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(54) **COLLAPSIBLE STRUCTURES**

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(57) **ABSTRACT**

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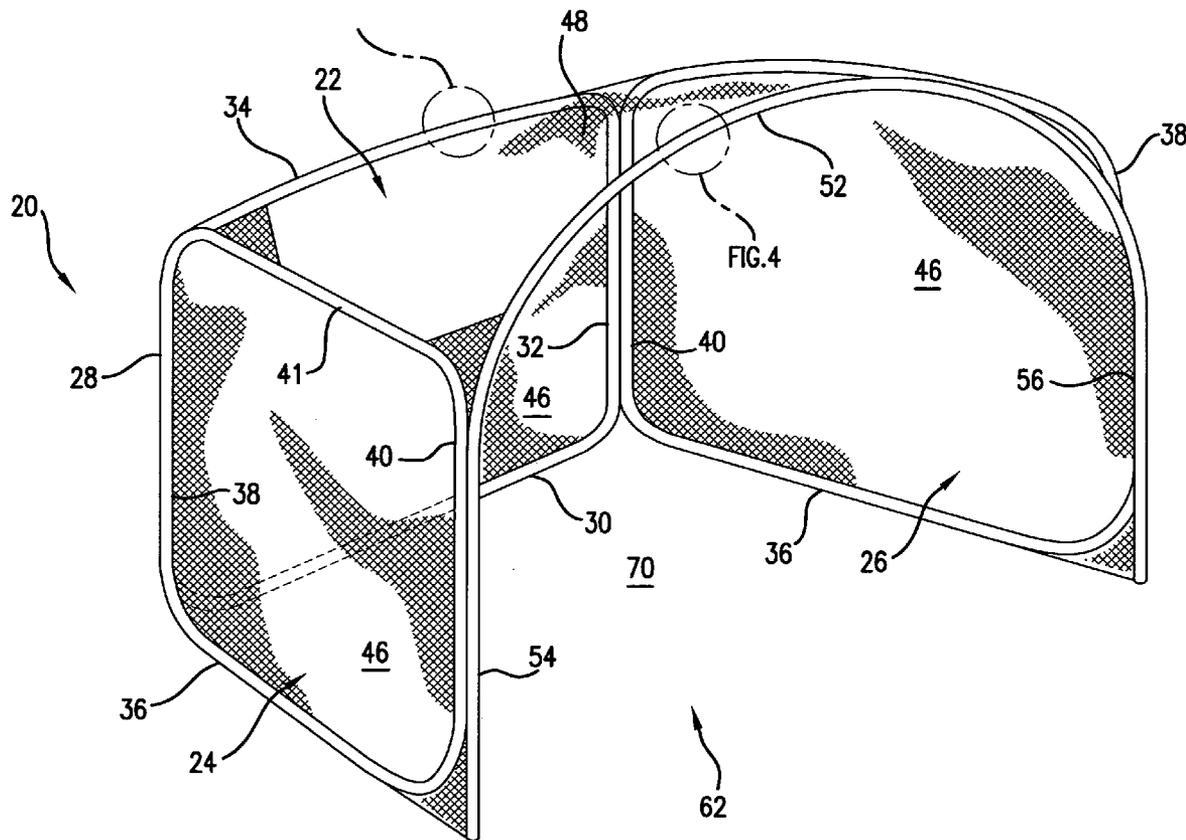
A collapsible structure has a first panel, a second panel and a third panel, with the second and third panels each having a foldable frame member that has a folded and an unfolded orientation, with a fabric material covering portions of each respective frame member to form the second or third panel for each frame member when the frame member is in the unfolded orientation. The left side of the first panel is hingedly coupled to the right side of the second panel, and the right side of the first panel is hingedly coupled to the left side of the third panel. A support member includes a frame member that has unconnected ends, the support member having a first portion hingedly coupled to the left side of the second panel, and a second portion hingedly coupled to the right side of the third panel.

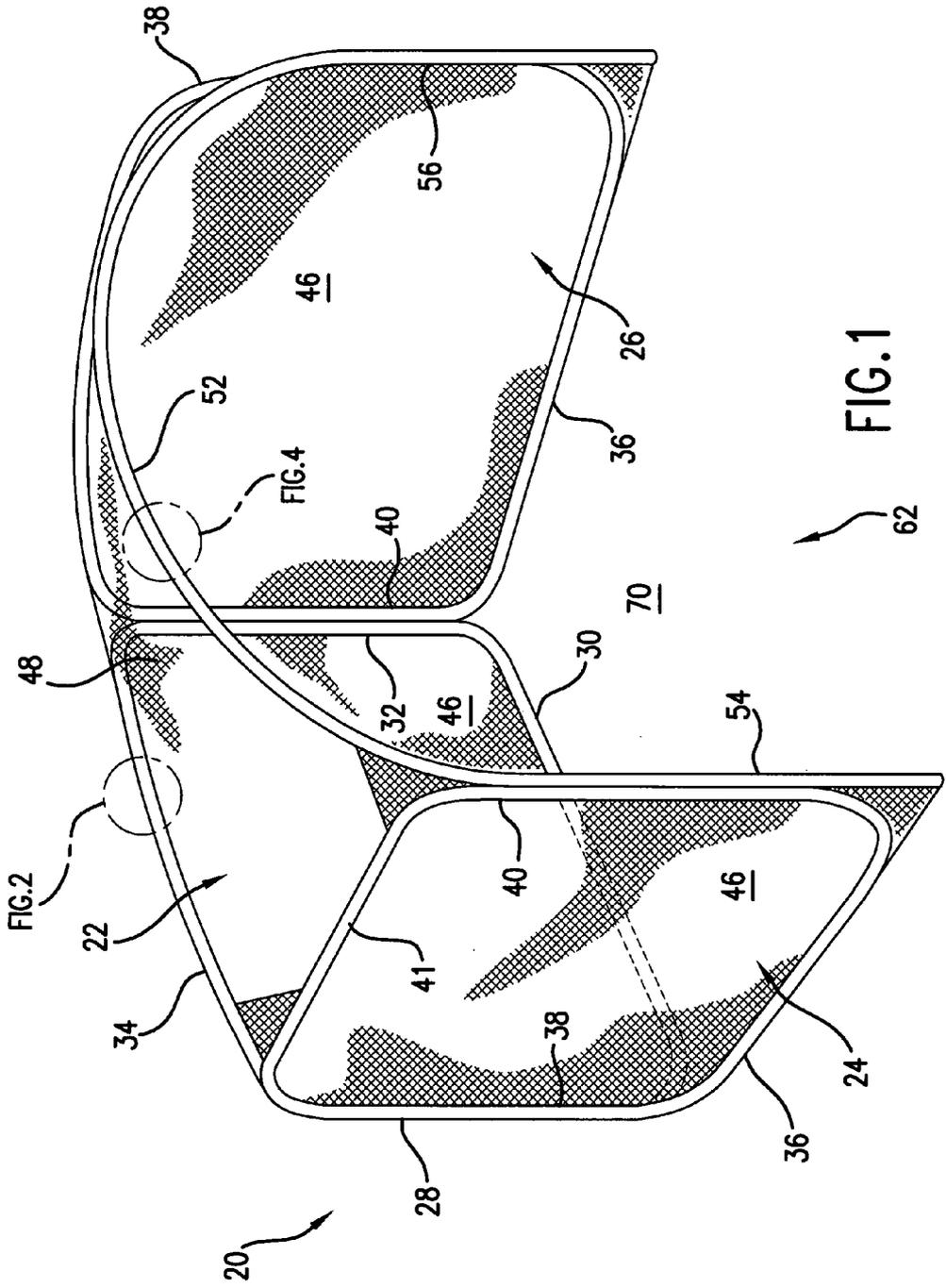
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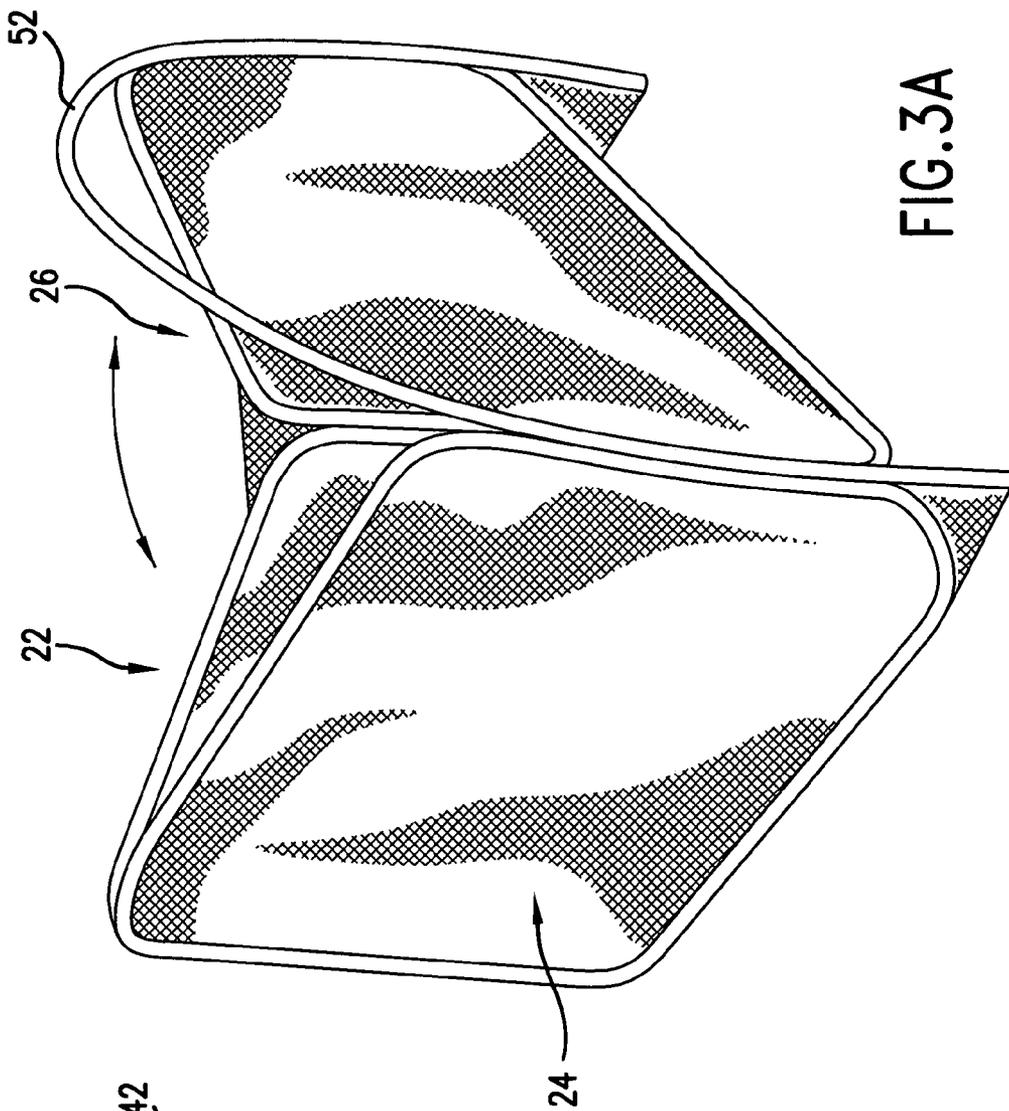


FIG. 3A

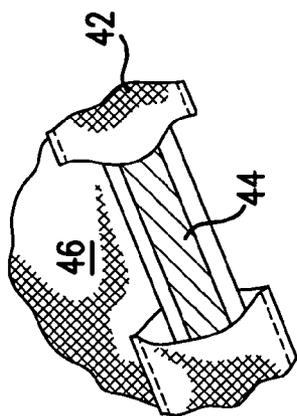


FIG. 2

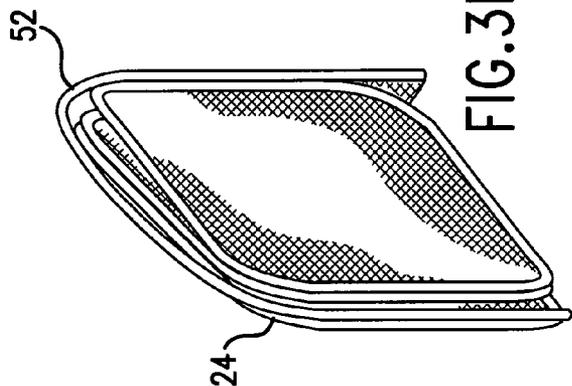


FIG. 3B

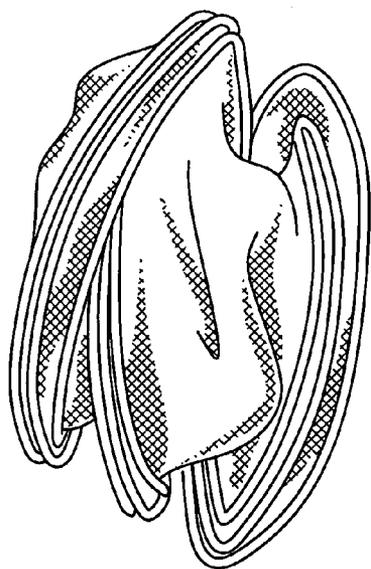


FIG. 3D

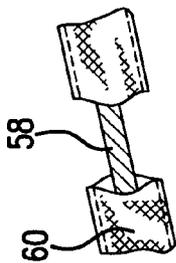


FIG. 4

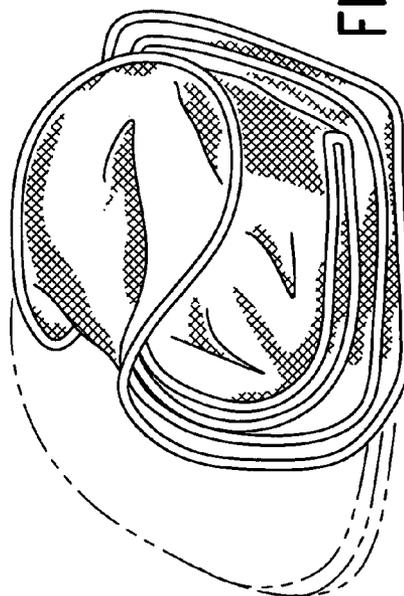


FIG. 3C

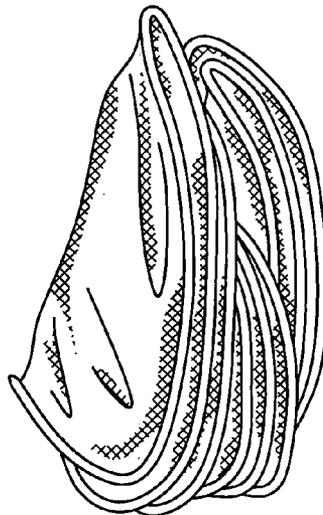


FIG. 3E

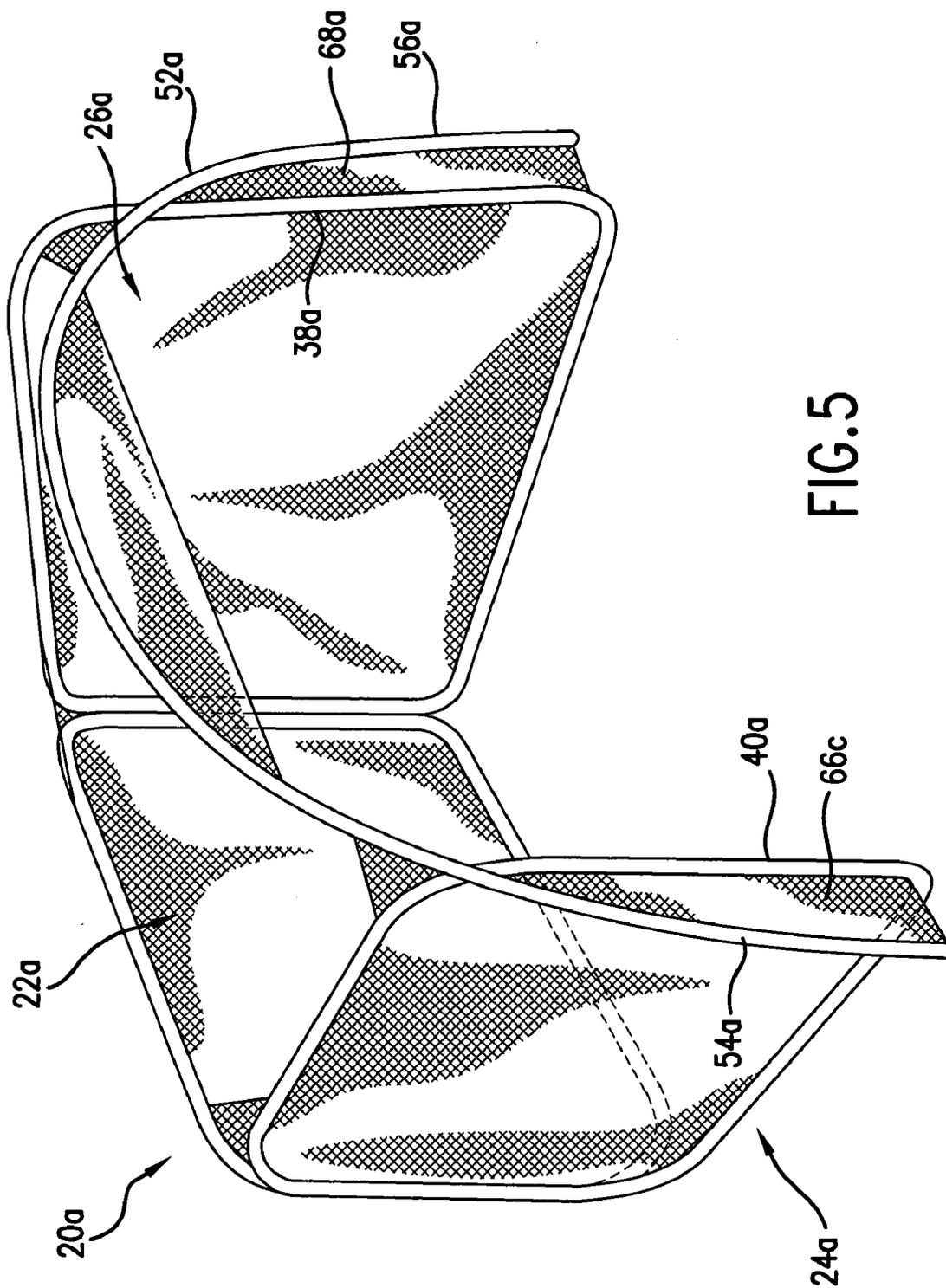


FIG. 5

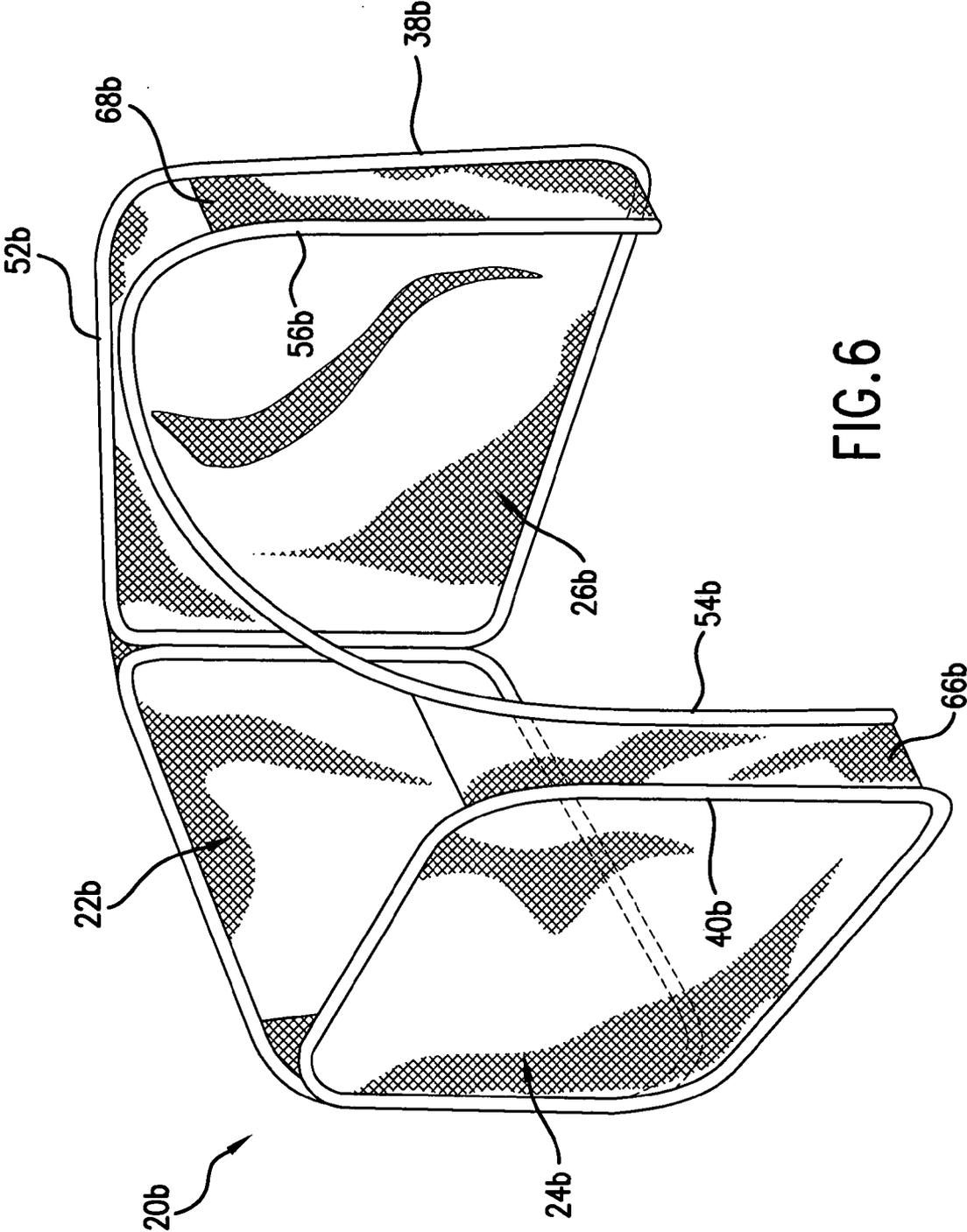


FIG. 6

## COLLAPSIBLE STRUCTURES

### BACKGROUND OF THE INVENTION

#### [0001] 1. Field of the Invention

[0002] The present invention relates to collapsible structures, and in particular, to collapsible structures which may be twisted and folded to reduce the overall size of the assembly to facilitate convenient storage and use.

#### [0003] 2. Description of the Prior Art

[0004] There are presently many collapsible structures that are being provided for use by children and adults in a number of different applications. Examples of these collapsible structures are illustrated in the following patents: U.S. Pat. No. 5,816,954 (Zheng), U.S. Pat. No. 6,006,772 (Zheng), U.S. Pat. No. 5,778,915 (Zheng), U.S. Pat. No. 5,467,794 (Zheng), U.S. Pat. No. 5,975,101 (Zheng), U.S. Pat. No. 5,722,446 (Zheng), U.S. Pat. No. 4,858,634 (McLeese), U.S. Pat. No. 4,825,592 (Norman), U.S. Pat. No. 5,964,533 (Ziglar), U.S. Pat. No. 5,971,188 (Kellogg et al.), and U.S. Pat. No. 5,038,812 (Norman), among others. These collapsible structures are supported by one or more frame members that can be twisted and folded to reduce the overall size of the structure. These collapsible structures can be used in a wide variety of applications, such as containers, tents, play structures, executive toys, shelters, sports structures, and others. As a result, collapsible structures have become very popular.

### SUMMARY OF THE DISCLOSURE

[0005] The present invention provides collapsible structures having a first panel, a second panel and a third panel, with the second and third panels each having a foldable frame member that has a folded and an unfolded orientation, with a fabric material covering portions of each respective frame member to form the second or third panel for each frame member when the frame member is in the unfolded orientation. The left side of the first panel is hingedly coupled to the right side of the second panel, and the right side of the first panel is hingedly coupled to the left side of the third panel. A support member includes a frame member that has unconnected ends, the support member having a first portion hingedly coupled to the left side of the second panel, and a second portion hingedly coupled to the right side of the third panel.

### BRIEF DESCRIPTION OF THE DRAWINGS

[0006] FIG. 1 is a perspective view of a collapsible structure according to one embodiment of the present invention.

[0007] FIG. 2 is a partial cut-away view of the section 2 of the structure of FIG. 1 illustrating a frame member retained within a sleeve.

[0008] FIGS. 3A-3E illustrate how the structure of FIGS. 1 and 2 can be twisted and folded to reduce the structure to a size which is a fraction of the size of the free-standing structure.

[0009] FIG. 4 is a partial cut-away view of the section 4 of the structure of FIG. 1 illustrating another frame member retained within another sleeve.

[0010] FIG. 5 is a perspective view of a collapsible structure according to another embodiment of the present invention.

[0011] FIG. 6 is a perspective view of a collapsible structure according to yet another embodiment of the present invention.

### DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0012] The following detailed description is of the best presently contemplated modes of carrying out the invention. This description is not to be taken in a limiting sense, but is made merely for the purpose of illustrating general principles of embodiments of the invention. The scope of the invention is best defined by the appended claims.

[0013] As used herein, the terms “hingedly coupled” or “hingedly connected” mean to couple two edges or sides by stitching or by the use of removable attachment mechanisms, such as but not limited to, Velcro™ pads or opposing toggles and loops in a manner where the panels can be folded about the connection.

[0014] FIG. 1 illustrates a collapsible structure 20 that has three panels 22, 24 and 26 that are hingedly connected to each other to partially enclose an enclosed space. One panel 22 acts as a central panel, and the other two panels 24 and 26 are side panels. The panel 22 has four sides, with a left side 28, a bottom side 30, a right side 32 and a top side 34. Each of the side panels 24 and 26 has a four-sided configuration, with a bottom side 36, a left side 38, a right side 40, and a top side 41. The right side 40 of the panel 26 is hingedly connected to the right side 32 of the panel 22, and the left side 38 of the panel 24 is hingedly connected to the left side 28 of the panel 22. Each panel 22, 24 and 26 has a continuous frame retaining sleeve (e.g., see 42 in FIG. 2) provided along and traversing the edges of its sides. A continuous frame member 44 is retained or held within each frame retaining sleeve 42 to support and define the shape of each panel 22, 24 and 26. Only the frame member 44 is shown in FIG. 2; the other frame members are not shown but are the same as frame member 44.

[0015] The continuous frame members 44 may be provided as one continuous loop, or may comprise a strip of material connected at both ends to form a continuous loop. The continuous frame members 44 are preferably formed of flexible coilable steel, although other materials such as plastics may also be used. The frame members 44 should be made of a material which is relatively strong and yet is flexible to a sufficient degree to allow it to be coiled. The material should have a memory that allows the frame members to spring back to the expanded position when unfolded from the folded position. Thus, each frame member 44 is capable of assuming two positions or orientations, an open or expanded position such as shown in FIG. 1, or a folded position (see FIG. 3E) in which the frame member is collapsed into a size which is much smaller than its open position.

[0016] Fabric or sheet material 46 extends across each panel 22, 24, 26, and is held generally taut by the respective frame members 44 when in its open position. The term “fabric” is to be given its broadest meaning and should be made from strong, lightweight materials and may include woven fabrics, sheet fabrics or even films. The fabric should be water-resistant and durable to withstand the wear and tear associated with rough treatment by children. The frame members 44 may be merely retained within the respective frame retaining sleeves 42 without being connected thereto. Alternatively, the frame retaining sleeves 42 may be mechanically fastened, stitched, fused, or glued to the frame members 44 to retain them in position.

[0017] The structure 20 further includes an arched or curved support member 52 that has opposite ends 54 and 56. The support member 52 includes a frame member 58 which can be housed inside a sleeve 60 (see FIG. 4). The frame member 58 can be made from the same material as the frame members 44, or of a stiffer material (e.g., fiberglass, plastics). A portion of the support member 52 adjacent one end 54 is attached (e.g., by stitching) to the sleeve 42 of the right side 40 of the panel 24, and a portion of the support member 52 adjacent the other end 56 is attached (e.g., by stitching) to the sleeve 42 of the left side 38 of the panel 26. The arched support member 52 defines an open space 62 which provides access to the interior of the structure 20. The interior of the structure 20 is defined by the panels 22, 24, 26, and a roof 48, if the roof 48 is utilized.

[0018] An optional roof 48 can be attached to the top of the support member 52, and the top sides 41 of the panels 22, 24 and 26, respectively, to form a canopy or shade. The roof 48 can be made of the same material as the fabric 46, and can be stitched to the sides 41 of the panels 22, 24 and 26, respectively, and to the support member 52, in the manner shown in FIG. 2.

[0019] The structure 20 shown in FIG. 1 can be folded and collapsed very quickly and conveniently. First, as shown in FIG. 3A, the panel 26 can be pushed or folded towards the support member 52 about the hinged connection between the panel 26 and the support member 52, which causes the panels 22, 24 and 26 to be pivoted about their respective hinged connections in the manner shown in FIG. 3A. Specifically, the panel 22 is pushed or folded against the panel 24, and then the combined panels 22 and 24 are pushed or folded against the panel 26 to form a stack of panels 24, 22, 26, in that order, with the support member 52, as shown in FIG. 3B. Then, the resulting structure (i.e., the stack of panels and support member 52) is twisted and folded to collapse the frame members and panels into a smaller shape. This can be accomplished by folding one border of the combined panels in upon the previous fold (see FIG. 3C) to further collapse the frame members with the panels. As shown in FIG. 3D, the next step is to continue the collapsing so that the initial size of the structure is reduced. FIG. 3E shows the frame members and panels collapsed on each other to provide for a small essentially compact configuration having a plurality of concentric frame members and layers of the panels so that the collapsed structure has a size which is a fraction of the size of the initial structure. Even though the frame member 58 of the support member 52 has discrete non-connected ends, the frame member 58 can still be twisted and folded together with the frame members 44.

[0020] To deploy the structure 20 for use, the user merely opens the folded panels 22, 24, 26. The natural bias of the frame members 44, 58 will cause the frame members 44, 58 to uncoil, so that the panels 22, 24, 26 and the support member 52 quickly spring back to the configuration shown in FIG. 3A. The panels 22, 24, 26 are then folded out away from the support member 52, so that the structure 20 is again ready for use. Thus, the structure 20 can be quickly and easily folded and collapsed for storage, and can be quickly and easily opened and re-deployed for use. The compact size of the collapsed structure 20 makes storage simple and convenient.

[0021] FIG. 5 illustrates another structure 20a that is very similar to the structure 20 in FIG. 1, but with the connection between the support member 52a and the panels 24a and 26a being modified. The three panels 22a, 24a, 26a can be the

same as, and be connected in the same manner as, the panels 22, 24, 26 in FIG. 1. However, the portions 54a and 56a of the support member 52a are now connected to the sides 40a and 38a of the panels 24a and 26a, respectively, by interconnecting fabrics 66a and 68a, respectively, that extend outwardly from the sides 40a and 38a of the panels 24a and 26a, respectively, with the support member 52a oriented perpendicular to the planar dispositions of the panels 24a and 26a. Thus, the width of the support member 52a is greater than the width of the opposing panel 22a. The structure 20a can be twisted and folded in the same manner as illustrated in FIGS. 3A-3E.

[0022] FIG. 6 illustrates another structure 20b that is very similar to the structures 20 and 20a in FIGS. 1 and 5, but with the connection between the support member 52b and the panels 24b and 26b being modified in a different way. The three panels 22b, 24b, 26b can be the same as, and be connected in the same manner as, the panels 22, 24, 26 in FIG. 1. However, the portions 54b and 56b of the support member 52b are now connected to the sides 40b and 38b of the panels 24b and 26b, respectively, by interconnecting fabrics 66b and 68b, respectively, that extend inwardly from the sides 40b and 38b of the panels 24b and 26b, respectively, with the support member 52b oriented perpendicular to the planar dispositions of the panels 24b and 26b. Thus, the width of the support member 52b is less than the width of the opposing panel 22b. The structure 20b can be twisted and folded in the same manner as illustrated in FIGS. 3A-3E.

[0023] A base or mat 70 can be provided for the structure 20 in FIG. 1. For example, a fabric base 70 can be permanently attached (e.g., by stitching) to the bottom sides 30, 36 of the panels 22, 24, 26. Alternatively, a base 70 that is made of a non-fabric but soft or elastic material (e.g., a foam base) can be removably coupled (e.g., by VELCRO™ pads, hooks, toggles, etc.) to the bottom sides 30, 36 of the panels 22, 24, 26.

[0024] The support member 52 functions to provide or define an opening for access to the interior of the structure 20. In addition, the support member 52 provides stability to the panels 22, 24, 26 that would allow the structure 20 to be embodied in larger sizes. For these reasons, the structures 20, 20a and 20b illustrated herein are well-suited for use as display booths, soccer goals, and other similar applications where a free-standing, largish yet stable, structure with an opened side (with the opening having good structural support) is desired.

[0025] While the description above refers to particular embodiments of the present invention, it will be understood that many modifications may be made without departing from the spirit thereof. The accompanying claims are intended to cover such modifications as would fall within the true scope and spirit of the present invention. As a non-limiting alternative, the panel 22 can be provided without a frame member 44, and provided merely in the form of a fabric material 46 that extends between the sides 38 and 40 of the panels 24 and 26, respectively.

1-16. (canceled)

17. A collapsible structure, comprising:

a first panel, a second panel and a third panel, each panel having a continuous foldable frame member that has a folded and an unfolded orientation, with a fabric material covering portions of each respective frame member to form the panel for each frame member when the frame member is in the unfolded orientation, each panel having a first side and a second side;

wherein the first side of the first panel is hingedly coupled to the second side of the second panel, and the second side of the first panel is hingedly coupled to the first side of the third panel;

a support member that includes a frame member that has unconnected ends, the support member having a first portion hingedly coupled to the first side of the second panel, and a second portion hingedly coupled to the second side of the third panel.

**18.** The structure of claim **17**, wherein the support member has a sleeve that houses the frame member of the support member.

**19.** The structure of claim **17**, wherein each panel has a sleeve that retains the respective frame member for the panel.

**20.** The structure of claim **17**, wherein each panel has a sleeve that retains the respective frame member for the panel, and wherein the sleeve of the support member at the first

portion is stitched to the sleeve of the second panel at the first side of the second panel, and the sleeve of the support member at the second portion is stitched to the sleeve of the third panel at the second side of the third panel.

**21.** The structure of claim **17**, wherein the first portion is coupled to the first side of the second panel by a first interconnecting fabric, and the second portion is coupled to the second side of the third panel by a second interconnecting fabric.

**22.** The structure of claim **17**, further including a roof coupled to the panels.

**23.** The structure of claim **17**, wherein the support member is arched.

**24.** The structure of claim **17**, further including a base coupled to the panels.

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