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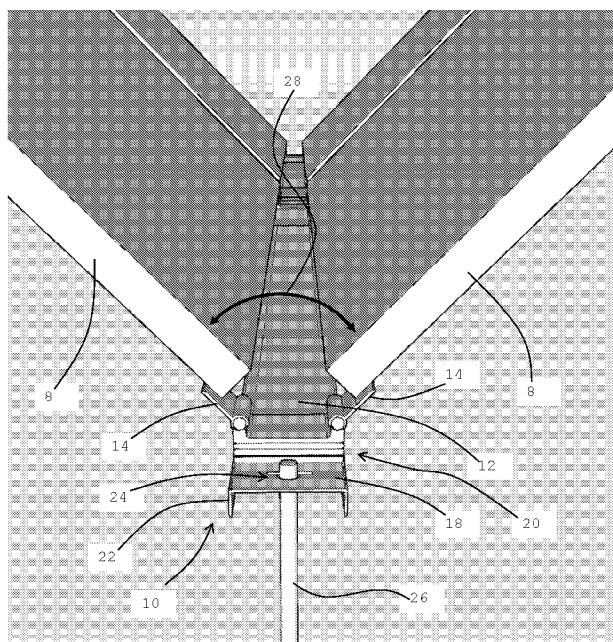


Figure 1.

(57) Abstract: Provided is a photovoltaic or solar panel deployment apparatus (10) comprising an elongate beam (12) and at least two carriages (14) hinged along opposed lateral sides along said beam (12). Each carriage (14) is configured to support a solar panel (8). Apparatus (10) also includes an anchor assembly (18) mounted at each end (20) of the beam (12) and defining an engagement structure (22) for complementarily engaging a similar anchor assembly (18) and an aperture (24) through which a suitable ground-engaging anchor (26) is passable. In this manner, the beam (12) is positionable on a surface with solar panels (8) hingedly supported by the carriages 14 and the anchor assemblies (18) are arrangeable to engage similar apparatus (10) and for anchoring to the surface.

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**PHOTOVOLTAIC PANEL DEPLOYMENT APPARATUS, ARRANGEMENT
AND METHOD**

TECHNICAL FIELD

[0001] This invention generally relates to the field of photovoltaic or solar energy harvesting, and more specifically to a photovoltaic panel deployment apparatus, an associated photovoltaic panel arrangement, a photovoltaic panel array and an associated method of photovoltaic panel deployment.

BACKGROUND ART

[0002] The following discussion of the background art is intended to facilitate an understanding of the present invention only. The discussion is not an acknowledgement or admission that any of the material referred to is or was part of the common general knowledge as at the priority date of the application.

[0003] As is known in the art, solar power is the conversion of energy from sunlight into electricity, either directly using photovoltaics (PV), indirectly using concentrated solar power, or a combination. Concentrated solar power systems use lenses or mirrors and solar tracking systems to focus a large area of sunlight into a small beam. Photovoltaic cells convert light into an electric current using the photovoltaic effect.

[0004] Solar panels, making use of the photovoltaic effect, has seen a dramatic increase in use, as increasing

numbers of companies and people move to solar panels as a source of clean and renewable energy. Accordingly, solar panels are being increasingly used as a replacement for fossil fuels.

[0005] However, solar panels are not always an ideal energy source as a replacement for fossil fuel energy sources. For example, in industrial projects such as mining, the inherent nature of an operation places limitations on simply replacing established fossil fuel practices with solar panel installations. Capital constraints on mining companies can also mean a preference for higher operating expenses, rather than increased capital expenses.

[0006] In light hereof, to operate profitably, mining companies typically procure energy on short- to medium-term contracts because of the flexibility, where a mine can be shut down if commodity prices fall, for example. Historically, fossil fuel generators can be easily relocated and reused in this scenario, whereas solar panel installations are traditionally static and present a large initial capital expenditure when opening a new mine. A diesel generator is inexpensive and uses fuel over time, whereas a solar panel installation or solar farm is more expensive up front, but requires little ongoing cost over the long term. As such, the operating characteristics of mining and renewable energy historically have not matched particularly well.

[0007] In seeking to ameliorate this situation, particularly in industrial operations such as mining where it would be ideal to 'rent' a solar installation rather than incur the capital expense of building a new installation,

modular and portable solar systems have been developed for exactly this reason.

[0008] One example of such portable solar system generally comprises so-called ballast mounted solar arrays, where concrete bases are used in combination with various frame structures to support an array of solar panels on a surface, such as the ground. Such installations are generally semi-permanent in nature and can be removed and repurposed elsewhere when required.

[0009] However, a major consideration of any portable or relocatable solar installation is logistical and concerns cost and ease of transport (often to remote locations, such as mine sites) as well as ease of installation, which also determines installations costs, i.e. labour costs, etc. As conventional systems generally require concrete bases and frames to support panels, this increases transport weight and requires space in, for example, intermodal or shipping containers when shipped to a remote location.

[0010] Accordingly, the Applicant has identified a shortcoming in the art of portable or relocatable solar panel installations and the current invention was conceived with this shortcoming in mind.

SUMMARY OF THE INVENTION

[0011] The skilled addressee is to appreciate that reference herein to the term 'solar panel' generally refers to established colloquial use and refers inclusively to a photovoltaic (PV) module, generally being an assembly of photovoltaic cells arranged and mounted in a framework for

installation as part of a solar installation or multiple such solar panels in a solar array for harvesting electromagnetic solar radiation energy.

[0012] According to a first aspect of the invention there is provided a photovoltaic or solar panel deployment apparatus comprising:

an elongate beam;

at least two carriages hingedly arranged along opposed lateral sides along said beam, each carriage configured to support a solar panel; and

an anchor assembly mounted at each end of said beam and defining an engagement structure for complementarily engaging a similar anchor assembly and an aperture through which a suitable ground-engaging anchor is passable;

wherein the beam is positionable on a surface with solar panels hingedly supported by the carriages and the anchor assemblies are arrangeable to engage similar apparatus and for anchoring to said surface.

[0013] Typically, the elongate beam comprises an extruded I-beam.

[0014] In an embodiment, the elongate beam is manufactured from a lightweight material, such as metal, polymer, or the like.

[0015] Typically, the carriage is configured to support a solar panel by receiving an edge of said panel which is securable or fastenable to said carriage.

[0016] Typically, the carriage comprises a bracket on which an edge of the solar panel is securable.

[0017] Typically, the carriage comprises a hinge or pivot hingedly arranging the carriage to the beam.

[0018] Typically, the carriages are arranged on opposed lateral sides along the beam to allow the supported solar panels to define an intersecting angle of between 0° and 180°.

[0019] Typically, the anchor assemblies are hingedly mounted at respective ends of said beam and downwardly hingeable to engage similar apparatus and for anchoring to the surface.

[0020] Typically, the engagement structure comprises at least one projecting flange shaped and dimensioned to sit over and/or about a portion of another anchor assembly and/or engagement structure of a similar apparatus.

[0021] Typically, the engagement structure is configured so that the aperture aligns with a similar aperture of another engagement structure of a similar apparatus when engaging said structure.

[0022] Typically, the ground-engaging anchor comprises a pin, a peg, a ground screw, or the like.

[0023] According to a second aspect of the invention there is provided a photovoltaic panel arrangement comprising:

- a plurality of solar panel deployment apparatuses in accordance with the first aspect of the invention;

- a plurality of solar panels each supported at respective bottom portions by respective apparatuses and adjacent panels

hingedly coupled at upper portions to form a concertina-like arrangement of solar panels;

wherein said panels are deployable and securable on a surface from a transport position (where respective adjacent panels define an intersecting angle of between 0° and 20°) to a deployed position (where respective adjacent panels define an intersecting angle of between 21° and 180°).

[0024] According to a third aspect of the invention there is provided a photovoltaic panel array comprising at least two of the photovoltaic panel arrangements in accordance with the second aspect of the invention arranged adjacent to each other so that anchor assemblies of deployment apparatuses align.

[0025] Typically, the photovoltaic panel array comprises respective engagement structure apertures of adjacent apparatuses aligning with a ground-engaging anchor passed therethrough to secure said array to a surface.

[0026] According to a fourth aspect of the invention there is provided a method of photovoltaic panel deployment comprising the steps of:

providing at least one photovoltaic panel arrangement in accordance with the second aspect of the invention; and

deploying the solar panels from a transport position (where respective adjacent panels define an intersecting angle of between 0° and 20°) to a deployed position (where respective adjacent panels define an intersecting angle of between 21° and 180°).

[0027] Typically, the method comprises the step of securing the arrangement by passing ground engaging anchors

through respective engagement structure apertures of adjacent aligning apparatuses.

[0028] According to a further aspect of the invention there is provided a photovoltaic panel deployment apparatus, a photovoltaic panel arrangement, a photovoltaic panel array and a method of photovoltaic panel deployment, substantially as herein described and/or illustrated.

BRIEF DESCRIPTION OF THE DRAWINGS

The description will be made with reference to the accompanying drawings in which:

Figure 1 is a diagrammatic front-view representation of an example of a photovoltaic or solar panel deployment apparatus, in accordance with aspects of the present invention;

Figure 2 is a diagrammatic left-side perspective-view representation of the apparatus of Figure 1;

Figure 3 is a diagrammatic right-side perspective-view representation of the apparatus of Figure 1;

Figure 4 is a diagrammatic perspective-view representation of two apparatuses with aligned anchor assemblies secured with one anchor passed through aligned apertures;

Figure 5 is a diagrammatic side perspective view representation of two aligned apparatuses;

Figure 6 is a diagrammatic perspective-view representation of an example of a photovoltaic panel array, in accordance with aspects of the present invention; and

Figure 7 is a diagrammatic top-view representation of the photovoltaic panel array of Figure 6.

DETAILED DESCRIPTION OF EMBODIMENTS

[0029] Further features of the present invention are more fully described in the following description of several non-limiting embodiments thereof. This description is included solely for the purposes of exemplifying the present invention to the skilled addressee. It should not be understood as a restriction on the broad summary, disclosure or description of the invention as set out above.

[0030] In the figures, incorporated to illustrate features of the example embodiment or embodiments, like reference numerals are used to identify like parts throughout. Additionally, features, mechanisms and aspects well-known and understood in the art will not be described in detail, as such features, mechanisms and aspects will be within the understanding of the skilled addressee.

[0031] With reference now to the accompanying figures, there is shown one embodiment of a photovoltaic or solar panel deployment apparatus 10. Such apparatus 10 generally comprises an elongate beam 12, at least two carriages 14 each for operatively supporting a solar panel 8 thereon, and an anchor assembly 18.

[0032] The elongate beam 12 typically comprises an extruded I-beam, as shown, to provide structural strength whilst minimising weight. However, the skilled addressee is to appreciate that variations hereon are possible, expected and within the scope of the present invention. The elongate beam 12 may be manufactured from a lightweight material, such as a metal, a polymer, or the like.

[0033] The solar panel deployment apparatus 10 generally includes at least two carriages 14 that are hingedly arranged along opposed lateral sides along the beam 12, as shown. Each carriage 14 is configured to support a solar panel 8. In a typical embodiment, each carriage 14 is configured to support a solar panel 8 by receiving an edge of a panel 8 which is securable or fastenable to said carriage by any suitable fastening means. For example, screws, rivets, nuts and bolts, adhesive, etc. may be used as required in order to secure an edge of a solar panel 8 to the carriage 14.

[0034] In the exemplified embodiment, the carriage 14 comprises a bracket on which an edge of the solar panel 8 is securable, but variations hereon are possible and expected. In a typical example, the carriage 14 comprises a hinge or pivot 16 hingedly arranging the carriage 14 on the beam 12, as shown. Importantly, the carriages 14 are arranged on opposed lateral sides along the beam 12 to allow the supported solar panels 8 to define an intersecting angle 28 of between 0° and 180°, i.e. the panels 8 are substantially parallel or lie flat to form a flat plane.

[0035] Solar panel deployment apparatus 10 also includes an anchor assembly 18 which is generally mounted at each end 20 of the beam 12. The anchor assembly 18 defines an

engagement structure 22 for complementarily engaging a similar anchor assembly 18 and an aperture 24 through which a suitable ground-engaging anchor 26 is passable.

[0036] In an embodiment, the anchor assemblies 18 are hingedly mounted at respective ends 20 of the beam 12 and downwardly hingeable to engage similar apparatus 10 and for anchoring to the surface. In a typical embodiment, the engagement structure 22 comprises at least one projecting flange 30 which is shaped and dimensioned to sit over and/or about a portion of another anchor assembly 18 of a similar apparatus 10. Typically, the engagement structure 22 is configured so that the aperture 24 aligns with a similar aperture 24 of another engagement structure 22 of a similar apparatus 10 when engaging said structure 22.

[0037] In this manner, each beam is positionable on a surface with solar panels 8 hingedly supported by the carriages 14 and the anchor assemblies 18 are arrangeable to engage similar apparatuses 10 and for anchoring to said surface. The ground-engaging anchor 26 comprises a pin, a peg, a ground screw, or the like in order to secure apparatus 10 to the surface.

[0038] Accordingly, the skilled addressee will appreciate that a photovoltaic panel arrangement 32 can be formed which comprises a plurality of solar panel deployment apparatuses 10, as described. Such an arrangement 32 includes a plurality of solar panels 8 each supported at respective bottom portions by respective apparatuses 10 and adjacent panels 8 hingedly coupled via suitable hinges 36 at upper portions thereof, as shown, to form a concertina-like arrangement 32 of solar panels 8.

[0039] In this manner, the solar panels 8 are deployable and securable on a surface from a transport position (where respective adjacent panels 8 define an intersecting angle 28 of between 0° and 20°) to a deployed position (where respective adjacent panels 8 define an intersecting angle 28 of between 21° and 180°).

[0040] Similarly, a photovoltaic panel array 34 can further be formed which comprises at least two of the photovoltaic panel arrangements 32, as described, arranged adjacent to each other so that anchor assemblies 18 of the respective deployment apparatuses 10 align. Typically, the photovoltaic panel array 34 comprises respective engagement structure apertures 24 of adjacent apparatuses 10 aligning with a ground-engaging anchor 26 passed therethrough to secure said array 34 to a surface.

[0041] The skilled addressee is to appreciate that the present invention includes an associated method of photovoltaic panel deployment. Such a method broadly comprises the steps of providing at least one photovoltaic panel arrangement 32 and deploying the solar panels 8 from a transport position (where respective adjacent panels 8 define an intersecting angle 28 of between 0° and 20°) to a deployed position (where respective adjacent panels 8 define an intersecting angle 28 of between 21° and 180°). Such deployment may be done of a shipping pallet using a forklift, or the like. Again, variations hereon are possible, anticipated and expressly included herein.

[0042] Typically, the method comprises the step of securing the arrangements 32 by passing ground engaging

anchors 26 through respective engagement structure apertures 24 of adjacent aligning apparatuses 10, as shown.

[0043] Applicant believes it particularly advantageous that the present invention provides for apparatus 10, arrangement 32 and array 34 capable of addressing the logistical considerations for portable or relocatable solar panel installations around cost, ease of transport as well as ease of installation. In particular, apparatus 10, arrangement 32 and array 34 allows the transport and deployment of solar panels without requiring heavy concrete ballast or support frames. Apparatus 10, arrangement 32 and array 34 is also transportable by means of intermodal containers to allow transport to remote locations, as required.

[0044] Optional embodiments of the present invention may also be said to broadly consist in the parts, elements and features referred to or indicated herein, individually or collectively, in any or all combinations of two or more of the parts, elements or features, and wherein specific integers are mentioned herein which have known equivalents in the art to which the invention relates, such known equivalents are deemed to be incorporated herein as if individually set forth. In the example embodiments, well-known processes, well-known device structures, and well-known technologies are not described in detail, as such will be readily understood by the skilled addressee.

[0045] The use of the terms "a", "an", "said", "the", and/or similar referents in the context of describing various embodiments (especially in the context of the claimed subject matter) are to be construed to cover both the singular and

the plural, unless otherwise indicated herein or clearly contradicted by context. The terms "comprising," "having," "including," and "containing" are to be construed as open-ended terms (i.e., meaning "including, but not limited to,") unless otherwise noted. As used herein, the term "and/or" includes any and all combinations of one or more of the associated listed items. No language in the specification should be construed as indicating any non-claimed subject matter as essential to the practice of the claimed subject matter.

[0046] Spatially relative terms, such as "inner," "outer," "beneath," "below," "lower," "above," "upper," and the like, may be used herein for ease of description to describe one element or feature's relationship to another element(s) or feature(s) as illustrated in the figures. Spatially relative terms may be intended to encompass different orientations of the device in use or operation in addition to the orientation depicted in the figures. For example, if the device in the figures is turned over, elements described as "below" or "beneath" other elements or features would then be oriented "above" the other elements or features. Thus, the example term "below" can encompass both an orientation of above and below. The device may be otherwise oriented (rotated 90 degrees or at other orientations) and the spatially relative descriptors used herein interpreted accordingly.

[0047] It is to be appreciated that reference to "one example" or "an example" of the invention, or similar exemplary language (e.g., "such as") herein, is not made in an exclusive sense. Various substantially and specifically practical and useful exemplary embodiments of the claimed

subject matter are described herein, textually and/or graphically, for carrying out the claimed subject matter.

[0048] Accordingly, one example may exemplify certain aspects of the invention, whilst other aspects are exemplified in a different example. These examples are intended to assist the skilled person in performing the invention and are not intended to limit the overall scope of the invention in any way unless the context clearly indicates otherwise. Variations (e.g. modifications and/or enhancements) of one or more embodiments described herein might become apparent to those of ordinary skill in the art upon reading this application. The inventor(s) expects skilled artisans to employ such variations as appropriate, and the inventor(s) intends for the claimed subject matter to be practiced other than as specifically described herein.

[0049] Any method steps, processes, and operations described herein are not to be construed as necessarily requiring their performance in the particular order discussed or illustrated, unless specifically identified as an order of performance. It is also to be understood that additional or alternative steps may be employed.

CLAIMS

1. A photovoltaic or solar panel deployment apparatus comprising:

an elongate beam;

at least two carriages hingedly arranged along opposed lateral sides along said beam, each carriage configured to support a solar panel; and

an anchor assembly hingedly mounted at each respective end of said beam and defining an engagement structure for complementarily engaging a similar anchor assembly and an aperture through which a suitable ground-engaging anchor is passable;

wherein the beam is positionable on a surface with solar panels hingedly supported by the carriages and the anchor assemblies are arrangeable and downwardly hingeable to engage similar apparatus and for anchoring to said surface.

2. The apparatus of claim 1, wherein the elongate beam comprises an extruded I-beam.

3. The apparatus of either of claims 1 or 2, wherein the elongate beam is manufactured from a lightweight material, such as metal, polymer, or the like.

4. The apparatus of any of claims 1 to 3, wherein the carriage is configured to support a solar panel by receiving an edge of said panel which is securable or fastenable to said carriage.

5. The apparatus of claim 4, wherein the carriage comprises a bracket on which an edge of the solar panel is securable.

6. The apparatus of any of claims 1 to 5, wherein the carriage comprises a hinge or pivot hingedly arranging the carriage to the beam.

7. The apparatus of any of claims 1 to 6, wherein the carriages are arranged on opposed lateral sides along the beam to allow the supported solar panels to define an intersecting angle of between 0° and 180° .

8. The apparatus of any of claims 1 to 7, wherein the engagement structure comprises at least one projecting flange shaped and dimensioned to sit over and/or about a portion of another anchor assembly and/or engagement structure of a similar apparatus.

9. The apparatus of any of claims 1 to 8, wherein the engagement structure is configured so that the aperture aligns with a similar aperture of another engagement structure of a similar apparatus when engaging said structure.

10. The apparatus of any of claims 1 to 9, wherein the ground-engaging anchor comprises a pin, a peg, a ground screw, or the like.

11. A photovoltaic panel arrangement comprising:
a plurality of solar panel deployment apparatuses in accordance with any of claims 1 to 10;
a plurality of solar panels each supported at respective bottom portions by respective apparatuses and adjacent panels hingedly coupled at upper portions to form a concertina-like arrangement of solar panels;
wherein said panels are deployable and securable on a surface from a transport position (where respective adjacent panels define an intersecting angle of between 0° and 20°) to a

deployed position (where respective adjacent panels define an intersecting angle of between 21° and 180°).

12. A photovoltaic panel array which comprises at least two of the photovoltaic panel arrangements of claim 11, arranged adjacent to each other so that anchor assemblies of deployment apparatuses align.

13. The photovoltaic panel array of claim 12, which comprises respective engagement structure apertures of adjacent apparatuses aligning with a ground-engaging anchor passed therethrough to secure said array to a surface.

14. A method of photovoltaic panel deployment comprising the steps of:

providing at least one photovoltaic panel arrangement in accordance with claim 11; and

deploying the solar panels from a transport position (where respective adjacent panels define an intersecting angle of between 0° and 20°) to a deployed position (where respective adjacent panels define an intersecting angle of between 21° and 180°).

15. The method of claim 14, which comprises the step of securing the arrangement by passing ground engaging anchors through respective engagement structure apertures of adjacent aligning apparatuses.

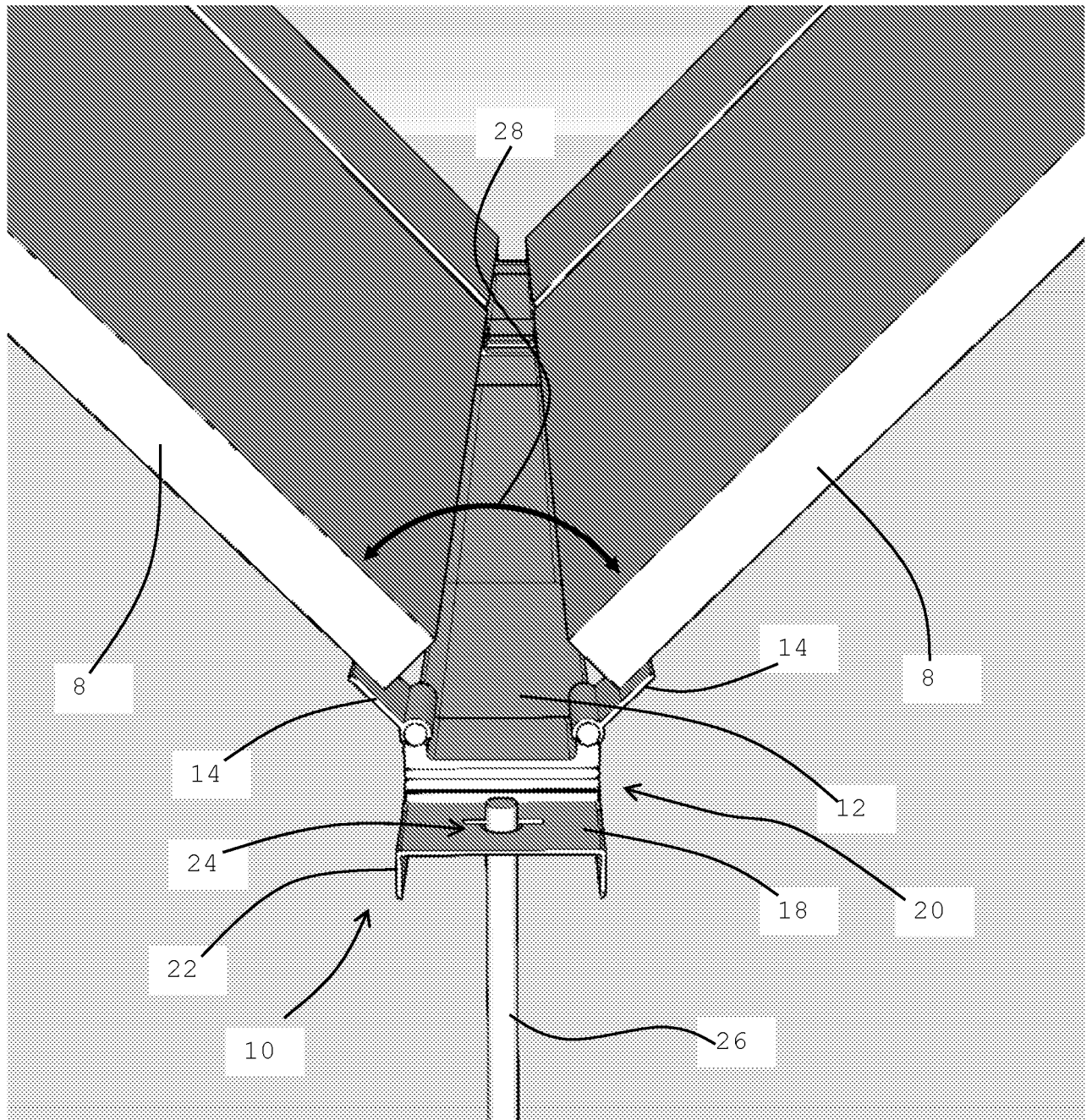


Figure 1.

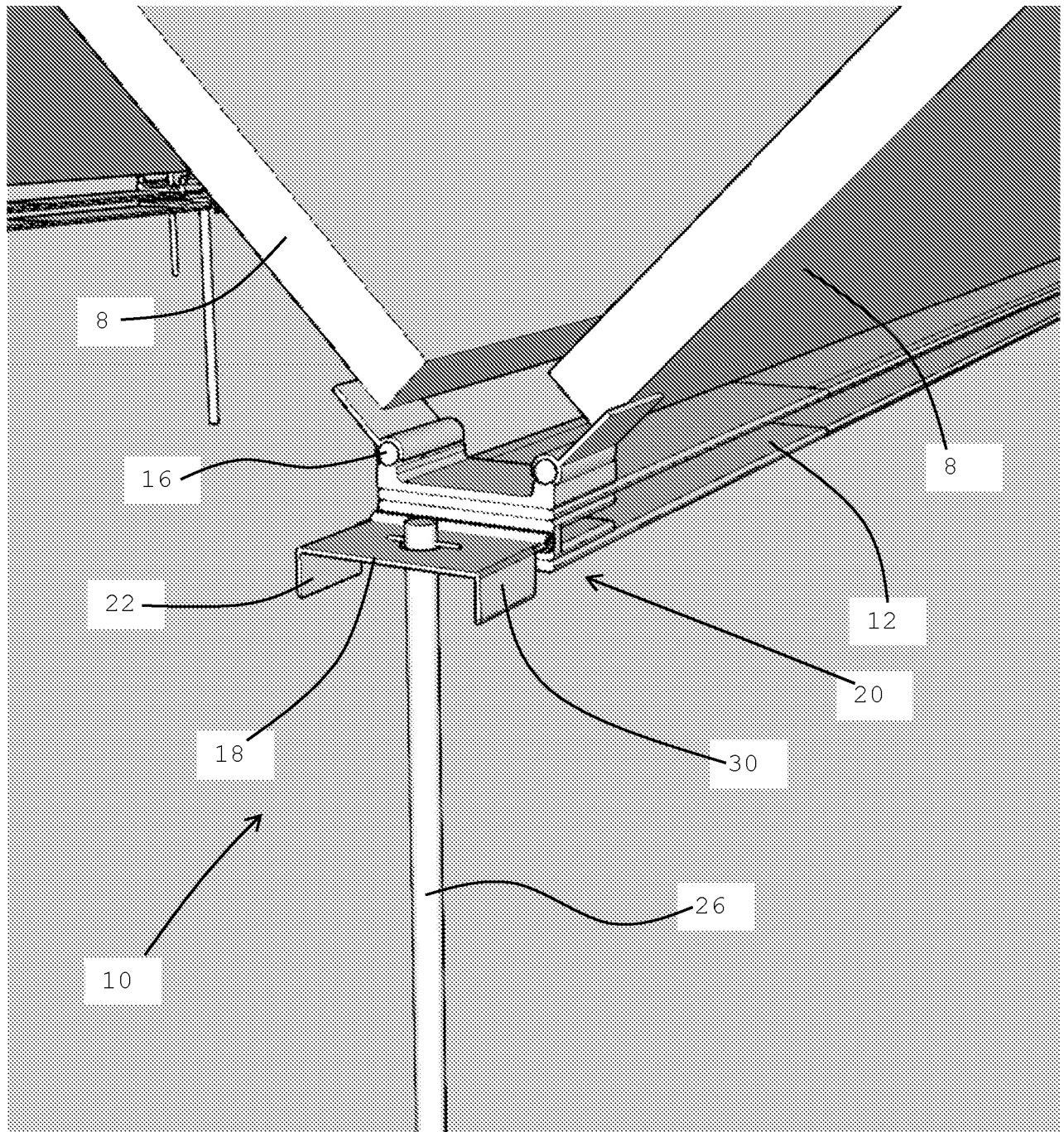


Figure 2.

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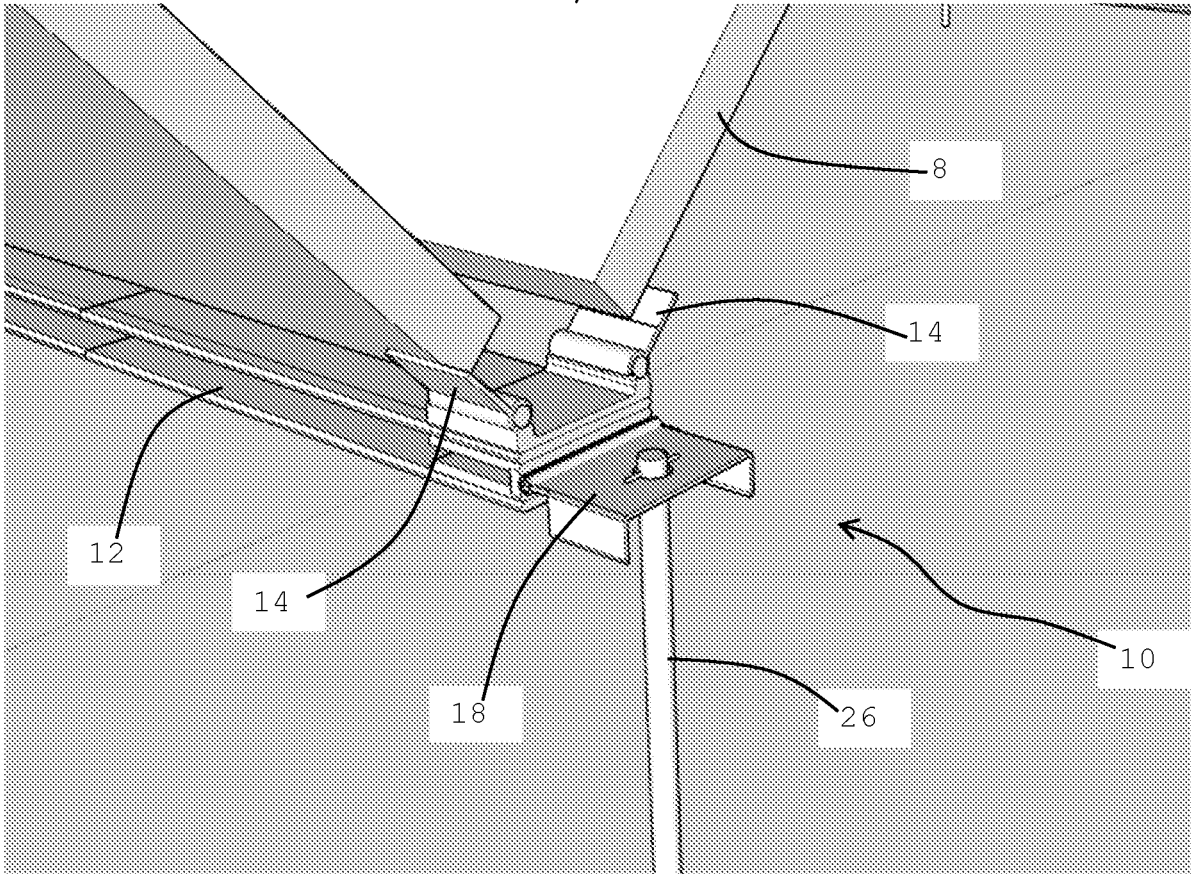


Figure 3.

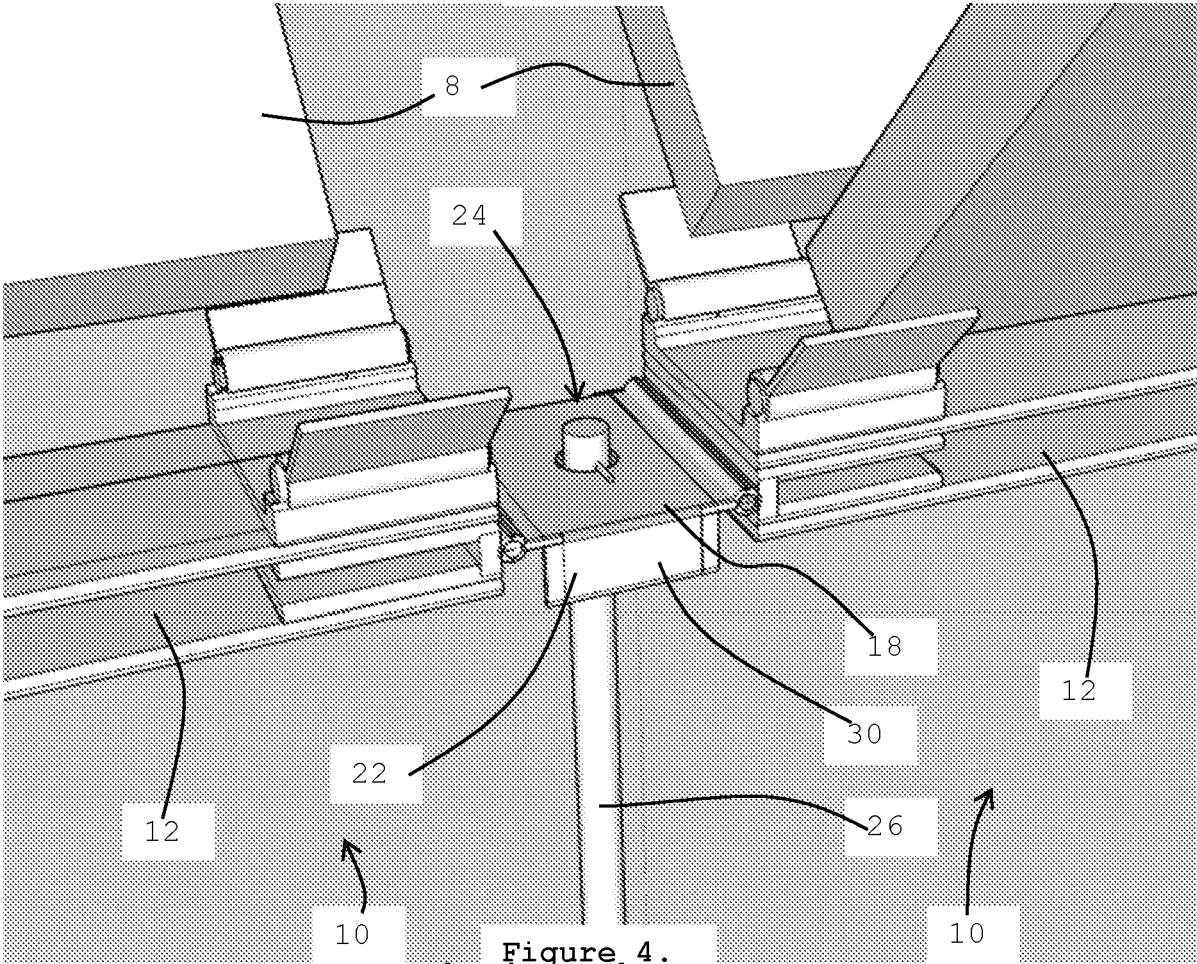


Figure 4.
Substitute Sheets
(Rule 26)
RO/AU

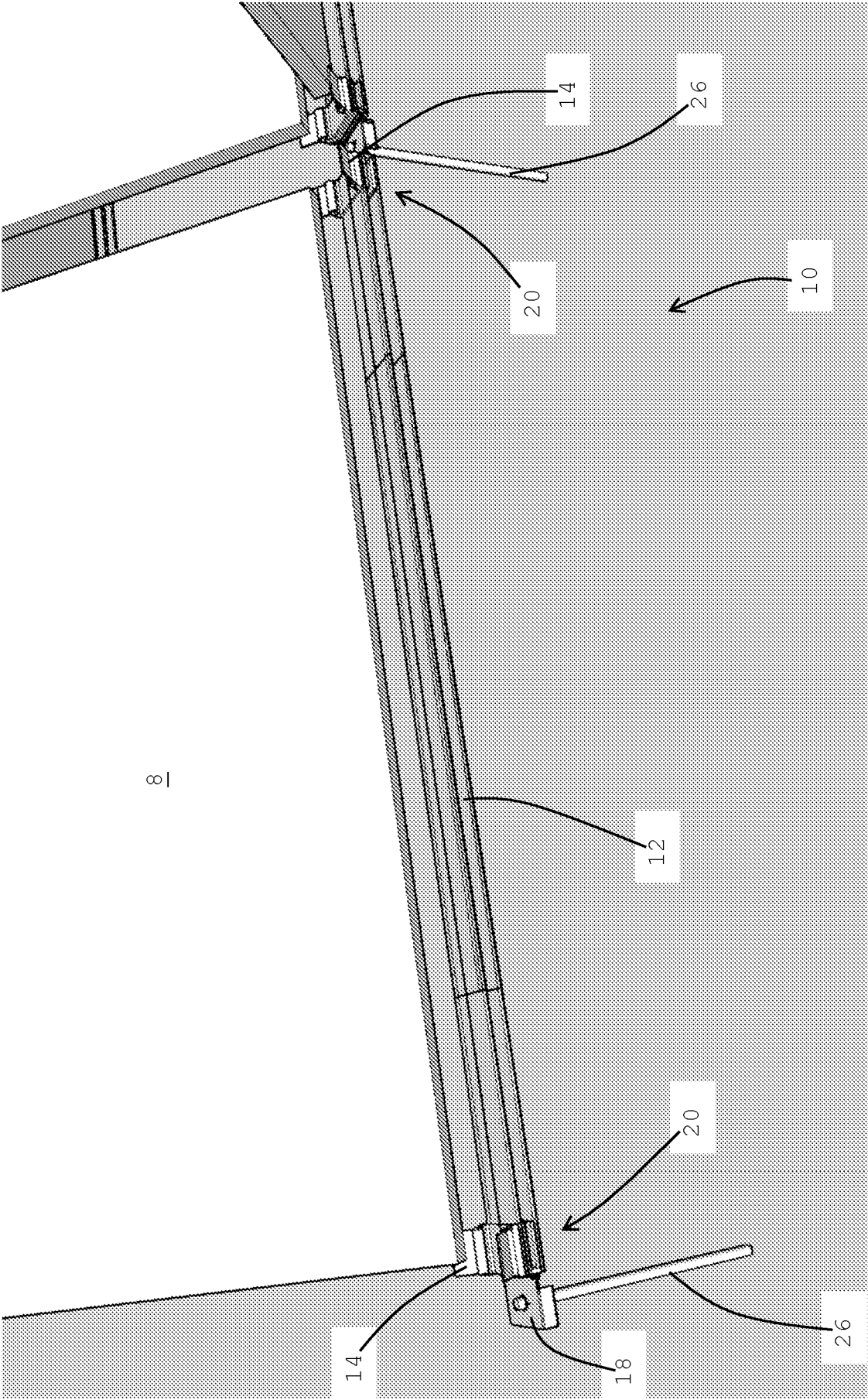


Figure 5.

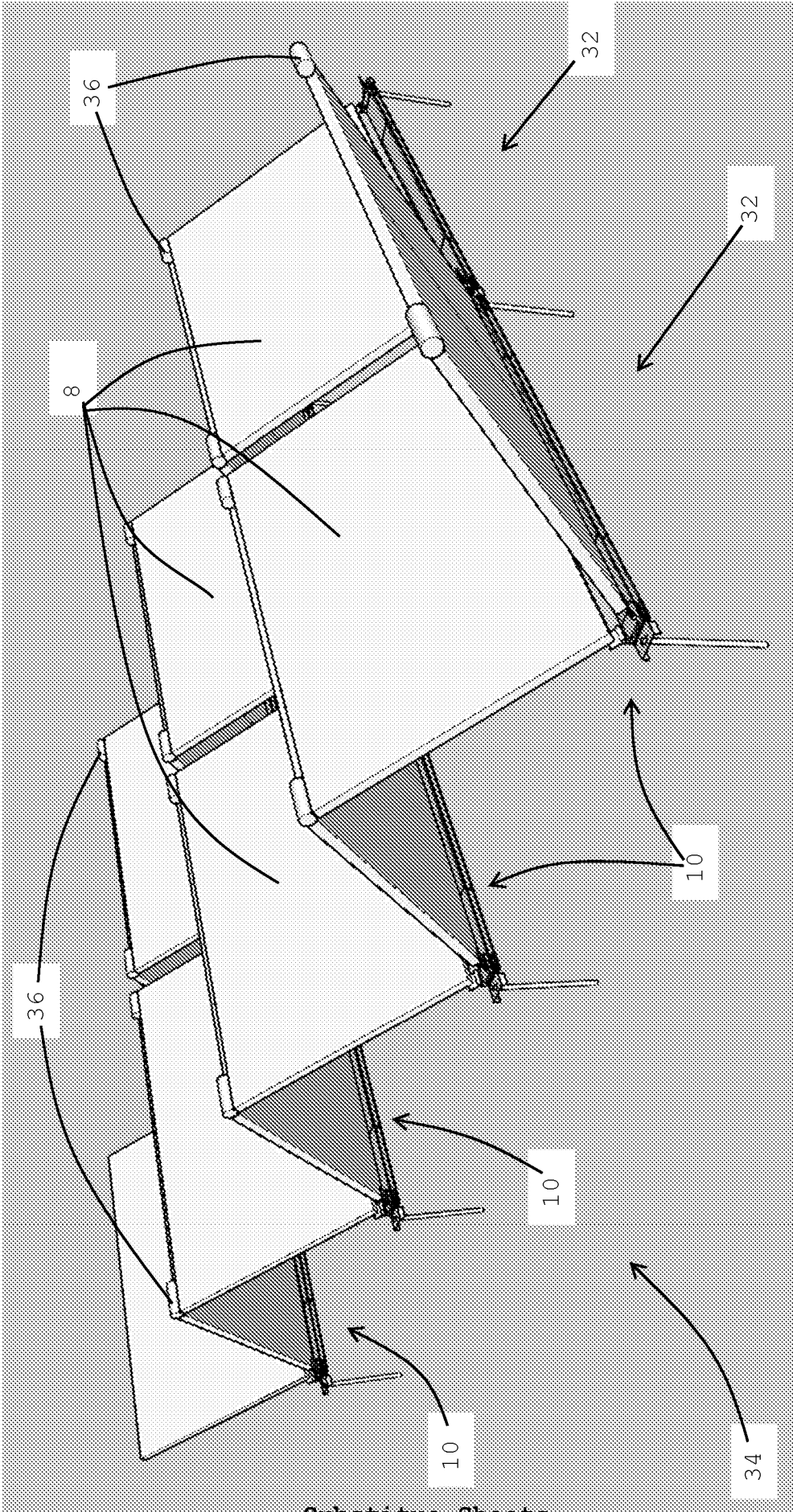


Figure 6.

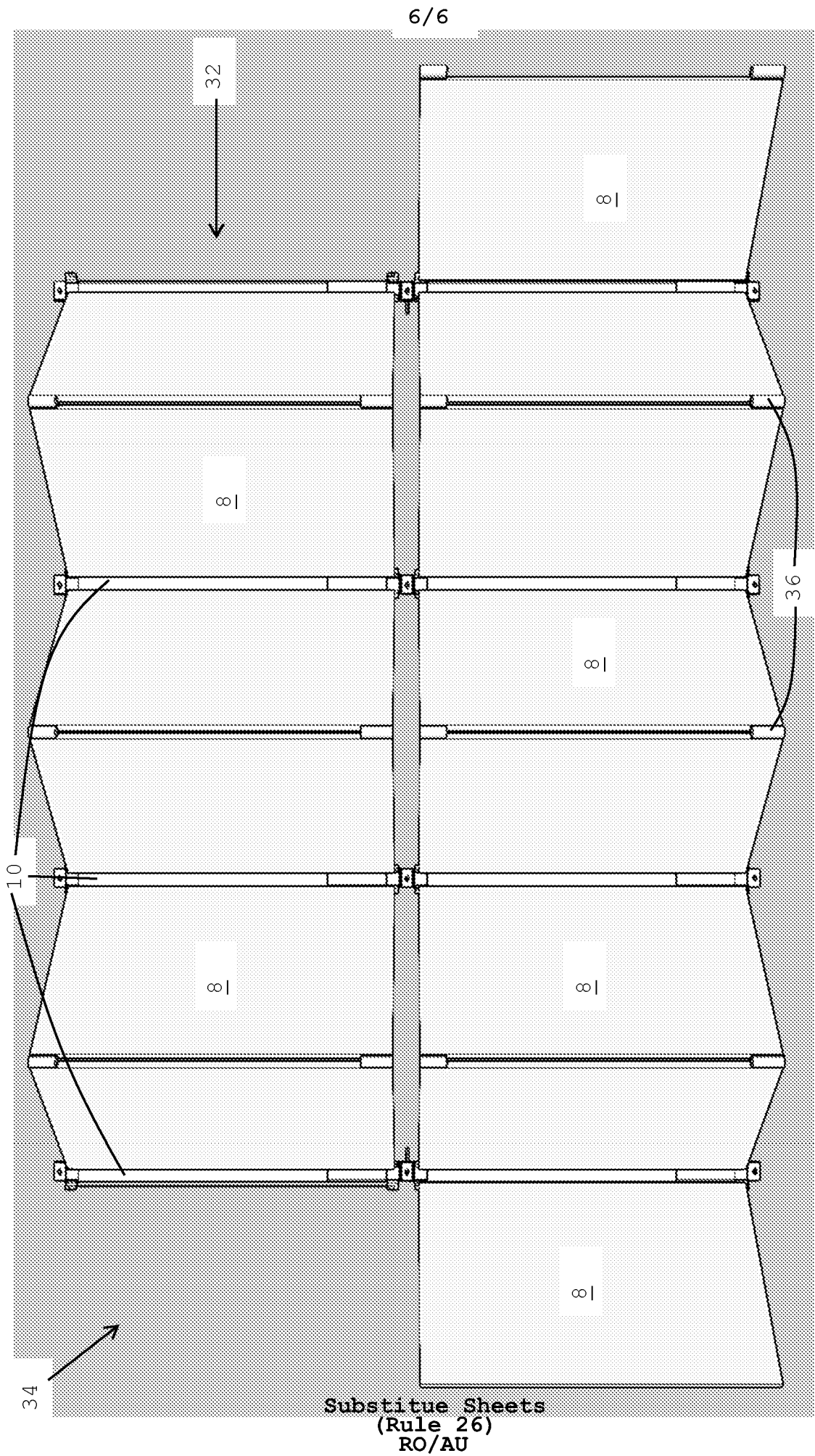


Figure 7.