section taken through the center of the sphere, the hemispheres being adjoined, one to another, along a plane which corresponds to the common base plane of the individual spherical panel segments or gores. The origins of each of the panel segments or gores converge at polar points, these polar points being disposed 90 degrees from the base plane along which the individual hemispheres are joined. In order to provide rigidity for each of the hemispherical elements, a reinforcing rib is adapted to be inserted along a channel which is formed from the elongated laterally extending tabs during the assembly process or operation, the edge surface of the arcuate reinforcing rib having an outer radius which is substantially equal to the radius of the hemispherical shell. In addition, when the sphere is entirely assembled, an axial reinforcing rod, sleeve, or the like extends diametrically between the polar points of the two hemispheres. Suitable latching or locking means may be employed to retain the two individual hemispheres together. The resultant is a substantially rigid, substantially spherical shell which is readily adapted for a variety of uses. One use which the apparatus of the present invention is peculiarly adapted is that of forming a global map of the world. In this connection, each of the panel segments has indicia imprinted on the face thereof each segment corresponding to individual sectors of the world. For convenience, the hemispheres may individually represent the Northern hemisphere and the Southern hemisphere, with the gores of each hemisphere meeting at a common point represented by the north and south poles respectively, and with suitable seams being provided along individual longitudinal divisions of the map of the globe. Of course, it will be appreciated that other uses are readily indicated for

a spherical shell prepared in accordance with the present invention.

Therefore, it is an object of the present invention to provide an improved spherical shell, the shell being fabricated from flexible material and being prepared from a plurality of spherical panel segments which are adapted to be serially joined along the lateral and base edge surfaces thereof to form a closed that is substantially spherical shell.

It is a further object of the present invention to provide an improved spherical or hemispherical shell which is fabricated from a plurality of individual spherical panel segments, each segment comprising a planar element, these planar elements being adapted to be joined along the lateral and base edge surfaces in a serial fashion so as to form a closed substantially spherical shell.

It is yet a further object of the present invention to provide a substantially rigid spherical shell fabricated from a plurality of flexible spherical segments, and being reinforced along the seams between adjoining panel segments.

It is still a further object of the present invention to provide an improved spherical shell which is fabricated from a plurality of flexible spherical panel segments, and which is reinforced so as to form a substantially rigid assembly, the assembly including an axial reinforcing member which extends diametrically of the spherical panel assembly, the origin of each of the spherical panel segments being disposed adjacent to the diametrically disposed reinforcing member.

Other objects of the present invention will become apparent to those skilled in the art upon a study of the following specification, appended claims, and accompanying drawings, wherein:

FIGURE 1 is a front elevational view of a global map of the world prepared from a plurality of spherical panel segments arranged in accordance with the present invention, and being disposed on a suitable display stand;

FIGURE 2 is a combined top plan view and edge view of a flat planar sheet of a spherical panel segment arranged in accordance with the present invention, with the planar panel being appropriately cut and scored;

FIGURE 3 is a bottom plan view of the panel segment of FIGURE 2, the panel segment being shown in partially completed form;

FIGURE 4 is an end view of the panel shown in FIGURE 3;

FIGURE 5 is a plan view, taken from the inner radius, of a pair of individual spherical panel segments arranged in accordance with the present invention, and joined one to another along the lateral edges thereof;

FIGURE 6 is a top plan view of a circular ring which is adapted to be joined to the individual panel members along the base edge surfaces thereof;

FIGURE 7 is an end view of the circular ring of FIGURE 6;

FIGURE 8 is a plan view taken radially inwardly, of a plurality of spherical panel segments secured together serially, one to another, and forming a hemisphere assembly, the hemisphere being joined to the circular reinforcing ring shown in FIGURE 6;

FIGURE 9 is a vertical sectional view taken through the radius of a pair of joined hemispheres, and showing the axial reinforcing member which is utilized to both join the hemispheres, one to another, and to reinforce the completed structure; and

FIGURE 10 is a partial sectional view taken along the line and in the direction of the arrows **10—10** of FIGURE 9.

In accordance with preferred modification of the present invention, in FIGURE 1 there is shown a global map of the world generally designated **10**, the structure having

been prepared in accordance with the present invention. The structure **10**, which has substantially the form of a spherical shell, comprises two hemispherical shells **11** and **12** which are joined together along a median plane as at **13**. The spherical shell **10** is supported on an axial shaft **15**, with the shaft **15** being supported in turn on a stand **16**. Suitable mounting means are interposed between the shaft **15** and the stand **16** as at **17** for securing the shaft to the stand element. A locking nut or cap screw **18** is provided at the end of the shaft **15** and acts as a retainer for holding the sphere **10** on the shaft **15**. Each of the hemispheres **11** and **12** is fabricated from a group of twelve serially joined spherical segment panels.

Particular attention is now directed to FIGURE 2 wherein there is shown, on the right, in plan view, a spherical panel segment in accordance with the present invention and generally designated **20**. The panel **20** is printed, scored, and arranged within the larger flexible fiber sheet **21**, the sheet **21** being fabricated, for example, from flexible construction paper, cardboard or the like. Accordingly, conventional printing and scoring techniques may be utilized in the preparation of the panel **20** within the confines of the square sheet **21**. Referring now in detail to the flexible spherical panel segment **20**, it will be seen that the segment includes a face portion **23** which normally is provided with printed indicia in accordance with the use to which the sphere is being put. The form of the panel **23** is that of a gore forming 1/12 of a hemisphere which will ultimately form one segment of the spherical shell being fabricated. In this connection, the panel has a pair of lateral edges **24** and **25** along with a base edge **26**. The lateral edges **24** and **25** of the panel **23** meet at an origin point as at **27**, the origin being adapted to be situated at one of the poles of the sphere ultimately formed. A plurality of elongated tab members are provided which extend outwardly in oppositely disposed relationship from each lateral edge of the face panel portion, these tab members being identified as **30**, **31**, **32**, **33**, **34**, **35**, **36** and **37** along with corresponding cooperating elongated tab members **30A–37A** inclusive. Each of the elongated tab members, with the exception of that tab member which is most closely adjacent the origin, is provided with an interlocking slot by which each tab may be securely joined to its oppositely disposed cooperating tab. For example, the interlocking slot means as at **39** and **39A** are adapted and arranged to be joined, one to another, as is indicated and described in FIGURE 3. In this connection, the elongated tabs **30** and **30A** are folded upon themselves at a scored mid-line **40** and **41** respectively. This folding operation provides the arrangement as is shown at **31** and **31A** respectively in FIGURE 3. Further score lines are provided at **42** and **43**, and also along the lateral edge lines **24** and **25** for a purpose to be described in greater detail hereinafter. Each of the elongated tabs **30–37** inclusive have a pair of locking slots arranged therein and defined by score lines. These locking slots are formed by the removal of knock-outs which are adapted to be physically removed from the structure, these locking slots as formed being shown at **48** and **49**. When the individual elongated tabs are ultimately folded along the extension of the score lines **40**, **42** and **24**, the locking slots **48** and **49** are in superimposed relationship and define a single locking slot aperture for receiving a cooperating locking ear therein. Referring now to the other group of elongated tabs, for example, the tabs **30A–37A** inclusive, it will be observed that each tab includes a pair of locking ears **50** and **51**. Inasmuch as each of the locking ears are identical one to another, for the purposes of clarity the description will be confined to the specific locking ears **50** and **51**. The locking ears are scored along a major portion of their periphery, the exception being along the center of the base lines one of which adjoins the lateral edge **25**, and the other of which lies along the extension of the score line **41**. Thus, each of the locking ears **50** and **51** is hingedly secured to the respective tab along the base line thereof. In order to form a more positive locking action with the locking slot, a pair of finger areas **53** and **54** along the base are physically removed as knock-outs from the remainder of the locking ear. Again, inasmuch as each of the locking ears is identical, one to another, the specific description is confined solely to the locking ear **50**. When the locking tab is folded upon itself, and ultimately folded in the manner illustrated at **30A** of FIGURES 3 and 4, the locking ears will be arranged and disposed as shown at FIGURE 4.

As the lines defining the lateral edge surfaces **24** and **25** of the gore panel converge toward the origin **27**, the score lines **40** and **41**, and the extensions thereof, mutually diverge. In this connection, however, the median score lines **42** and **43** are substantially parallel. Thus, as the individual tab members are folded and caused to assume a configuration shown in FIGURES 3 and 4, a composite channel is created along the lateral edge of the individual panel segment. As the face or gore of the unit is curved to the configuration desired in the spherical shell, for example, the structure shown in FIGURE 3 being curved concavely to the reader, the channels will assume a substantially straight line form or relationship. The purpose of this channel is to receive a reinforcing rib such as is described more fully hereinafter.

Referring now in particular to FIGURE 2, it will be observed that adjacent to the base line **26**, a group of three tabs are situated and extend therefrom, these tabs being identified as tabs **55—55**. The base edge seam **26** of the panel is scored in order to facilitate easy folding of the tab members **55—55** relative to the face of the panel **23**. The ultimate purpose of the tab members **55—55** is to be received in locking engagement with locking ports provided in a center circular reinforcing plate. The plate is shown in detail in FIGURES 6 and 7, along with the locking ports **61—61** which are adapted to receive the locking prongs **56** of each of the base tab extensions **55—55**. Inasmuch as each of the tabs **55—55** is identical, one to another, in the interest of clarity only one locking prong **56** has been indicated.

Attention is now directed to FIGURES 6 and 7 wherein there is illustrated a circular reinforcing disc generally designated **60**. The disc **60** is provided with a plurality of annularly disposed locking ports **61—61**, these ports, as previously indicated, being adapted to receive the locking prongs **56—56** of the base tab extensions **55—55**. The reinforcing disc **60** is provided with diametrical reinforcing elements **62—62**, the remaining quadrant portions being scored and thereby enabling their removal from the confines of the circular panel **60**. Each of the quadrants includes, for economy and convenience, a pair of reinforcing ribs such as the ribs **63—63**, these ribs being adapted to be inserted within the confines of the channel formed between the individual joined segments. In order to accommodate the central shaft or axis through the sphere, the center of the circular disc **60** is scored in order to provide for ready removal of the center **65**. Also contained within this panel are a pair of polar end caps **66—66** which are adapted to be disposed along the ends of a reinforcing rod which passes through the diametrical center of the spherical shell, the caps **66—66** being adapted to receive the origins of the individual spherical segments, at a common point and in adhesively bonded relationship therewith. The center of the individual caps **66—66** is likewise scored to permit removal in order to allow the shaft **15** to pass therethrough. After removal of the quadrants along with the center **65** and the caps **66—66** and the circular reinforcing member **60** appears substantially as is shown in FIGURE 8. This figure also shows the further accomplishment of a plurality of segments being joined to the reinforcing disc.

Particular attention is now directed to FIGURE 9 wherein a pair of hemispheres prepared in accordance

with the present invention are illustrated, the spherical segments being shown along a plane taken substantially through the poles thereof, and normal to the plane of the juncture between the hemispheres. In this connection, a center hollow reinforcing shaft **70** is provided which extends from pole-to-pole. The end caps **66—66** are arranged in contact with the ends of the pole **70**, the origin points of each of the individual segments being received and directed to a common point on the cap members **66—66**. In addition, if desired, an outer pole cap **72** and **73** may be interposed between the retaining means and the spherical shell. In this regard, the shield or cap **72** is interposed between the cap screw **18** and the origin areas of the individual spherical segments, while the shield **73** is interposed between the origin areas of the various spherical segments and a wedge or collar **75** along the support rod **15**.

In order to properly assemble a sphere in accordance with the present invention, the operator initially removes the segments from the confines of the various panels and arranges them for further disposition. Particular attention is directed to FIGURE 3 wherein the initial assembly operation is clearly illustrated. In this regard, the longitudinally extending tabs **30–36** and **30A–36A** respectively are folded upon themselves and interlocked at the extremities thereof. Following the interlocking operation, the individual tabs are then folded along their score lines as at **40** and along the lateral side **24** of the panel, the resultant operation producing a radially inwardly disposed pair of tabs such as is illustrated at **78** and **79** of FIGURE 4. It will be appreciated that the tabs **78** and **79** are identical to and correspond with the tab members **30** and **30A**, the additional numeral being utilized for increasing the clarity. This operation is continued until each of the tabs **30–36** and **30A–36A** respectively have been formed in the manner designated at **78** and **79**. At this time, the tabs **37** and **37A** are also folded upon themselves along the score lines **40** and **45** respectively, and these tabs are then being formed in the manner designated at **78** and **79**. Because of the proximity of tabs **37** and **37A** to the origin of the gore or spherical segment, it is generally not essential that the tabs be interlocked as is done in the remaining tabs.

Attention is now directed to FIGURE 5 wherein the next step in the assembly series is illustrated. In this connection, two individually prepared spherical segment panels are placed in side-by-side abutting relationship. The locking ears of one segment are pivoted downwardly through the confines of the locking slot combination **48–49**. As is indicated, the profile of the locking slot combination **48–49** provides a means for forming a pair of locking or retaining shoulders **48A** and **49A** respectively. These locking shoulders permit the passage of the locking ears **50–51**, particularly when the finger areas **53** and **54** have been removed from the locking ears. Accordingly, each locking ear pair is moved pivotally downwardly through the locking slot, and into a disposition by which they are substantially parallel to the outer surface of the individual spherical segments or gores. Upon completion of this joining operation, the assembly will assume a curved configuration which is concave to the reader, as illustrated in FIGURE 5. This assembly operation is continued until a sufficient number of spherical segments have been mutually adjoined, and a sufficient number of gores are available to form a hemisphere. In the embodiment shown in this application, a plurality of twelve gores are utilized for each hemisphere. If certain indicia such as, for example, a global map or the like are presented along the surface of the gores, the selection of individual gores must come of course, following a preselected pattern. A suitable numbering scheme or the like may be utilized in order to expedite the selection of the individual pattern.

After the individual hemispheres have been prepared from the group of individual segments or gores, reinforcing ribs such as the ribs **63**, may be inserted into the channel means which are formed in the confined area established when the elongated tabs are turned upon themselves. As previously indicated, the score lines which are formed along these tabs are arranged in divergent relationship, one to another, relative to the lateral seam lines of the individual spherical panels or gores. Thus, the height dimension of the channels is the greatest at the point adjacent the origin of the spherical segment. The reinforcing ribs **63** may thus be inserted into these channels to an extent whereby the rib will become locked against the confines of the channel. The profile of the reinforcing rib is adapted to match the profile of the channels, hence the rib may become snugly fitted within the confines of the individual channels. Particular attention is directed to FIGURE 9 wherein the composite structure of the channels and reinforcing ribs are shown, the reinforcing ribs being illustrated, in part, in phantom. If desired, a triangular reinforcing panel may be inserted under the individual locking tabs, the reinforcing panel having substantially the planar configuration of the individual gore.

Following the insertion of the reinforcing ribs, the circular reinforcing rim is then ready to be attached or secured to the bases of the individual spherical segments. As previously indicated, the tabs **56** are folded radially inwardly along the score line **26** at the base of the spherical segment, and the blocking prong **56** is inserted into the confines of the annularly disposed locking slots **61—61**. Obviously, these locking prongs **56—56** have a sufficiently large transverse dimension so as to prevent their escaping from the confines of the locking ports **61—61**. In this regard, a blocking shoulder or the like **67** is provided in order to more securely retain the tab within the confines of the locking port **61**. The assembly operation is indicated in FIGURE 8 of the drawings, the operation being substantially complete in this figure. The penultimate locking tab is shown as it is being folded radially inwardly, and before it is pressed into contact with the port **61**. The final tab to be inserted is also shown at approximately the eleven o'clock position, and immediately to the right of the penultimate tab being inserted. After this operation is accomplished, the hemisphere is complete.

Following the assembly of two complete hemispheres, a sphere may be fabricated therefrom in accordance with the operation illustrated in FIGURE 9. In this connection, a support post or rod **70** is inserted diametrically through each of the hemispheres. The axis of the reinforcing rod or shaft **70** coincides with the axis of the polar caps **66—66** which have previously been utilized to provide a suitable support for the individual origin points for the spherical panel segments. Following insertion of the pole member, a pair of outer retainer caps **72** and **73** may be positioned coaxially with the caps **66—66**, and the shaft **15** may then be passed diametrically through the center of the hemisphere pair. A shoulder **75** supports the hemisphere pair along the lower pole area, while the cap screw **18** supports the hemisphere pair at the other pole area. If desired, and in order to conceal the seam which exists along the juncture point of the bases of the individual spherical panel segments or gores, a suitable tape or the like may be used to cover this area of the individual hemisphere pairs.

It will be appreciated that while various specific embodiments of the apparatus of the present invention have been illustrated and described herein, those skilled in the art will be able to depart from these specific examples without actually departing from the spirit and scope of the present invention. Therefore, these specific illustrations are provided for purposes of illustration only, and are not to be otherwise construed as a limitation upon the scope of the present invention.

What is claimed is:

1. Flexible spherical panel segments adapted to be serially joined along the lateral edge surfaces thereof to form a closed spherical shell, each of said panel segments comprising:

(a) a spherical segment face panel portion representing one gore of the spherical shell to be formed,

(b) a plurality of first and second elongated tab members extending laterally outwardly and in oppositely disposed relationship from each lateral edge of said face panel portion and adjoining said face along a lateral seam, each tab being foldable upon itself, having interlocking means adapted to engage an oppositely disposed tab in locking relationship one with another, at least one locking ear formed in a first elongated tab member and disposed adjacent to said lateral seam, at least one locking slot in a second elongated tab member and disposed adjacent said lateral seam, and being further arranged to receive a locking ear in cooperative relationship therewith.

2. In combination, flexible spherical panel segments and at least one reinforcing rib therefor, each panel segment being adapted to be serially joined to a similar segment along the lateral edge surfaces thereof to form a closed spherical shell, each of said panel segments comprising:

(a) a spherical segment face panel portion representing one gore of the spherical shell to be formed,

(b) a plurality of first and second elongated tab members extending laterally outwardly and in oppositely disposed relationship from each lateral edge of said face panel portion and adjoining said face along a lateral seam, each elongated tab being foldable upon itself, having interlocking means adapted to engage an oppositely disposed elongated tab in locking relationship therewith and further being adapted when so folded, to form a composite circumferential channel each elongated tab portion forming the channel being foldable substantially normally and inwardly to the face panel portion, at least one locking ear formed in at least one first elongated tab member and disposed adjacent to said lateral seam, at least one locking slot formed in a second elongated tab member and disposed adjacent said lateral seam and being further arranged to receive a locking ear in cooperative relationship therewith, the locking ear being disposed substantially parallel to said face panel, and

(c) at least one arcuate reinforcing rib arranged along and disposed within said composite channel.

3. The combination as defined in claim 2 being further characterized in that said composite channels have a progressively decreasing radial height dimension from one channel end to the other, and said reinforcing ribs have a substantially matching progressively decreasing height dimension and are adapted to be snugly received within said composite channels.

4. The combination as defined in claim 2 being particularly characterized in that the outer edge surface of said arcuate reinforcing rib has an outer radius substantially equal to the radius of said spherical shell.

5. The combination as defined in claim 2 being particularly characterized in that an arcuate reinforcing rib is provided for each joint between adjacent panel segments.

6. In combination, flexible spherical panel segments adapted to be serially joined along the edge surfaces thereof to form a closed spherical shell and a circular ring having locking slots therein adapted to be joined to

said segments along the base edge of the panel segments, each of said panel segments comprising:

(a) a spherical segment face panel portion having two lateral edges and one base edge and representing one gore of the spherical shell to be formed,

(b) a plurality of first and second elongated tab members extending laterally outwardly and in oppositely disposed relationship from each lateral edge of said face panel portion and adjoining said face along a lateral seam, each elongated tab being foldable upon itself and having interlocking means adapted to engage an oppositely disposed elongated tab in locking relationship therewith and further being adapted to form a circumferential composite channel when so folded, each elongated tab forming the composite channel being foldable substantially normally and radially inwardly to the face panel portion, at least one locking ear formed in a first elongated tab member and disposed adjacent to said lateral seam, at least one locking slot formed in a second elongated tab member and disposed adjacent said lateral seam and being further arranged to receive a locking ear in cooperative relationship therewith, and third tab members extending outwardly from the base edge of said face panel portion, said third tab members having locking ears adapted to be received in the locking slots of said circular ring.

7. Flexible spherical panel segments adapted to be serially joined along the lateral edge surfaces thereof to form a closed spherical shell, each of said panel segments comprising:

(a) a spherical segment face panel portion having a base edge, and a pair of lateral edges intersecting said base edge and meeting at an orgin, the face panel representing one gore of the spherical shell to be formed,

(b) a plurality of first and second elongated tab members extending laterally outwardly and in oppositely disposed relationship from each lateral edge of said face panel portion and adjoining said face along a lateral seam, each tab being foldable upon itself, having interlocking means adapted to engage an oppositely disposed tab in locking relationship one with another, at least one locking ear formed in a first elongated tab member and disposed adjacent to said lateral seam, at least one locking slot in a second elongated tab member and disposed adjacent said lateral seam, and being further arranged to receive a locking ear in cooperative relationship therewith,

(c) means for joining a plurality of spherical panel segments along the origin thereof to form a hemisphere,

(d) means for mutually joining said hemispheres along the base edges of the panel segments to form a sphere, and

(e) axial reinforcing means disposed diametrically through said hemispheres from one polar origin point to the other.

References Cited by the Examiner

UNITED STATES PATENTS

2,352,225	6/1944	Riddiford	35—46
2,378,115	6/1945	Von Siegl	35—46
2,436,860	3/1948	Fisher	35—46

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