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Wu

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(54) **METHOD FOR FOLDING FLAT, NON-RIGID MATERIALS TO CREATE RIGID, THREE-DIMENSIONAL STRUCTURES**

(71) Applicant: **Indiana University Research and Technology Corp.**, Indianapolis, IN (US)

(72) Inventor: **Jiangmei Wu**, Bloomington, IN (US)

(73) Assignee: **Indiana University Research and Technology Corporation**, Indianapolis, IN (US)

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Related U.S. Application Data

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(51) **Int. Cl.**

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F21V 1/26	(2006.01)
F21V 1/18	(2006.01)

(52) **U.S. Cl.**

CPC ***F21V 1/146*** (2013.01); ***F21V 1/18*** (2013.01); ***F21V 1/26*** (2013.01)

(58) **Field of Classification Search**

None

See application file for complete search history.

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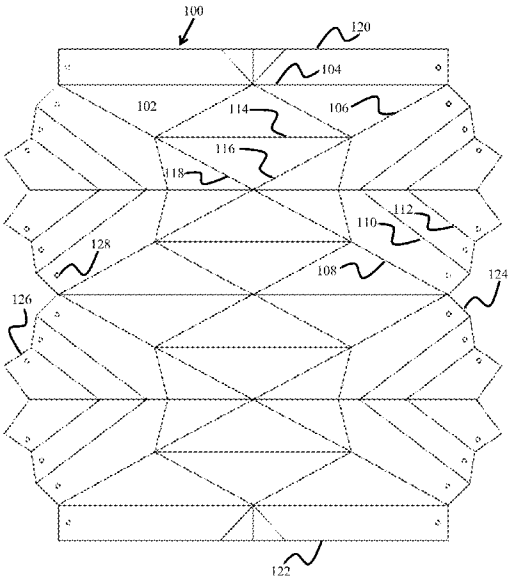
Primary Examiner — Sharon Payne

(74) *Attorney, Agent, or Firm* — Faegre Baker Daniels LLP

(57) **ABSTRACT**

The present disclosure provides a cover for a light source and a method for making a cover for a light source.

19 Claims, 18 Drawing Sheets



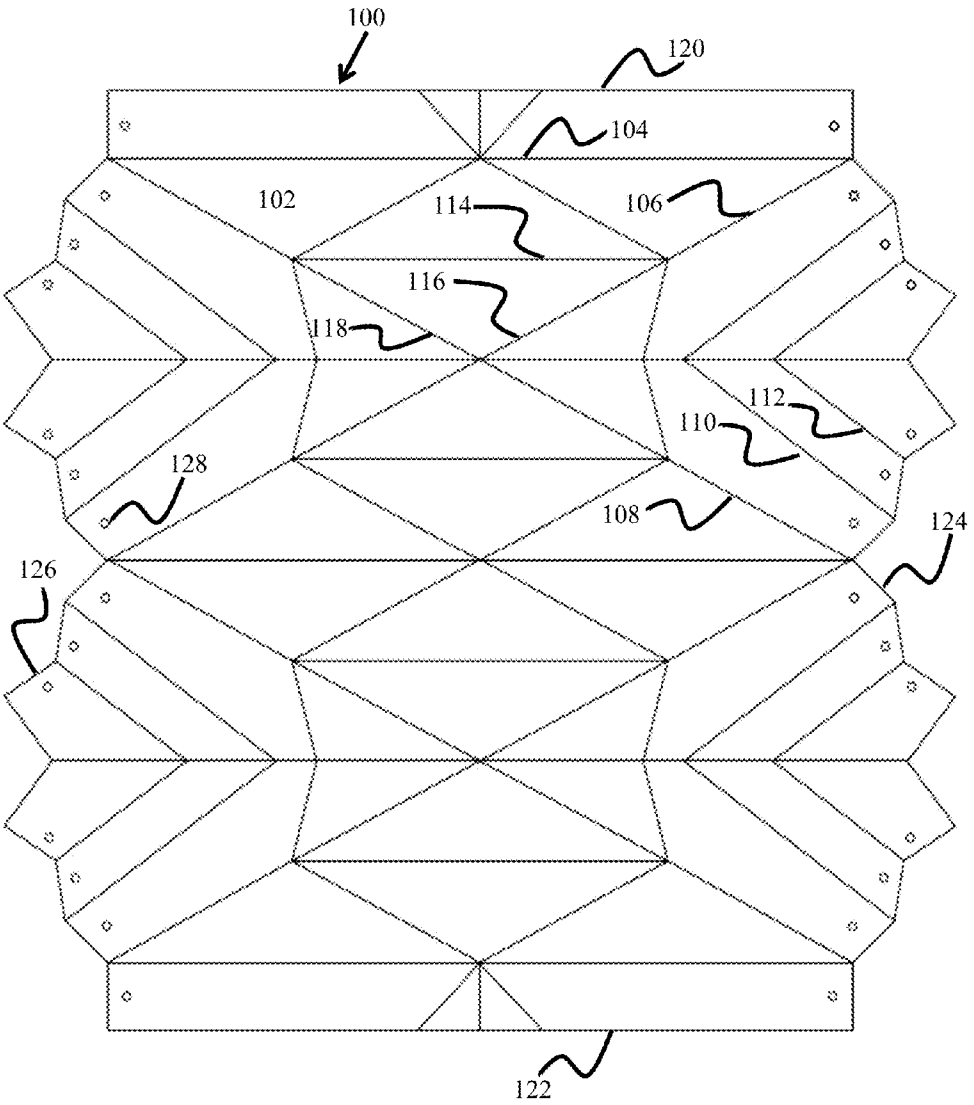


FIG. 1

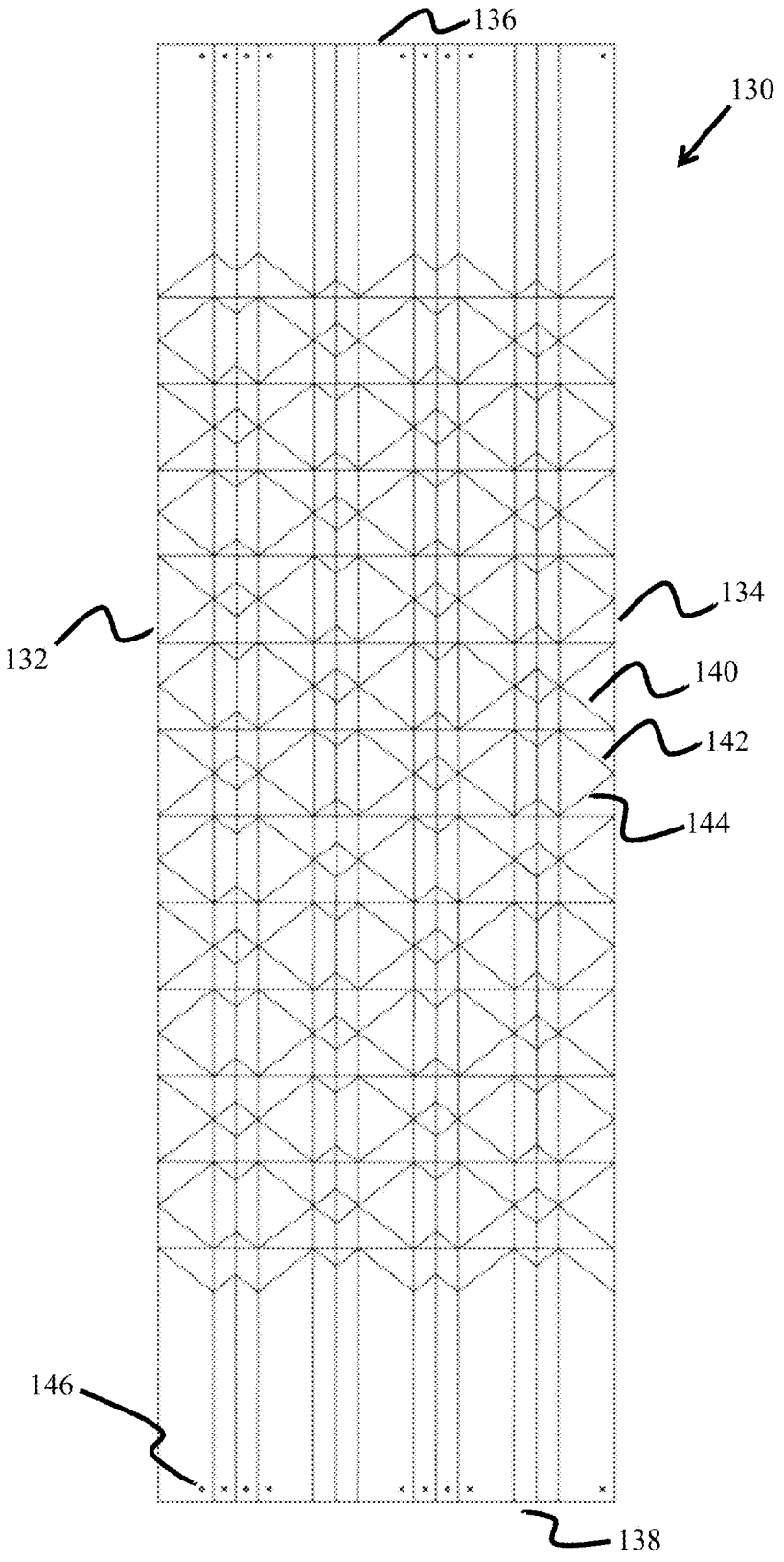


FIG. 2

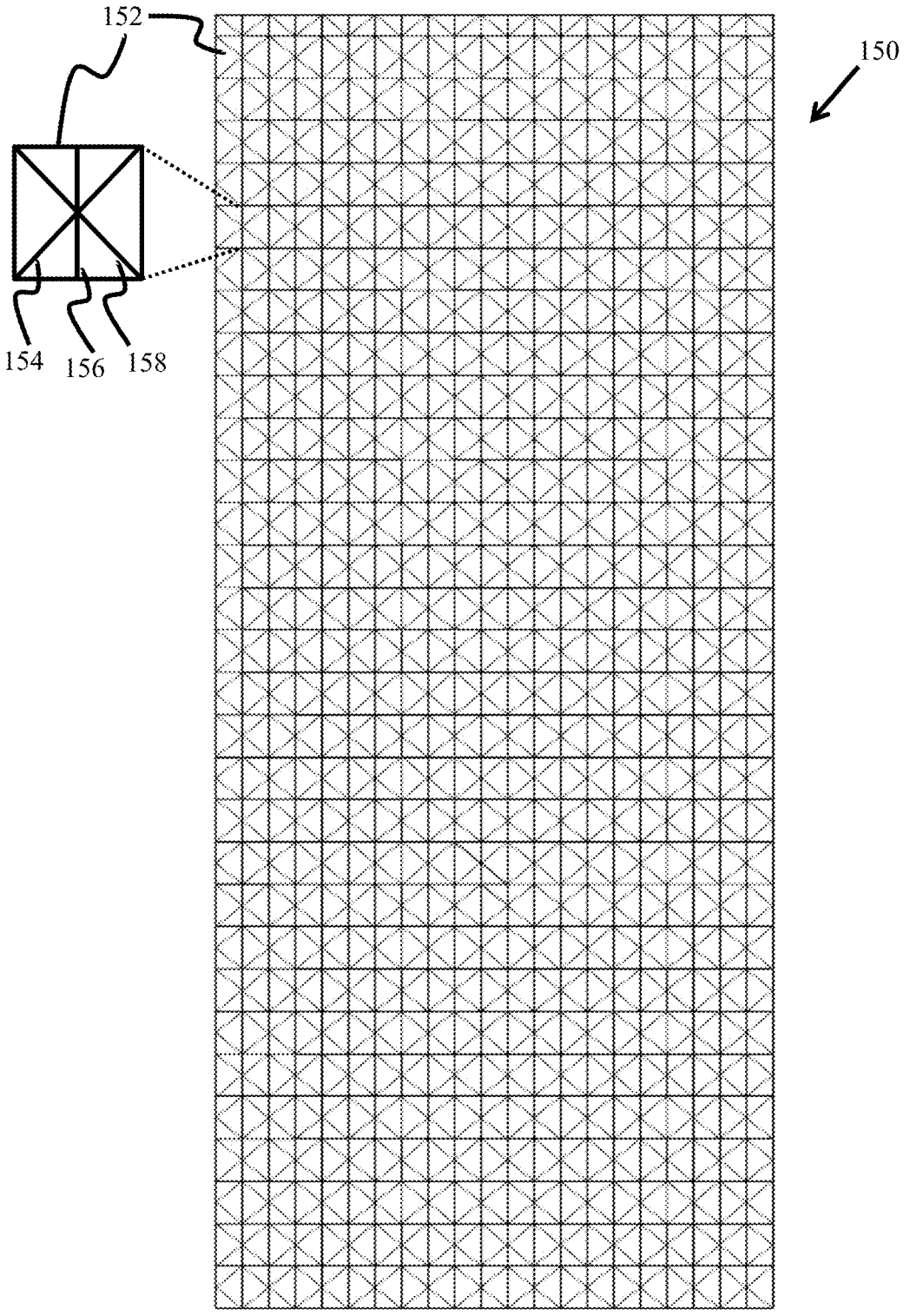


FIG. 3

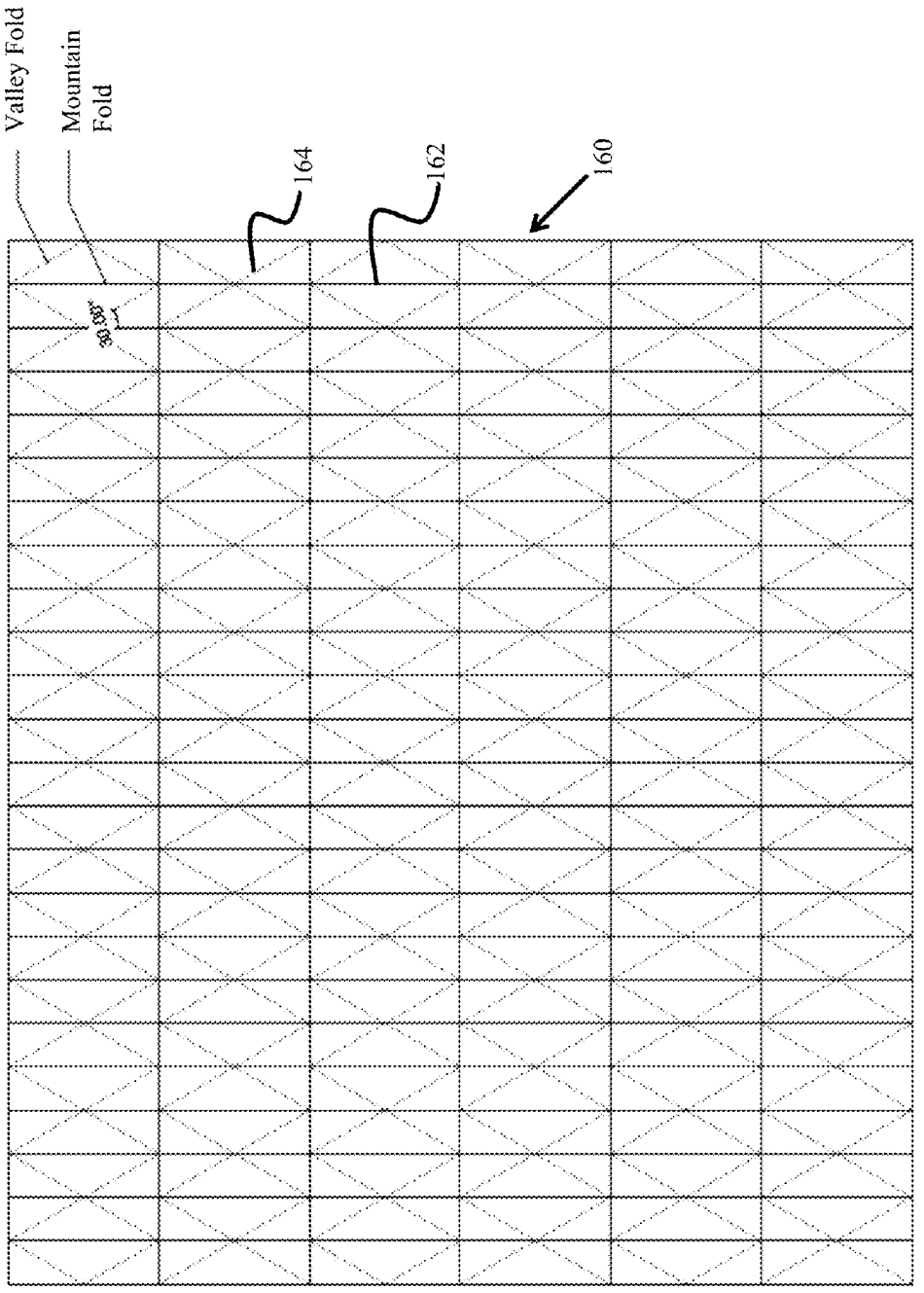


FIG. 4

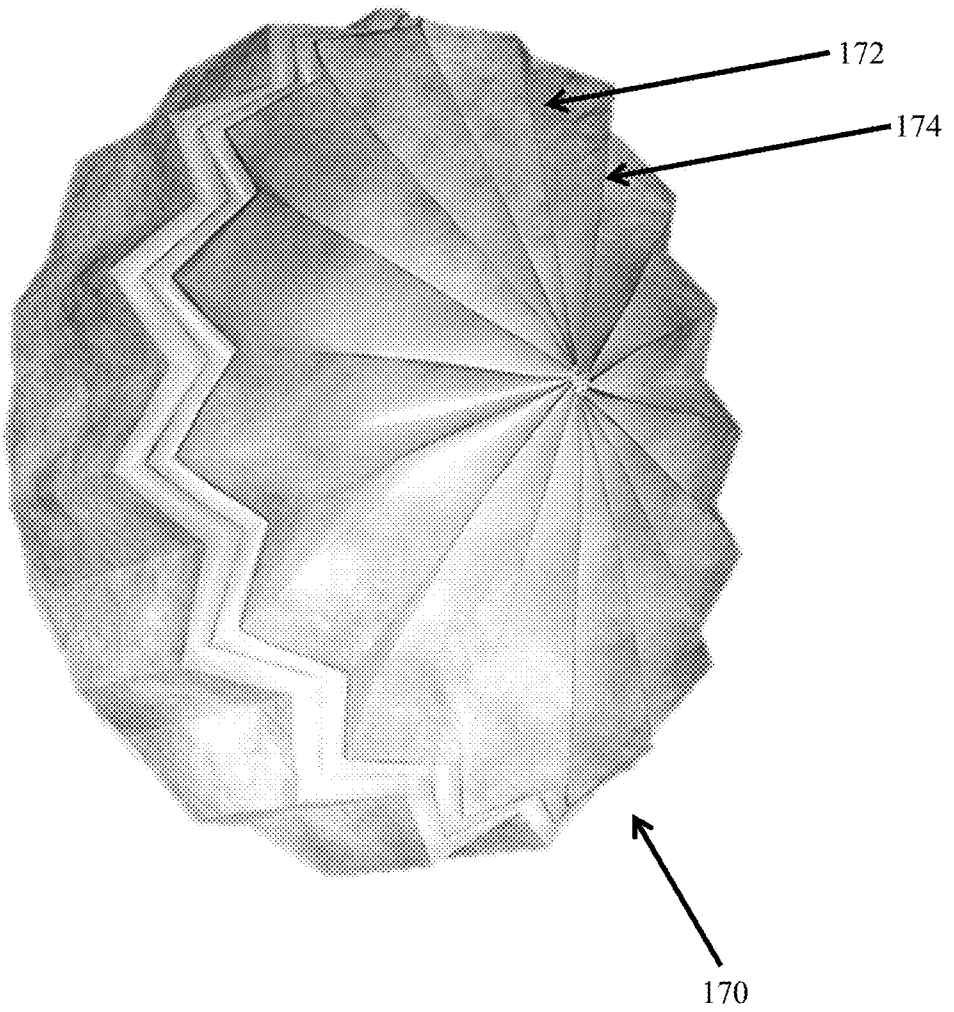


FIG. 5

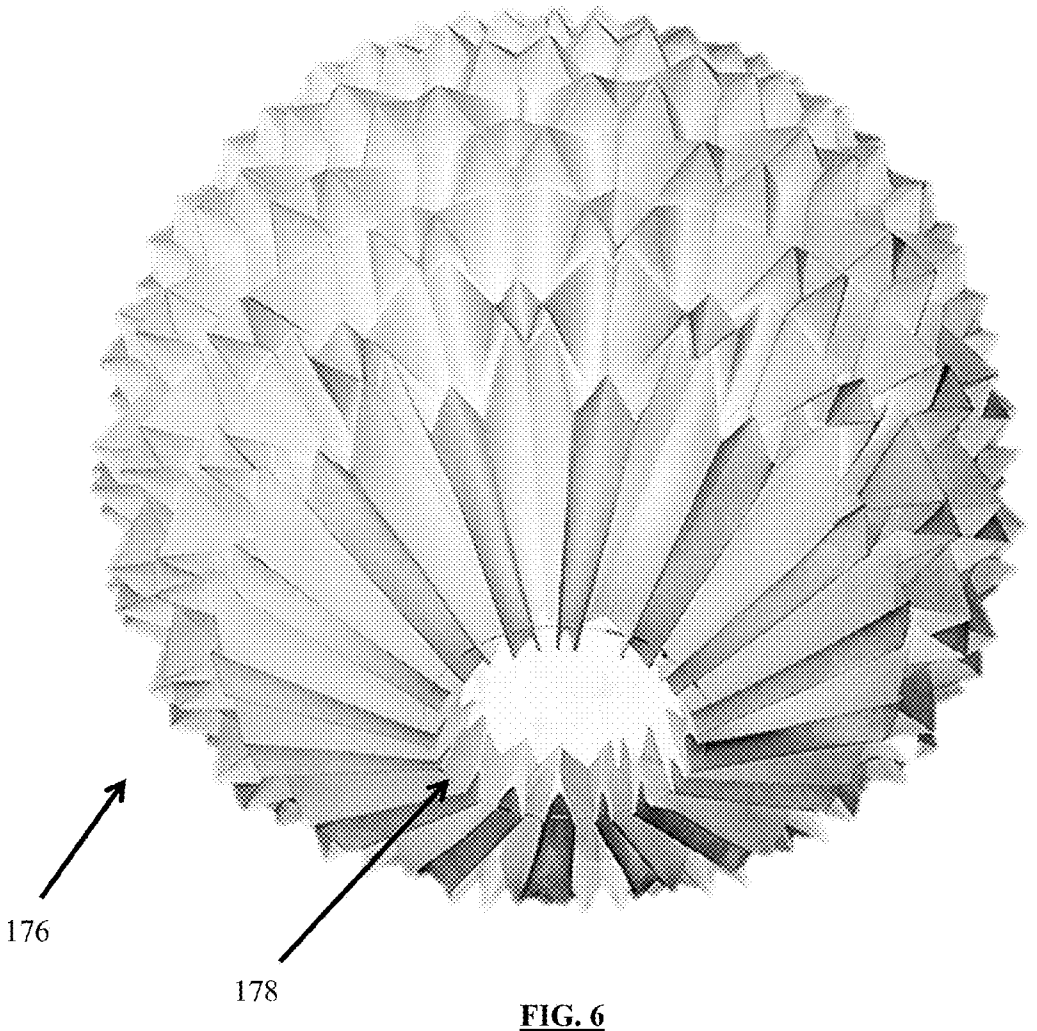


FIG. 6

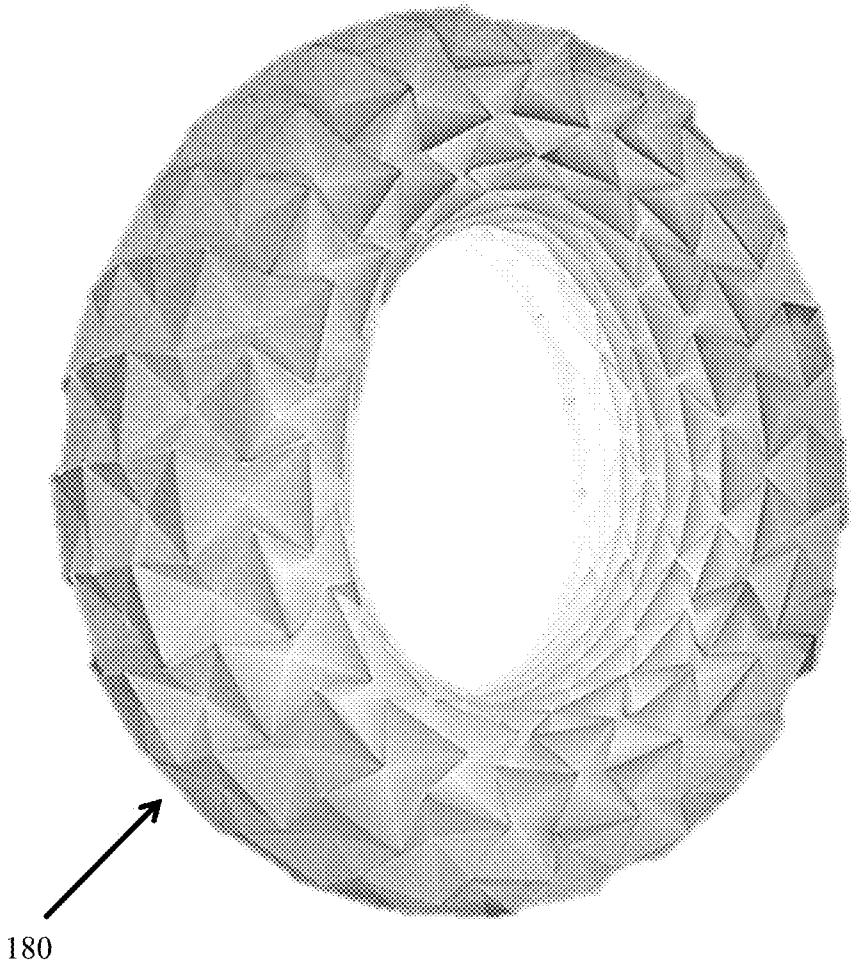


FIG. 7

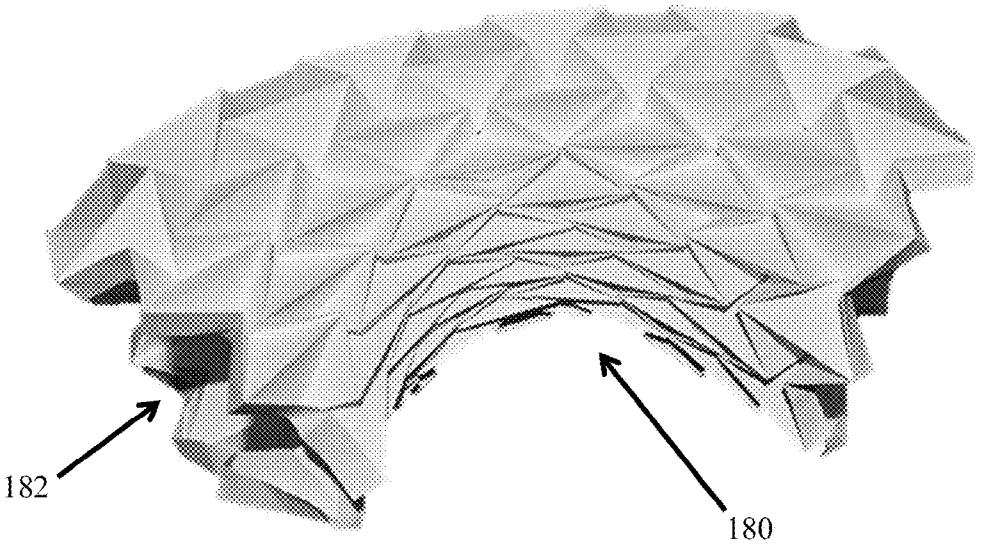


FIG. 8

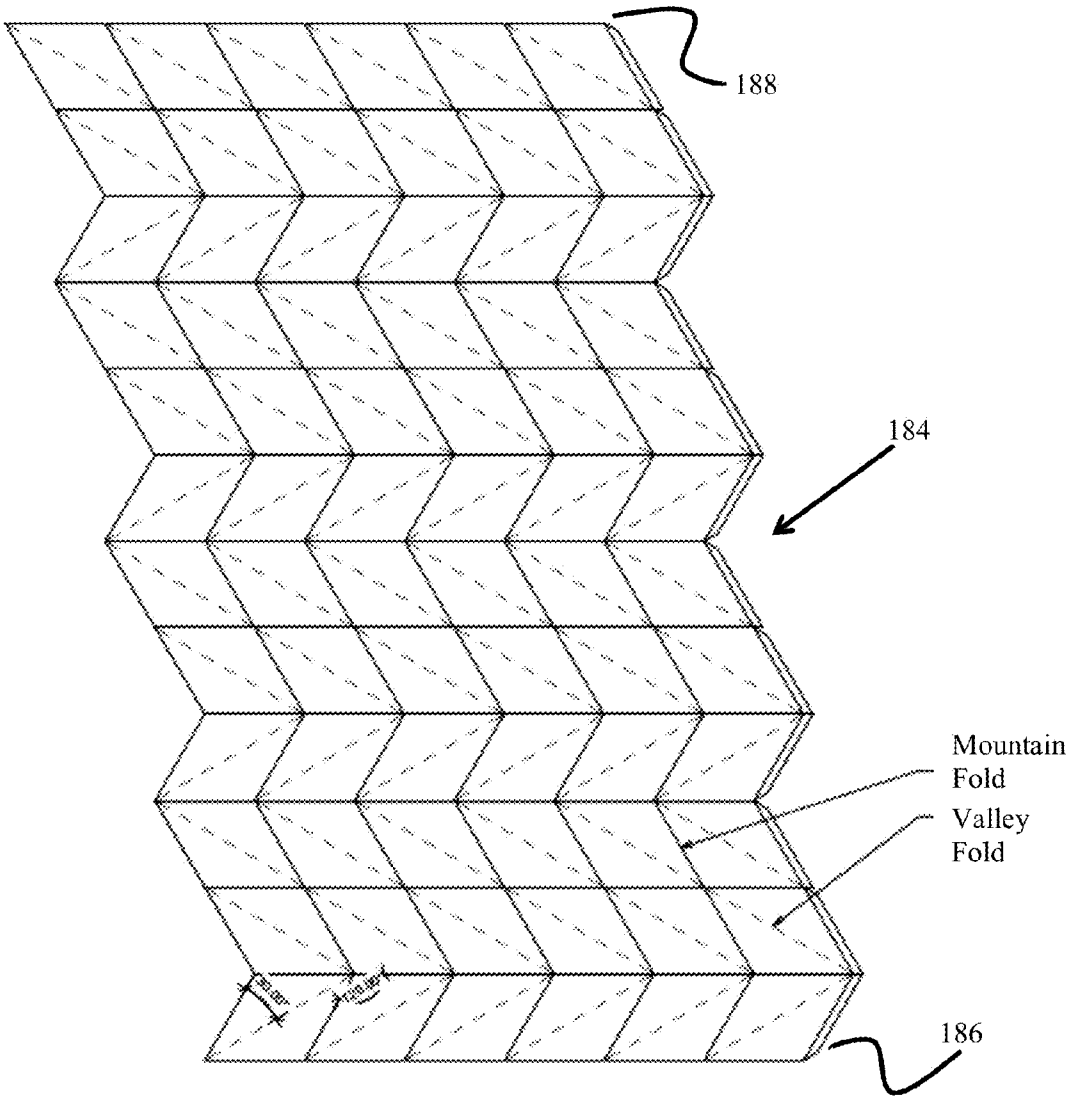


FIG. 9

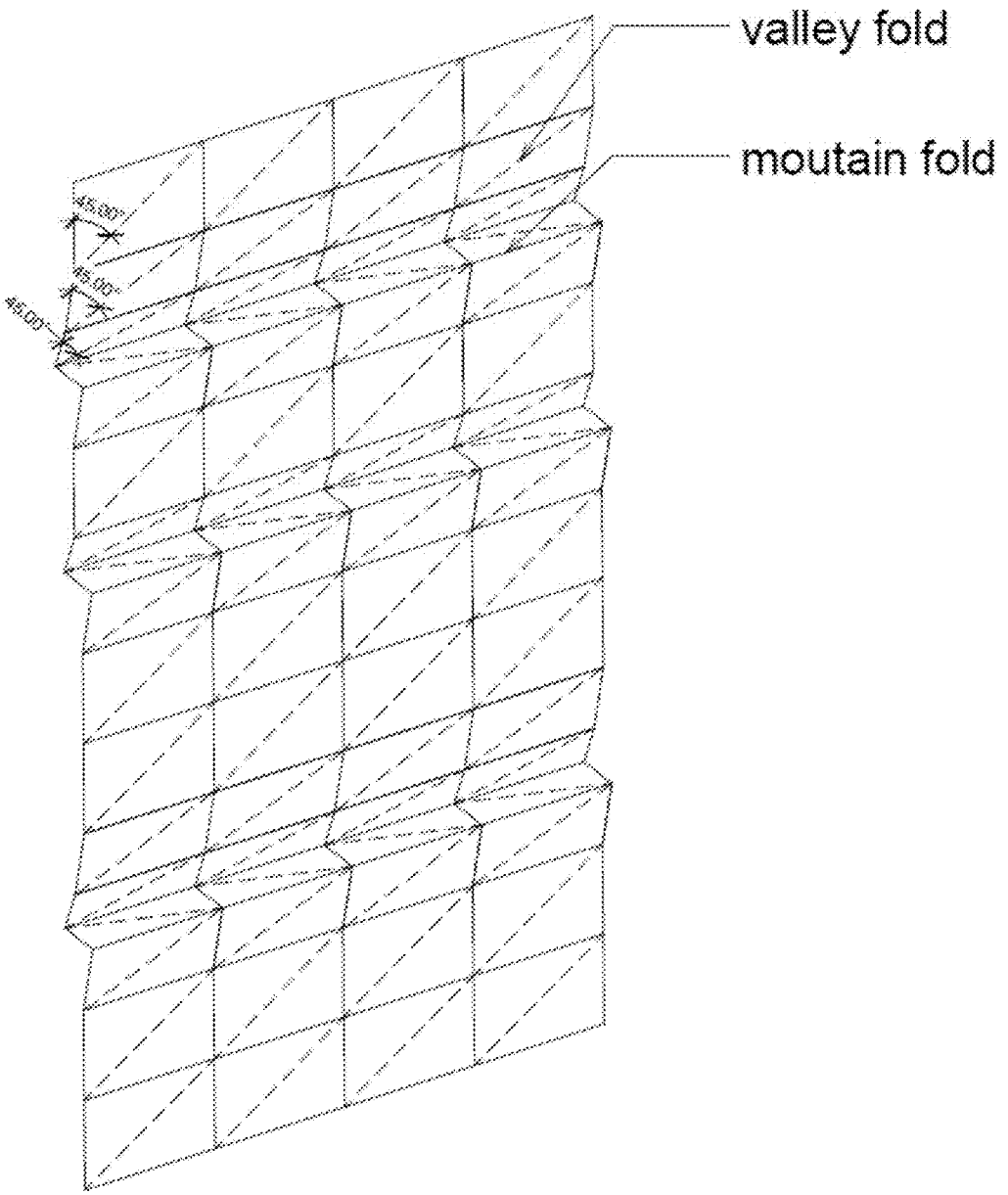


FIG. 10

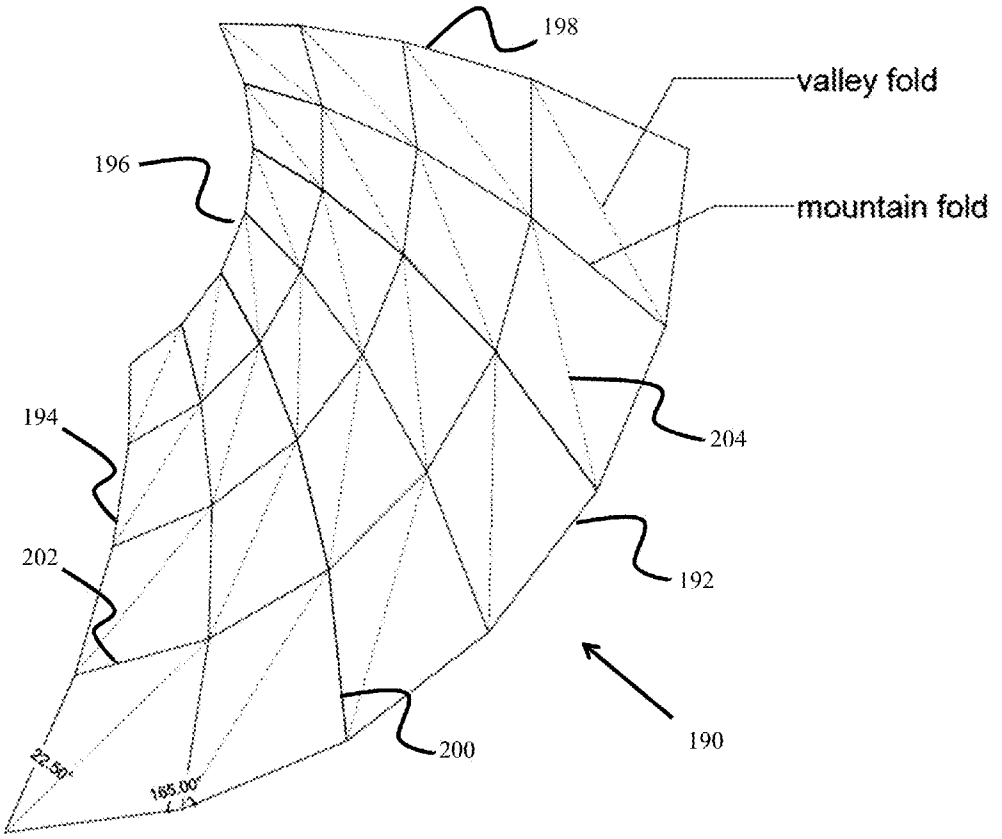

198
valley fold
196
mountain fold
194
204
202
192
200
190
22.50°
165.00°

FIG. 11

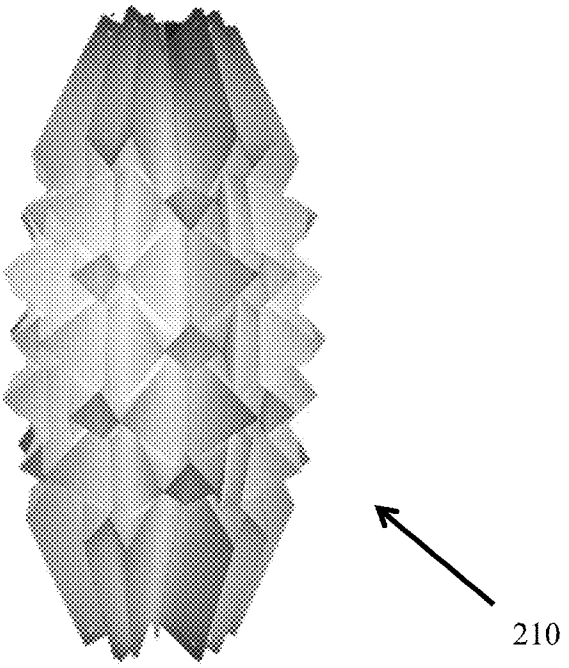


FIG. 12

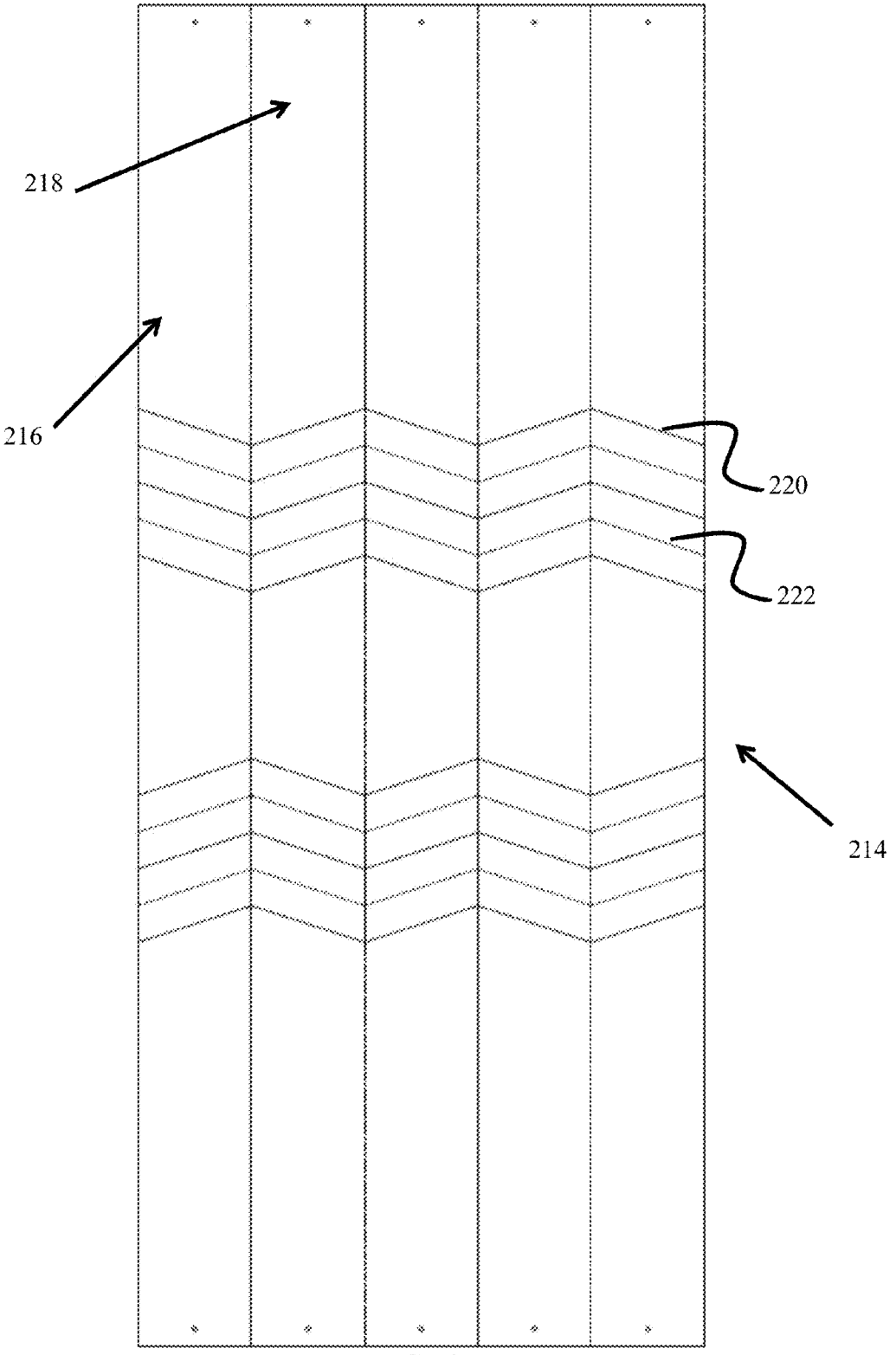


FIG. 13

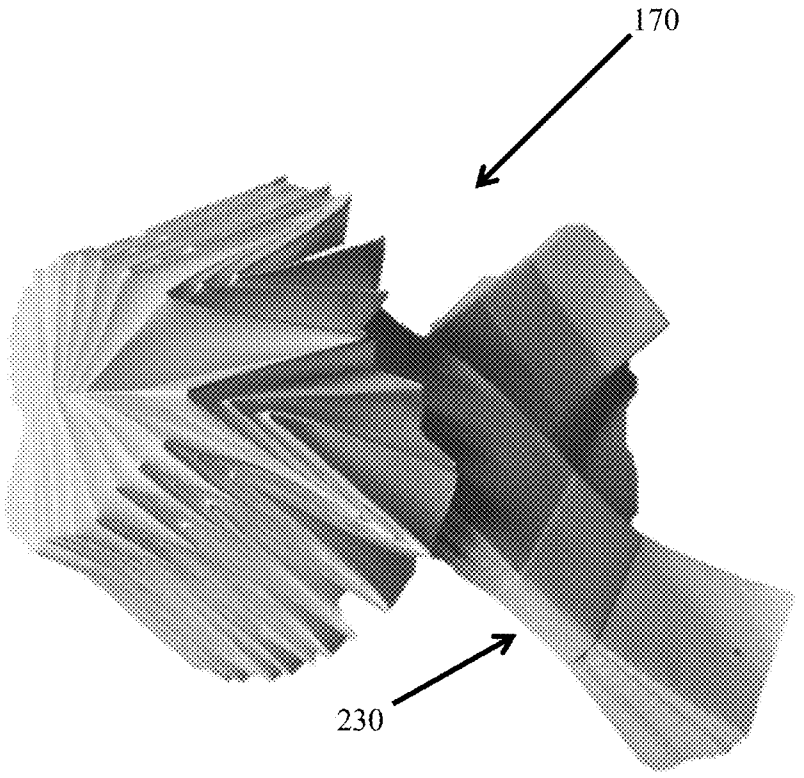


FIG. 14

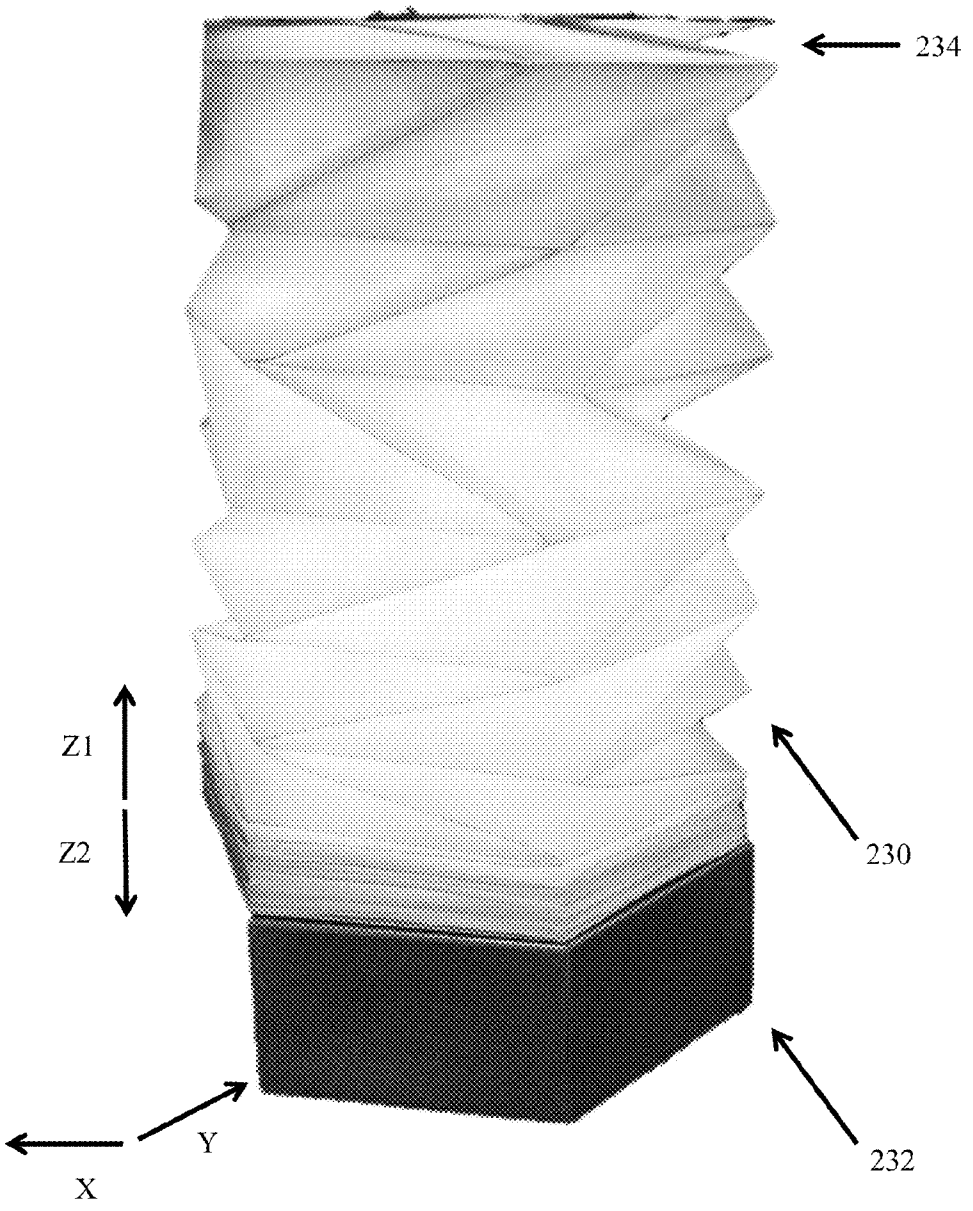


FIG. 15

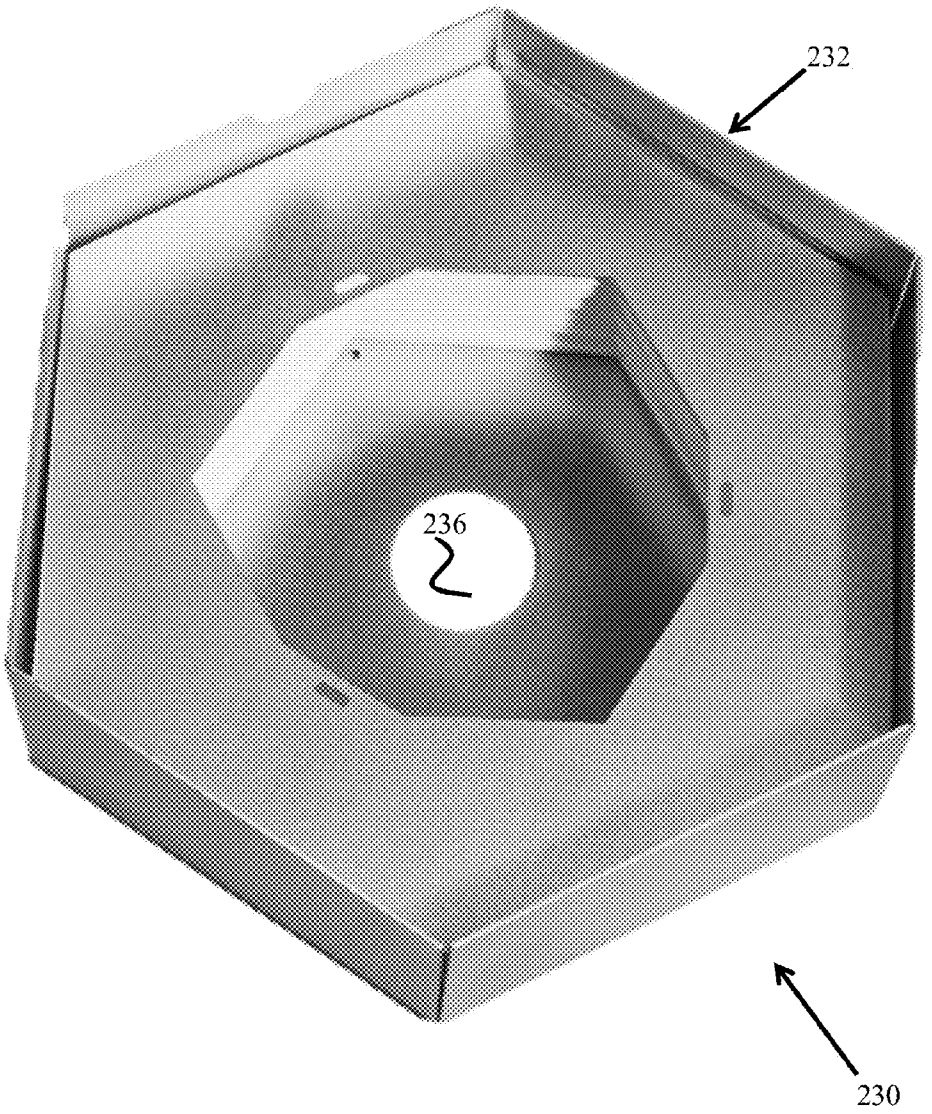


FIG. 16

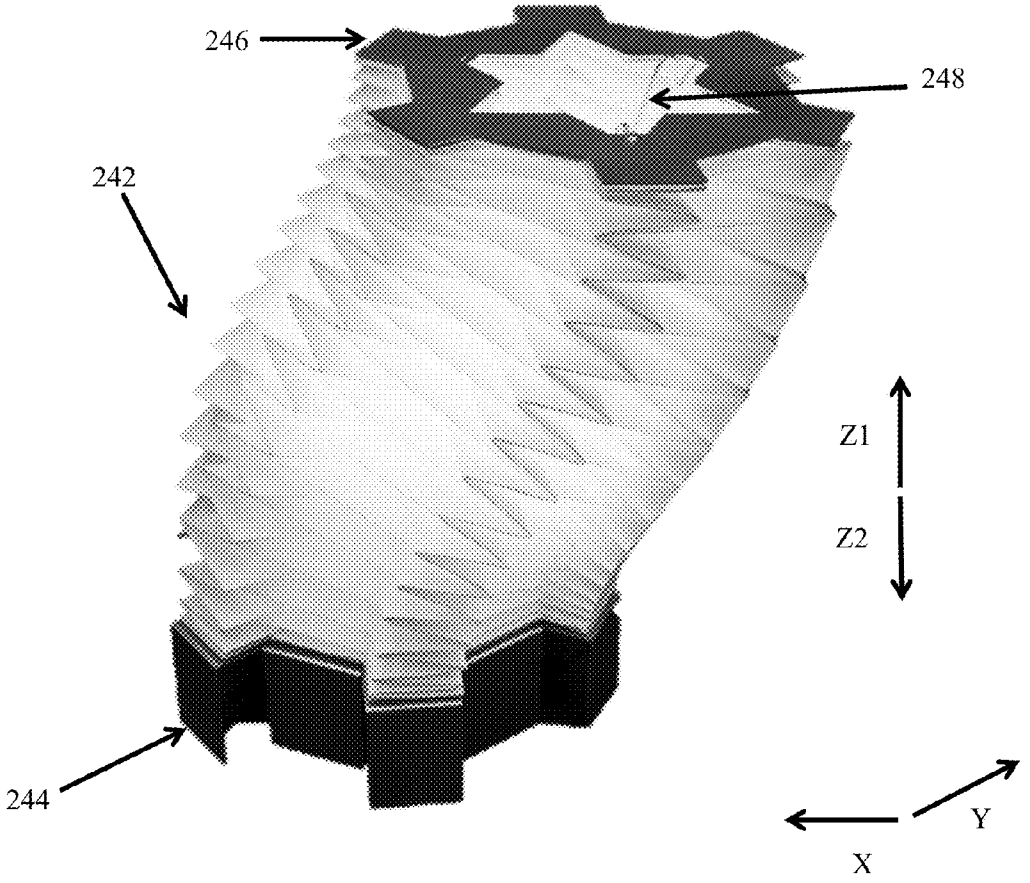


FIG. 17

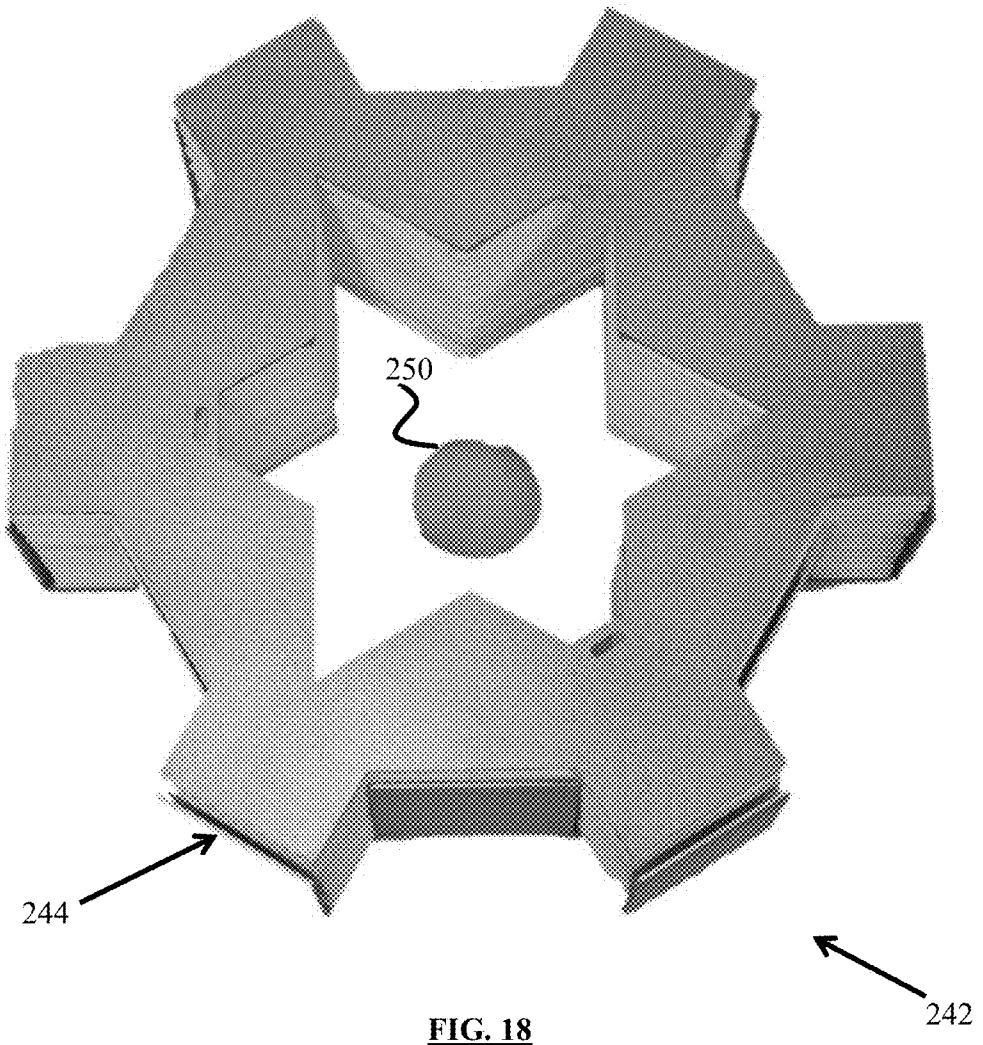


FIG. 18

METHOD FOR FOLDING FLAT, NON-RIGID MATERIALS TO CREATE RIGID, THREE-DIMENSIONAL STRUCTURES

PRIORITY CLAIM

The present application claims priority to U.S. Provisional Patent App. No. 61/893,519, filed Oct. 21, 2013, the entire disclosure of which is hereby expressly incorporated herein by reference.

FIELD

The present disclosure relates generally to creating rigid three-dimensional structures by folding flat, non-rigid materials. More particularly, the present disclosure relates to a method of folding a non-rigid material with a score or crease pattern into a three-dimensional structure for covering a light source.

BACKGROUND AND SUMMARY

A variety of covers and shades exist for use with different light sources. A cover for a light source with a flame, such as an oil lamp, may be made from glass. A cover for a light bulb may be made from cloth, or a similar non-rigid material, which is then made rigid by a metal frame.

The need for light source coverings to rest a distance away from one or more light sources and be stable has required the use of rigid materials or rigid supports with light source coverings. However, this limits the design and aesthetic qualities for light source coverings. In the typical situation, a covering for a light source is made from a rigid material such as glass or plastic, or is made from a non-rigid material such as cloth, and is supported by a frame made from a rigid material, such as metal. Rigid materials such as glass and plastic cannot be easily manipulated like a non-rigid material such as cloth, yet cloth and similar materials cannot provide support without a frame.

Although paper folding has been around for hundreds of years, the advance of digital techniques in recent years has allowed artists, mathematicians and computer engineers to develop complex paper objects that can be folded from hundreds of creases. These creases in paper, or a similar non-rigid material, increase the rigidity of the material. A flat piece of paper doesn't exhibit stiffness, but once paper and similar materials are folded in the manner of the present disclosure, the rigidity and stiffness of the material increase significantly.

In the present disclosure, score lines or crease lines are imprinted or marked on a non-rigid material while it lies substantially flat. In one exemplary embodiment, a non-rigid material is one or more flat pieces of paper, cardboard, or Tyvek. The score lines create patterns or grids on the flat, non-rigid material. The grids allow the paper or similar non-rigid material to be orderly folded with mountain and valley folds. Once folded according to the grids, the non-rigid material behaves in a structurally sound manner. A rigid, three-dimensional shape is formed after folding, and may be used as a cover or shade for a light source.

Various digital programs and digital tools can be used to create score line patterns and mark the score lines onto a non-rigid material, such as paper. These digital pattern design programs include, but are not limited to, those programs such as AutoCAD and Adobe Illustrator. Digital machines can be used to imprint or mark the score patterns or grids onto the non-rigid material without cutting the material. Such machines include, but are not limited to, Graphtec vinyl cutters. Pieces of paper or similarly non-rigid material can be shaped into three-dimensional spatial forms that are structurally cohesive when folded according to particular two-dimensional crease patterns. Mechanical properties such as rigidity or stiffness are altered by adding folded textures to a non-rigid material's surface.

Once the paper or similar non-rigid material is folded into a three-dimensional shape, it may be used as a lamp shade. Though, such a structurally sound three-dimensional object might be used for other purposes, such as, for example, as containers or buildings, at larger or smaller scales. Furthermore, materials of different rigidity may be used depending on the intended final use of the folded object.

In some exemplary embodiments, the present disclosure provides a structure for covering a light source folded from one piece of paper, or one piece of similarly non-rigid material. Paper, as a material, is chosen because it can be easily manipulated using simple tools such as scissors and knives. In such an embodiment, the material can be folded flat for shipping and storage, and can then be deployed into three-dimensional forms. These designs therefore are flat-foldable. In some embodiments, the coverings for a light source are folded from multiple pieces of paper by using modular Origami, or paper folding, techniques. In other embodiments, the cover for a light source may be of a complex design. Such a complex design may be made with a digital program. Once designed, the grids or patterns are scored or marked onto a non-rigid material using a digital machine, such as a digital cutter. In some embodiments, the cover for a light source may be of a simple design and easily reproducible.

In other embodiments, cotton paper or recyclable synthetic material able to be marked and folded, such as Tyvek paper, is used to make a three-dimensional covering for a light source wherein the light source is a LED (light-emitting diode) light or lights. Tyvek, as one example of synthetic material, comprises flashspun high-density polyethylene fibers. The material is very strong, and it is difficult to tear, but can be cut easily with scissors or a knife. Water vapor can pass through Tyvek, but liquid water cannot.

The present disclosure thus provides a cover for a light source comprising a non-rigid material with a plurality of mountain and valley folds, wherein said folds create a rigid three-dimensional shape capable of covering a light source.

Another embodiment provides a cover for a light source comprising a non-rigid material with a plurality of mountain and valley folds, wherein: (1) said folds create a rigid three-dimensional shape capable of covering a light source and (2) the rigid three-dimensional shape comprises a single piece of non-rigid material.

Still another embodiment provides a cover for a light source comprising a non-rigid material with a plurality of mountain and valley folds, wherein: (1) said folds create a rigid three-dimensional shape capable of covering a light source and (2) the non-rigid material is selected from the group consisting of paper, cardboard, synthetic material, and cotton paper.

Still another embodiment provides a cover for a light source comprising a non-rigid material with a plurality of mountain and valley folds, wherein: (1) said folds create a rigid three-dimensional shape capable of covering a light source and (2) the non-rigid material has digitally created and marked score lines to identify locations for said folds.

Still another embodiment provides a cover for a light source comprising a non-rigid material with a plurality of mountain and valley folds, wherein: (1) said folds create a

rigid three-dimensional shape capable of covering a light source, (2) the rigid three-dimensional shape comprises a single piece of non-rigid material, and (3) the non-rigid material has digitally created and marked score lines to identify locations for said folds.

Still another embodiment provides a cover for a light source comprising a non-rigid material with a plurality of mountain and valley folds, wherein: (1) said folds create a rigid three-dimensional shape capable of covering a light source, (2) the non-rigid material is selected from the group consisting of paper, cardboard, synthetic material, and cotton paper, and (3) the rigid three-dimensional shape comprises a single piece of non-rigid material.

Still another embodiment provides a cover for a light source comprising a non-rigid material with a plurality of mountain and valley folds, wherein: (1) said folds create a rigid three-dimensional shape capable of covering a light source, (2) the non-rigid material is selected from the group consisting of paper, cardboard, synthetic material, and cotton paper, and (3) the non-rigid material has digitally created and marked score lines to identify locations for said folds.

Still another embodiment provides a cover for a light source comprising a non-rigid material with a plurality of mountain and valley folds, wherein: (1) said folds create a rigid three-dimensional shape capable of covering a light source, (2) the non-rigid material is selected from the group consisting of paper, cardboard, synthetic material, and cotton paper, (3) the rigid three-dimensional shape comprises a single piece of non-rigid material, and (4) the non-rigid material has digitally created and marked score lines to identify locations for said folds.

This disclosure also provides a method of making a cover for a light source comprising the steps of marking score patterns on a non-rigid material, folding said non-rigid material with mountain and valley folds according to the score patterns into a rigid three-dimensional shape, and placing said three dimensional shape over a light source.

Also disclosed is a method of making a cover for a light source comprising the steps of marking score patterns on a non-rigid material, folding said non-rigid material with mountain and valley folds according to the score patterns into a rigid three-dimensional shape, and placing said three dimensional shape over a light source, wherein the rigid three-dimensional shape comprises a single piece of non-rigid material.

Also disclosed is a method of making a cover for a light source comprising the steps of marking score patterns on a non-rigid material, folding said non-rigid material with mountain and valley folds according to the score patterns into a rigid three-dimensional shape, and placing said three dimensional shape over a light source, wherein the non-rigid material is selected from the group consisting of paper, cardboard, synthetic material, and cotton paper.

Also disclosed is a method of making a cover for a light source comprising the steps of marking score patterns on a non-rigid material, folding said non-rigid material with mountain and valley folds according to the score patterns into a rigid three-dimensional shape, and placing said three dimensional shape over a light source, wherein the score patterns are created and marked with one or more digital computer programs.

Also disclosed is a method of making a cover for a light source comprising the steps of marking score patterns on a non-rigid material, folding said non-rigid material with mountain and valley folds according to the score patterns into a rigid three-dimensional shape, and placing said three dimensional shape over a light source, wherein the light source is comprised of light-emitting diode (LED) lights.

Also disclosed is a method of making a cover for a light source comprising the steps of marking score patterns on a non-rigid material, folding said non-rigid material with mountain and valley folds according to the score patterns into a rigid three-dimensional shape, and placing said three dimensional shape over a light source, wherein: (1) the rigid three-dimensional shape comprises a single piece of non-rigid material and (2) the score patterns are created and marked with one or more digital computer programs.

Also disclosed is a method of making a cover for a light source comprising the steps of marking score patterns on a non-rigid material, folding said non-rigid material with mountain and valley folds according to the score patterns into a rigid three-dimensional shape, and placing said three-dimensional shape over a light source, wherein: (1) the rigid three-dimensional shape comprises a single piece of non-rigid material and (2) the light source is comprised of light-emitting diode (LED) lights.

Also disclosed is a method of making a cover for a light source comprising the steps of marking score patterns on a non-rigid material, folding said non-rigid material with mountain and valley folds according to the score patterns into a rigid three-dimensional shape, and placing said three-dimensional shape over a light source, wherein: (1) the non-rigid material is selected from the group consisting of paper, cardboard, synthetic material, and cotton paper and (2) the rigid three-dimensional shape comprises a single piece of non-rigid material.

Also disclosed is a method of making a cover for a light source comprising the steps of marking score patterns on a non-rigid material, folding said non-rigid material with mountain and valley folds according to the score patterns into a rigid three-dimensional shape, and placing said three-dimensional shape over a light source, wherein: (1) the non-rigid material is selected from the group consisting of paper, cardboard, synthetic material, and cotton paper and (2) the score patterns are created and marked with one or more digital computer programs.

Also disclosed is a method of making a cover for a light source comprising the steps of marking score patterns on a non-rigid material, folding said non-rigid material with mountain and valley folds according to the score patterns into a rigid three-dimensional shape, and placing said three-dimensional shape over a light source, wherein: (1) the non-rigid material is selected from the group consisting of paper, cardboard, synthetic material, and cotton paper and (2) the light source is comprised of light-emitting diode (LED) lights.

Also disclosed is a method of making a cover for a light source comprising the steps of marking score patterns on a non-rigid material, folding said non-rigid material with mountain and valley folds according to the score patterns into a rigid three-dimensional shape, and placing said three-dimensional shape over a light source, wherein: (1) the non-rigid material is selected from the group consisting of paper, cardboard, synthetic material, and cotton paper, (2) the rigid three-dimensional shape comprises a single piece of non-rigid material, and (3) the score patterns are created and marked with digital computer programs.

Also disclosed is a method of making a cover for a light source comprising the steps of marking score patterns on a non-rigid material, folding said non-rigid material with mountain and valley folds according to the score patterns into a rigid three-dimensional shape, and placing said three-dimensional shape over a light source, wherein: (1) the

non-rigid material is selected from the group consisting of paper, cardboard, synthetic material, and cotton paper, (2) the rigid three-dimensional shape comprises a single piece of non-rigid material, and (3) the light source is comprised of light-emitting diode (LED) lights.

Also disclosed is a method of making a cover for a light source comprising the steps of marking score patterns on a non-rigid material, folding said non-rigid material with mountain and valley folds according to the score patterns into a rigid three-dimensional shape, and placing said three-dimensional shape over a light source, wherein: (1) the non-rigid material is selected from the group consisting of paper, cardboard, synthetic material, and cotton paper, (2) the rigid three-dimensional shape comprises a single piece of non-rigid material, (3) the score patterns are created and marked with digital computer programs, and (4) the light source is comprised of light-emitting diode (LED) lights.

Also disclosed is a three-dimensional structure folded from a single flat piece of non-rigid material comprising: a first outer side and a third outer side, wherein said first and third outer sides are spaced a distance apart, are parallel, and are of substantially the same length; a second outer side and a fourth outer side, wherein said second and fourth outer sides are spaced a distance apart, are parallel, and are of substantially the same length; a first group of parallel score lines consisting of a plurality of score lines which traverse the single flat piece of material from the second outer side to the fourth outer side being parallel and adjacent to the first and third outer sides, further being equally spaced apart relative to each other and relative to the first and third outer sides; a second group of parallel score lines comprising a plurality of score lines which traverse the single flat piece of material from the first outer side to the third outer side, are parallel to the second outer side and fourth outer side, and are spaced equal distances apart relative to each other and relative to the first and third outer sides; and a sixth group of score lines comprising a plurality of score lines which traverse the single flat piece of material from the first outer side to the third outer side, each score line comprising: a plurality of segments wherein a first segment begins at the first outer side, said plurality of segments proceeding at alternating substantially 45° angles to every score line of the first group of score lines, and a last segment terminating at the third outer side.

Also disclosed is a three-dimensional structure folded from a single flat piece of non-rigid material comprising: a first outer side and a third outer side, wherein said first and third outer sides are spaced a distance apart, are parallel, and are of substantially the same length; a second outer side and a fourth outer side, wherein said second and fourth outer sides are spaced a distance apart, are parallel, and are of substantially the same length; a first group of three parallel score lines which traverse the single flat piece of material from the second outer side to the fourth outer side being parallel and adjacent to the first outer side; a second group of three parallel score lines which traverse the single flat piece of material from the second outer side to the fourth outer side being parallel and adjacent to the first group of three parallel score lines; a third group of three parallel score lines which traverse the single flat piece of material from the second outer side to the fourth outer side being parallel and adjacent to the second group of three parallel score lines; a fourth group of three parallel score lines which traverse the single flat piece of material from the second outer side to the fourth outer side being parallel and adjacent to the third group of three parallel score lines and the third outer side; a fifth group of parallel score lines comprising a plurality of score lines which traverse the single flat piece of material from the first outer side to the third outer side, are parallel to the second outer side and fourth outer side, and are spaced equal distances apart relative to each other; and a sixth group of score lines comprising a plurality of score lines which traverse the single flat piece of material from the first outer side to the third outer side, each score line comprising: a first segment proceeding from the first outer side to a first line of the first group of three parallel score lines at a substantially 45° angle to the first outer side; a second segment proceeding from the first line of the first group of three parallel score lines to a second line of the first group of three parallel score lines at a substantially 45° angle such that the first segment and second segment form a substantially 90° angle; a third segment proceeding from the second line of the first group of three parallel score lines to a third line of the first group of three parallel score lines at a substantially 45° angle such that the third segment and second segment form a substantially 90° angle; a fourth segment proceeding from the third line of the first group of three parallel score lines to a first line of the second group of three parallel score lines at a substantially 45° angle such that the fourth segment and third segment form a substantially 90° angle; a fifth segment proceeding from the first line of the second group of three parallel score lines to a second line of the second group of three parallel score lines at a substantially 45° angle such that the fifth segment and fourth segment form a substantially 90° angle; a sixth segment proceeding from the second line of the second group of three parallel score lines to a third line of the second group of three parallel score lines at a substantially 45° angle such that the sixth segment and fifth segment form a substantially 90° angle; a seventh segment proceeding from the third line of the second group of three parallel score lines to a first line of the third group of three parallel score lines at a substantially 45° angle such that the seventh segment and sixth segment form a substantially 90° angle; an eighth segment proceeding from the first line of the third group of three parallel score lines to a second line of the third group of three parallel score lines at a substantially 45° angle such that the eighth segment and seventh segment form a substantially 90° angle; a ninth segment proceeding from the second line of the third group of three parallel score lines to a third line of the third group of three parallel score lines at a substantially 45° angle such that the ninth segment and eighth segment form a substantially 90° angle; a tenth segment proceeding from the third line of the third group of three parallel score lines to a first line of the fourth group of three parallel score lines at a substantially 45° angle such that the tenth segment and ninth segment form a substantially 90° angle; an eleventh segment proceeding from the first line of the fourth group of three parallel score lines to a second line of the fourth group of three parallel score lines at a substantially 45° angle such that the eleventh segment and tenth segment form a substantially 90° angle; a twelfth segment proceeding from the second line of the fourth group of three parallel score lines to a third line of the fourth group of three parallel score lines at a substantially 45° angle such that the twelfth segment and eleventh segment form a substantially 90° angle; and a thirteenth segment proceeding from the third line of the fourth group of three parallel score lines to the third outer side at a substantially 45° angle such that the thirteenth segment and twelfth segment form a substantially 90° angle.

BRIEF DESCRIPTION OF THE DRAWINGS

The features of this disclosure, and the manner of attaining them, will become more apparent and the disclosure

itself will be better understood by reference to the following description of embodiments of the disclosure taken in conjunction with the accompanying drawings.

FIGS. **1-4** are top plan views of exemplary two-dimensional score patterns on a substantially flat, non-rigid material.

FIGS. **5-8** are perspective views of exemplary three-dimensional structures folded from a non-rigid material.

FIGS. **9-10** are perspective views of exemplary two-dimensional, single, flat pieces of non-rigid material being folded according to a score pattern with mountain and valley folds.

FIG. **11** is a top plan view of a two-dimensional score pattern on a non-rigid material for a hexagonal swirl.

FIG. **12** is a perspective view of one embodiment of a three-dimensional oblong shape formed from the score pattern of FIG. **2**.

FIG. **13** is a top plan view of one embodiment of a score pattern that can be folded to create the three-dimensional light covering of FIG. **5**.

FIG. **14** is a perspective view of the three-dimensional light covering of FIG. **5** in a compressed or packaged form for easy shipping, handling, storage, and/or display.

FIG. **15** is a perspective view of a three-dimensional light covering formed from the score pattern and folds of FIG. **9**.

FIG. **16** is a top plan view of the three-dimensional light covering of FIG. **15** in a compressed state.

FIG. **17** is a perspective view of a three-dimensional light covering formed from the score pattern and folds of FIG. **4**.

FIG. **18** is a top plan view of the three-dimensional light covering of FIG. **17** in a compressed state.

Corresponding reference characters indicate corresponding parts throughout the several views. Although the drawings represent embodiments of the present disclosure, the drawings are not necessarily to scale and certain features may be exaggerated in order to better illustrate and explain the present disclosure. The exemplifications set out herein illustrate an exemplary embodiment of the disclosure, in one form, and such exemplifications are not to be construed as limiting the scope of the disclosure in any manner.

DETAILED DESCRIPTION OF THE DRAWINGS

The embodiments disclosed herein are not intended to be exhaustive or limit the disclosure to the precise form disclosed in the following detailed description. Rather, the embodiments are chosen and described so that others skilled in the art may utilize their teachings.

Referring first to FIG. **1**, an exemplary two-dimensional score pattern **100** on a non-rigid material **102** is provided. By way of example, non-rigid material **102** can include any non-rigid material that when folded with a series of mountain and valley folds retains a rigid three-dimensional shape. In some embodiments, non-rigid material **102** is paper, such as cotton paper, and in other embodiments is synthetic material able to be scored and folded, such as Tyvek paper. The term non-rigid material also contemplates any material that is non-rigid in a two-dimensional form, such as thin cardboard, but is of sufficient rigidity when scored and folded to form a three-dimensional cover for a light source.

Score pattern **100** is comprised of a plurality of score lines **104**, also referred to as crease lines herein. Score lines **104**, in some embodiments, are indentations made in non-rigid material **102** by a hand tool or by an automated device, such as a digital cutter. In other embodiments, score lines **104** are partial cuts in non-rigid material **102**. Still in other embodiments, score lines **104** are a printed pattern made by ink or a substantially similar substance, such as graphite.

As shown in FIG. **1**, score lines **106**, **108** lie in different directions. Score lines **110**, **112** lie in the same direction and are parallel. Score lines **108**, **110** lie in substantially the same direction and are substantially parallel. Score lines **114**, **116**, **118** form a substantially triangular shape. Any configuration for score lines **104** is envisioned as long as score lines **104** can be folded in a series of mountain and valley folds (described further below) into a rigid three-dimensional structure.

Material **102** includes opposing sides **120**, **122** which are parallel. In the embodiment shown, opposing sides **124**, **126** are not parallel. In some embodiments, non-rigid material **102** has more or fewer than four sides. In some embodiments, all opposing sides are parallel. In other embodiments, no opposing sides are parallel. As shown by FIG. **1**, score lines **104** form complex patterns or grids with parallel and non-parallel lines. In other embodiments, score lines **104** can form simple patterns composed of repeating units.

In some embodiments, score lines **104** can be made by a hand-held implement with a point. In other embodiments, a digital cutter may be used, either by itself or in combination with a hand-held implement, to imprint or mark score lines **104** without fully cutting through non-rigid material **102**. In one exemplary embodiment, the digital cutter is a Graphtec digital vinyl cutter. Still referring to FIG. **1**, holes **128** are punched into non-rigid material **102**, optionally with a hand-held and/or automated tool, to finalize the three-dimensional shape of the light covering when non-rigid material **102** is folded. For example, a string or thin cord might be run through one or more holes **128** in order to place non-rigid material **102** around a light source once folded.

Referring now to FIG. **2**, one portion of a two-dimensional score pattern **130** is provided, which in some embodiments can be folded to attain the three-dimensional shapes shown in FIG. **6** and FIG. **12**. Depending on the size of the flat material onto which pattern **130** is scored or printed, smaller or larger three-dimensional shapes will be achieved with folding. For example, if pattern **130** extended further in the horizontal direction, a larger three-dimensional shape would be obtained.

In the embodiment shown, opposing sides **132**, **134** are parallel and of the same length. Similarly, opposing sides **136**, **138** are parallel and of the same length. In some embodiments, opposing sides **132**, **134**, **136**, **138** can be parallel and of differing lengths. In other embodiments, opposing sides **132**, **134**, **136**, **138** can be not parallel and of differing lengths. Still in other embodiments, opposing sides **132**, **134**, **136**, **138** can be not parallel and of the same length.

Still referring to FIG. **2**, score lines **140**, **142** lie substantially parallel to one another, while score lines **142**, **144** lie in different directions disposed at substantially a 90° right angle to one another. Score pattern **130** includes a plurality of holes **146**, which, similar to holes **128** in FIG. **1**, are used for finalizing the three dimensional shape of the light covering, optionally with a string or cord.

Referring now to FIG. **3**, score pattern **150** is provided. Score pattern **150** includes a series of repeating units **152**. One such unit is shown as enlarged in FIG. **3**. Score lines **154**, **158** are disposed at substantially 103° angles to one another, and score line **156** is disposed at substantially 51° angles to both score lines **154**, **158**. In other embodiments, other angles preferably between 1° and 90° could be used. Still in other embodiments, different configurations of score lines within repeating units **152** can be used, so long as a

series of mountain and valley folds can be made in score pattern **150** to provide rigidity to pattern **150** in a three-dimensional shape. Additionally, alternative configurations for repeating units **152** are envisioned, such as non-repeating units placed in between or dispersed amongst repeating units **152**. FIG. **3** provides one exemplary two-dimensional score pattern to attain the shape of FIG. **7** with a series of mountain and valley folds.

Referring now to FIG. **4**, score pattern **160** includes a plurality of vertical, parallel score lines **162**, shown with solid lines, and a plurality of diagonal score lines **164**, shown with dotted lines. As shown in FIG. **4**, score lines **164** are disposed at 30.00° angles relative to parallel score lines **162**. In other embodiments, other angles of between about 1° and about 90° could be used.

In the embodiment of FIG. **4**, score lines **162** are folded as mountain folds, and score lines **164** are folded as valley folds. Such folds may be made by hand by a person, or may be made by an automated device capable of detecting score lines **162**, **164**. Mountain folds refer to folds made in an upward direction relative to a flat, two-dimensional plane formed by score pattern **160** as it lies flat. Valley folds refer to folds made in a downward direction relative to a flat, two-dimensional plane formed by score pattern **160** as it lies flat. Mountain and valley folds, once creased, are disposed opposite to one another.

Referring now to FIGS. **5-8**, exemplary three-dimensional structures folded from flat pieces of non-rigid material are shown. As shown in FIG. **5**, three-dimensional light covering **170** includes valley folds **172** and mountain folds **174**. Folds **172**, **174** provide structure, three-dimensional shape, and rigidity to the piece of flat, non-rigid material **102** which forms three-dimensional light covering **170**. Light covering **170**, in one embodiment, is hung from a ceiling, optionally using a string or cord in combination with holes similar to holes **128** of FIG. **1**, over a light source such as, for example, one or more standard incandescent and/or LED light bulbs.

Referring now to FIG. **6**, a substantially spherically-shaped three-dimensional covering **176** for a light source, with a plurality of mountain and valley folds, is shown. Disposed near the bottom of covering **176** is a string or cord **178** which is disposed within a series of holes, optionally similar to holes **128** of FIG. **1** or holes **146** of FIG. **2**. Cord **178**, in some embodiments, is used to add stability to covering **176** and/or to help position covering **176** over a light source.

Referring now to FIG. **7**, a torus-shaped, rigid three-dimensional light covering **180** is shown. FIG. **3** provides one exemplary two-dimensional score pattern to attain the shape of FIG. **7** with a series of mountain and valley folds. The mountain and valley folds provide stability and rigidity to covering **180**. In some embodiments, covering **180** houses one light source, but in other embodiments covering **180** can house more than one light source, preferably LED light bulbs.

FIG. **8** shows a perspective view of covering **180** of FIG. **7**. As can be seen, hollow portion **182** exists within covering **180**. Hollow portion **182** is used to house one or more light sources such as, for example, LED light bulbs.

FIGS. **9-10** illustrate exemplary two-dimensional, single, flat pieces of non-rigid material being folded according to score patterns with mountain and valley folds. Referring now to FIG. **9**, score pattern **184** has solid, vertical and horizontal lines representing locations where mountain folds are to be made, and dotted, diagonal lines representing locations where valley folds are to be made. In the embodiment shown, there are 30° angles between the solid vertical lines and the dotted, diagonal lines. In other embodiments, other angles of between about 1° and about 90° could be used.

Still referring to FIG. **9**, lower portion **186** and upper portion **188** are shown. In some embodiments, score pattern **184** may be extended partially or wholly as a table and/or floor lamp, wherein lower portion **186** is connected to a base resting on a table or the floor, and upper portion **188** is extended upwardly relative to the base. Pattern **184** can provide an easy storage, shipping, and/or sale condition in which the pattern is compressed, with upper portion **188** disposed proximate to lower portion **186**, and easily expandable for use as a light covering by an end user.

Referring now to FIG. **10**, solid, horizontal lines represent locations where mountain folds are to be made, and dotted, diagonal lines represent locations where valley folds are to be made. In the embodiment shown, there are 45° angles between the solid horizontal lines and the dotted, diagonal lines. In other embodiments, other angles of between about 1° and about 90° could be used.

Referring now to FIG. **11**, a two-dimensional score pattern **190** on a non-rigid material for a hexagonal swirl is shown. Score pattern **190** has first side **192**, second side **194**, third side **196**, and fourth side **198**. In the embodiment shown, third side **196** is shorter in length between second side **194** and fourth side **198** than first side **192** is in length between second side **194** and fourth side **198**. Plurality of score lines **200** proceeds from first side **192** to third side **196**. Score lines **200** are folded as mountain folds. Plurality of score lines **202** proceeds from second side **194** to fourth side **198**. Score lines **202** also are folded as mountain folds.

Score pattern **190** includes diagonal score lines **204**, which in the embodiment shown are folded as valley folds. As noted above, mountain folds refer to folds made which place portions of score pattern **190** upward relative to a plain formed by score pattern **190** in its two-dimensional form, and valley folds refer to folds made which place portions of score pattern **190** downward relative to a plain formed by score pattern **190** in its two-dimensional form.

Referring now to FIG. **12**, one embodiment of a three-dimensional oblong shape **210** formed from the pattern of FIG. **2** is shown. As explained above, score pattern **130** of FIG. **2** could, in some embodiments, create substantially spherically-shaped three-dimensional covering **176** shown in FIG. **6**, and score pattern **130** of FIG. **2** can also create oblong shape **210** of FIG. **12**. If score pattern **130** is scored or printed on a larger two-dimensional flat sheet of material, a larger shape such as that of FIG. **6** may be obtained through a series of mountain and valley folds. If score pattern **130** is scored or printed on a smaller two-dimensional flat sheet of material, a smaller and/or otherwise differently shaped three-dimensional structure such as that of FIG. **12** may be obtained.

Referring to FIG. **13**, a portion of a score pattern **214** is shown, which can be folded to create three-dimensional light covering **170** of FIG. **5**. A series of repeating units **216**, **218** form score pattern **214**, and the number of repeating units **216**, **218** can be more or fewer than the number shown in FIG. **13**. Mountain folds **220** are shown by solid lines and valley folds **222** are shown by dotted or broken lines. Once again, if a flat two-dimensional piece of material was large and pattern **214** were printed on the large piece of material, possibly in different ratios and/or with more repeating units **216**, **218**, then a larger and/or differently-shaped version of three-dimensional light covering **170** of FIG. **5** would be obtained.

Alternatively, if a flat two-dimensional piece of material was small and pattern **214** were printed on the small piece of material, possibly in different ratios and/or with fewer repeating units **216**, **218**, then a smaller and/or differently-shaped version of three-dimensional light covering **170** of FIG. **5** would be obtained.

Referring now to FIG. **14**, three-dimensional light covering **170** of FIG. **5** is shown in a compressed or packaged form for easy shipping, handling, storage, and/or display. One or more removable straps **230**, or similar removable restraining means such as tape, can be used to maintain the compressed form. The three-dimensional shapes of the present disclosure are able to be compressed such as is shown in FIG. **14** for ease of the user to handle the shapes before they are shipped, displayed, purchased, and/or in use. After being compressed, the shapes of the present disclosure are easily expandable by the end user when straps **230** are removed. Thus, after removing straps **230**, the expanded form of three-dimensional light covering **170** of FIG. **5** could be disposed over a light source.

Referring now to FIG. **15**, a perspective view of a three-dimensional light covering **230** formed from the score pattern and folds of FIG. **9** is shown. Light covering **230** is disposed on top of base **232**. Once folded with a series of mountain and valley folds, light covering **230** is rigid or stable in the horizontal plane (X, Y plane) and is optionally vertically flexible (Z1, Z2 directions). Thus, light covering **230** could be compressed in the Z2 direction for compact storage, movement, and/or shipping. Light covering **230** is then expanded in the Z1 direction for use as a light covering of a light source within covering **230**. Upper support **234** is disposed on top of light covering **230**, and upper support **234** can contribute to structurally supporting covering **230** in the Z1 direction. For example, a string or cord from above support **234** could hold support **234** stable, thus supporting covering **230** in the Z1 direction. Alternatively, a support within covering **230** such as a wire, spring, and/or any other means known in the art with sufficient strength to support covering **230** in the Z1 direction could be used to hold covering **230** in an expanded state.

Referring now to FIG. **16**, a top plan view of three-dimensional light covering **230** of FIG. **15** is shown in a compressed state. Light covering **230** could be compressed in the Z2 direction for compact storage, movement, and/or shipping. Light covering **230** is then expanded in the Z1 direction for use as a light covering of a light source within covering **230**. Opening **236** is shown within base **232**, wherein one or more light sources could be disposed, such as, for example LED lights.

Referring now to FIG. **17**, a perspective view of a three-dimensional light covering **242** formed from the score pattern and folds of FIG. **4** is shown. Light covering **242** is disposed on top of base **244**. Once folded with a series of mountain and valley folds, light covering **242** is rigid or stable in the horizontal plane (X, Y plane) and is optionally vertically flexible (Z1, Z2 directions). Thus, light covering **242** could be compressed in the Z2 direction for compact storage, movement, and/or shipping. Light covering **242** is then expanded in the Z1 direction for use as a light covering of a light source within covering **242**. Upper support **246** is disposed on top of light covering **242**, and upper support **246** can contribute to structurally supporting covering **242** in the Z1 direction. For example, a string or cord from above support **246** could hold support **246** stable, thus supporting covering **242** in the Z1 direction. Alternatively, a support within covering **242** such as wire **248**, a spring, and/or any other means known in the art with sufficient strength to support covering **242** in the Z1 direction could be used to hold covering **242** in an expanded state. As shown, wire **248** supports covering **242** in the Z1 direction by supporting upper support **246**. More or fewer wires could be used alone or in combination with any combination of springs, cords, strings, and/or any other similar support means known in the art.

Base **244** and upper support **246**, in some embodiments, are comprised of the same material as covering **242**, but in other embodiments either or both base **244** and upper support **246** are made of material more rigid than the material of light covering **242**.

Referring now to FIG. **18**, a top plan view of the three-dimensional light covering of FIG. **17** is shown in a compressed state. Light covering **242** could be compressed in the Z2 direction for compact storage, movement, and/or shipping. Light covering **242** is then expanded in the Z1 direction for use as a light covering of a light source within covering **242**. Light source **250** is shown within base **244**, wherein one or more light sources could be disposed, such as, for example LED lights.

While this disclosure has been described as having an exemplary design, the present disclosure may be further modified within the spirit and scope of this disclosure. This application is therefore intended to cover any variations, uses, or adaptations of the disclosure using its general principles. Further, this application is intended to cover such departures from the present disclosure as come within the known or customary practice in the art to which this disclosure pertains.

What is claimed is:

1. A cover for a light source comprising:

a non-rigid material including:

a first outer side and a third outer side, wherein said first and third outer sides are spaced a distance apart, are parallel, and are of substantially the same length,

a second outer side and a fourth outer side, wherein said second and fourth outer sides are spaced a distance apart, are parallel, and are of substantially the same length,

a first group of parallel score lines comprising a plurality of score lines which traverse the material between the second outer side and the fourth outer side being parallel and adjacent to the first and third outer sides, further being equally spaced apart relative to each other and relative to the first and third outer sides,

a second group of parallel score lines comprising a plurality of score lines which traverse the material between the first outer side and the third outer side, are parallel to the second outer side and fourth outer side, and are spaced equal distances apart relative to each other and relative to the first and third outer sides, and

a third group of score lines comprising a plurality of score lines which traverse the material between the first outer side and the third outer side,

wherein the score lines are digitally created and identify locations for a plurality of mountain and valley folds, wherein said folds create a rigid three-dimensional light source cover.

2. The cover of claim **1** wherein the rigid three-dimensional light source cover comprises a single piece of non-rigid material.

3. The cover of claim **1** wherein the non-rigid material is selected from the group consisting of paper, cardboard, synthetic material, and cotton paper.

4. The cover of claim 1 wherein the non-rigid material has digitally created and marked score lines to identify locations for said folds, and wherein the non-rigid material provides an expanded and compressed three-dimensional shape.

5. The cover of claim 1, wherein the cover comprises a geometry selected from the group consisting of: torus, a substantially spherical shape, and a substantially oblong shape.

6. The cover of claim 3 wherein the rigid three-dimensional light source cover comprises a single piece of non-rigid material.

7. The cover of claim 6 wherein the non-rigid material has digitally created and marked score lines to identify locations for said folds.

8. The cover of claim 1, wherein the cover comprises a base and an upper support.

9. A method of making a cover for a light source comprising:

marking score patterns on a flat non-rigid material, wherein the non-rigid material includes a first outer side and a third outer side, wherein said first and third outer sides are spaced a distance apart, are parallel, and are of substantially the same length,

a second outer side and a fourth outer side, wherein said second and fourth outer sides are spaced a distance apart, are parallel, and are of substantially the same length,

a first group of parallel score lines comprising a plurality of score lines which traverse the material between the second outer side and the fourth outer side being parallel and adjacent to the first and third outer sides, further being equally spaced apart relative to each other and relative to the first and third outer sides,

a second group of parallel score lines comprising a plurality of score lines which traverse the material between the first outer side and the third outer side, are parallel to the second outer side and fourth outer side, and are spaced equal distances apart relative to each other and relative to the first and third outer sides, and

a third group of score lines comprising a plurality of score lines which traverse the material between the first outer side and the third outer side;

folding said non-rigid material with mountain and valley folds according to the score patterns into a rigid three-dimensional shape;

attaching said three-dimensional shape to a base such that said three-dimensional shape is rigid in an X-Y plane and vertically flexible in a Z-direction; and

attaching said three dimensional shape to a light source.

10. The method of claim 9, further comprising inserting a plurality of openings onto the non-rigid material, the plurality of openings to receive a string or a cord; and

hanging said three-dimensional shape from a ceiling using the string or the cord in combination with the plurality of openings.

11. The method of claim 9, wherein the rigid three-dimensional shape comprises a single piece of non-rigid material.

12. The method of claim 9, wherein the non-rigid material is selected from the group consisting of paper, cardboard, synthetic material, and cotton paper.

13. The method of claim 9, wherein marking includes executing one or more digital computer programs to generate and mark the score patterns, and wherein the non-rigid material provides an expanded and compressed three-dimensional shape.

14. The method of claim 9, wherein the light source is comprised of light-emitting diode (LED) lights.

15. The method of claim 9 wherein marking includes executing one or more digital computer programs to generate and mark the score patterns.

16. The method of claim 9 wherein the light source is comprised of light-emitting diode (LED) lights.

17. The method of claim 11, further comprising attaching said three dimensional shape to an upper support disposed on top of the cover, the upper support configured to further support said three-dimensional shape in the Z-direction.

18. An apparatus for forming a three-dimensional structure comprising:

a single, flat piece of non-rigid material including

a first outer side and a third outer side, wherein said first and third outer sides are spaced a distance apart, are parallel, and are of substantially the same length,

a second outer side and a fourth outer side, wherein said second and fourth outer sides are spaced a distance apart, are parallel, and are of substantially the same length,

a first group of parallel score lines comprising a plurality of score lines which traverse the material between the second outer side and the fourth outer side being parallel and adjacent to the first and third outer sides, further being equally spaced apart relative to each other and relative to the first and third outer sides,

a second group of parallel score lines comprising a plurality of score lines which traverse the material between the first outer side and the third outer side, are parallel to the second outer side and fourth outer side, and are spaced equal distances apart relative to each other and relative to the first and third outer sides, and

a third group of score lines comprising a plurality of score lines which traverse the material between the first outer side and the third outer side, each score line comprising:

a plurality of segments wherein a first segment begins at the first outer side, said plurality of segments proceeding at alternating angles of about 45° to every score line of the first group of score lines, and a last segment terminating at the third outer side.

19. An apparatus for forming a three-dimensional structure comprising:

a single, flat piece of non-rigid material including:

a first outer side and a third outer side, wherein said first and third outer sides are spaced a distance apart, are parallel, and are of substantially the same length;

a second outer side and a fourth outer side, wherein said second and fourth outer sides are spaced a distance apart, are parallel, and are of substantially the same length;

a first group of three parallel score lines which traverse the single flat piece of material from the second outer side to the fourth outer side being parallel and adjacent to the first outer side;

a second group of three parallel score lines which traverse the single flat piece of material from the second outer side to the fourth outer side being parallel and adjacent to the first group of three parallel score lines;

a third group of three parallel score lines which traverse the single flat piece of material from the second outer

side to the fourth outer side being parallel and adjacent to the second group of three parallel score lines;

a fourth group of three parallel score lines which traverse the single flat piece of material from the second outer side to the fourth outer side being parallel and adjacent to the third group of three parallel score lines and the third outer side;

a fifth group of parallel score lines comprising a plurality of score lines which traverse the single flat piece of material from the first outer side to the third outer side, are parallel to the second outer side and fourth outer side, and are spaced equal distances apart relative to each other; and

a sixth group of score lines comprising a plurality of score lines which traverse the single flat piece of material from the first outer side to the third outer side, each score line comprising:

a first segment proceeding from the first outer side to a first line of the first group of three parallel score lines at a substantially 45° angle to the first outer side;

a second segment proceeding from the first line of the first group of three parallel score lines to a second line of the first group of three parallel score lines at a substantially 45° angle such that the first segment and second segment form a substantially 90° angle;

a third segment proceeding from the second line of the first group of three parallel score lines to a third line of the first group of three parallel score lines at a substantially 45° angle such that the third segment and second segment form a substantially 90° angle;

a fourth segment proceeding from the third line of the first group of three parallel score lines to a first line of the second group of three parallel score lines at a substantially 45° angle such that the fourth segment and third segment form a substantially 90° angle;

a fifth segment proceeding from the first line of the second group of three parallel score lines to a second line of the second group of three parallel score lines at a substantially 45° angle such that the fifth segment and fourth segment form a substantially 90° angle;

a sixth segment proceeding from the second line of the second group of three parallel score lines to a third line of the second group of three parallel score lines at a substantially 45° angle such that the sixth segment and fifth segment form a substantially 90° angle;

a seventh segment proceeding from the third line of the second group of three parallel score lines to a first line of the third group of three parallel score lines at a substantially 45° angle such that the seventh segment and sixth segment form a substantially 90° angle;

an eighth segment proceeding from the first line of the third group of three parallel score lines to a second line of the third group of three parallel score lines at a substantially 45° angle such that the eighth segment and seventh segment form a substantially 90° angle;

a ninth segment proceeding from the second line of the third group of three parallel score lines to a third line of the third group of three parallel score lines at a substantially 45° angle such that the ninth segment and eighth segment form a substantially 90° angle;

a tenth segment proceeding from the third line of the third group of three parallel score lines to a first line of the fourth group of three parallel score lines at a substantially 45° angle such that the tenth segment and ninth segment form a substantially 90° angle;

an eleventh segment proceeding from the first line of the fourth group of three parallel score lines to a second line of the fourth group of three parallel score lines at a substantially 45° angle such that the eleventh segment and tenth segment form a substantially 90° angle;

a twelfth segment proceeding from the second line of the fourth group of three parallel score lines to a third line of the fourth group of three parallel score lines at a substantially 45° angle such that the twelfth segment and eleventh segment form a substantially 90° angle; and

a thirteenth segment proceeding from the third line of the fourth group of three parallel score lines to the third outer side at a substantially 45° angle such that the thirteenth segment and twelfth segment form a substantially 90° angle.

* * * * *