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(54) **RIGID SHEET BLANK AND METHOD FOR PRODUCING SAME**

(57) A rigid sheet blank (10) including a first section and an adjacent second section configured to be bent relative to the first section. A seam (30) separates the first section from the second section to facilitate bending of the first and second sections relative to one another. The seam (30) defines a seam axis (32) and includes at least one cut (34) through a material of the rigid sheet blank (10). Each of the at least one cut (34) includes a main portion (40) that is elongated such as to extend along a direction parallel to the seam axis (32), a first extension (42) extending from a first end (46) of the main portion (40) and being generally perpendicular to the main portion (40), and a second extension (44) extending from a second end (48) of the main portion (40) and being generally perpendicular to the main portion (40). The first and second extensions (42, 44) extend on a same side of the main portion (40).

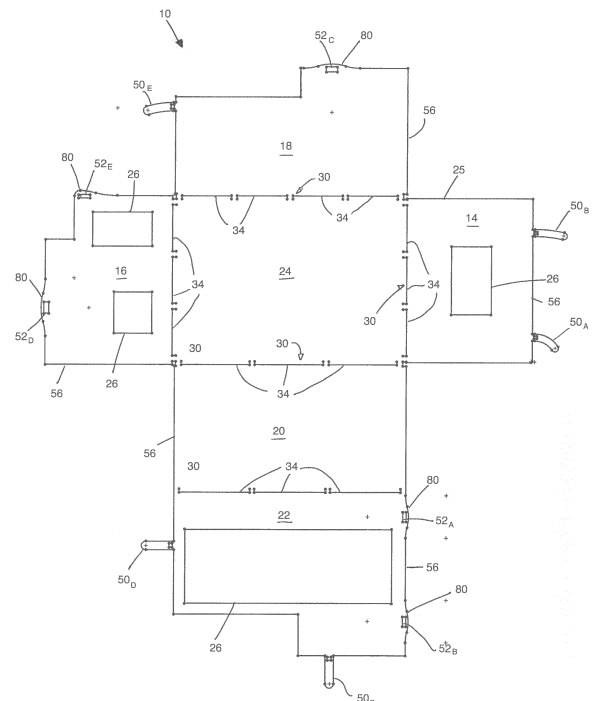


FIG. 1

Description

FIELD OF TECHNOLOGY

[0001] The present technology relates to rigid sheet blanks for bending into a bent sheet component.

BACKGROUND

[0002] Sheet metal components are generally formed by cutting a metal sheet into a blank and bending the blank as required to form the desired sheet metal component. The bending process can be costly as it typically involves a qualified operator that is able to use machinery and/or tools such as presses and other specialized tooling. In order to avoid using tooling during bending, metal sheet blanks are sometimes provided with cuts at intended bend sites which act to locally weaken the metal sheet blank such as to facilitate bending thereof. In this manner, the metal sheet blank can be made bendable by hand which eliminates the need of a qualified operator and the associated machinery and/or tooling.

[0003] However, producing such weakening cuts in the metal sheet blank can be time-consuming. Notably, when a laser cutting machine is used to produce the metal sheet blank, the material being cut out from the metal sheet sometimes remains stuck to the sheet. In some cases, rather than detaching itself from the sheet and falling to a bed of the machine, a piece of cut material may pivot downward, causing part of the piece to surpass an upper surface of the sheet. The piece of cut material may thus interfere with the motion of a head of the laser cutting machine which stops its work cycle upon such an occurrence, thus requiring operator intervention.

[0004] In addition, while the metal sheet blank is made bendable by hand by the weakening cuts, the metal sheet blank can be accidentally bent in a wrong direction since a directionality that is conventionally provided by tools during bending is now absent.

[0005] Furthermore, the bent sheet component resulting from bending the metal sheet blank can have a relatively low load bearing capacity, notably due to the presence of the weakening cuts.

[0006] Similar problems may arise with sheet blanks made of a rigid material other than metal.

[0007] There is therefore a desire for a rigid sheet blank which can alleviate at least some of these drawbacks.

SUMMARY

[0008] It is an object of the present technology to ameliorate at least some of the inconveniences present in the prior art.

[0009] According to one aspect of the present technology, there is provided a rigid sheet blank. The rigid sheet blank includes a first section, a second section adjacent the first section and configured to be bent relative to the first section, and a seam separating the first section from

the second section to facilitate bending of the first and second sections relative to one another. The seam defines a seam axis and includes at least one cut through a material of the rigid sheet blank. Each of the at least one cut includes: a main portion that is elongated such as to extend along a direction parallel to the seam axis, the main portion having a first end and a second end; a first extension extending from the first end of the main portion and being generally perpendicular to the main portion; and a second extension extending from the second end of the main portion and being generally perpendicular to the main portion. The first and second extensions extend on a same side of the main portion.

[0010] In some implementations of the present technology, the rigid sheet blank is made of a metallic material.

[0011] In some implementations of the present technology, the at least one cut includes a first cut and a second cut spaced apart from one another by an inter-cut segment of material. The main portion of the first cut is collinear with the main portion of the second cut.

[0012] In some implementations of the present technology, the first and second extensions of each of the first cut and the second cut extend toward a same one of the first and second sections.

[0013] In some implementations of the present technology, at least one of the first cut and the second cut is adjacent an edge of the rigid sheet blank and is spaced from the edge of the rigid sheet blank by an edge segment of material. The inter-cut segment of material and the edge segment of material form a hinge for bending the first and second sections of the rigid sheet blank relative to one another.

[0014] In some implementations of the present technology, the rigid sheet blank is bendable about the seam axis by hand.

[0015] In some implementations of the present technology, a length of the first extension is less than a length of the main portion, and a length of the second extension is less than the length of the main portion.

[0016] In some implementations of the present technology, the length of the first extension is approximately the same as the length of the second extension.

[0017] In some implementations of the present technology, a ratio of the length of the first extension over the length of the main portion is between 0.1 and 0.3.

[0018] According to another aspect of the present technology, there is provided a method for producing a hand-bendable rigid sheet blank. The method includes providing a sheet of rigid material and forming a seam separating a first section of the sheet from a second section of the sheet adjacent to the first section. Forming the seam includes cutting through the material of the sheet such as to produce at least one cut. Each of the at least one cut includes: a main portion that is elongated such as to define a seam axis of the seam, the main portion having a first end and a second end; a first extension extending from the first end of the main portion and being

generally perpendicular to the main portion; and a second extension extending from the second end of the main portion and being generally perpendicular to the main portion. The first and second extensions extend on a same side of the main portion.

[0019] In some implementations of the present technology, the material of the sheet is a metallic material.

[0020] In some implementations of the present technology, cutting through the material of the sheet to produce the at least one cut includes: cutting through the material of the sheet to produce a first cut and cutting through the material of the sheet to produce a second cut spaced apart from the first cut by an inter-cut segment of material. The main portion of the first cut is collinear with the main portion of the second cut.

[0021] In some implementations of the present technology, the first and second extensions of each of the first cut and the second cut extend toward a same one of the first and second sections.

[0022] In some implementations of the present technology, at least one of the first cut and the second cut is spaced adjacent an edge of the rigid sheet blank and is spaced from the edge of the rigid sheet blank by an edge segment of material. The inter-cut segment of material and the edge segment of material form a hinge for bending the first and second sections relative to one another.

[0023] In some implementations of the present technology, a length of the first extension is less than a length of the main portion, and a length of the second extension is less than the length of the main portion.

[0024] Implementations of the present technology each have at least one of the above-mentioned object and/or aspects, but do not necessarily have all of them. It should be understood that some aspects of the present technology that have resulted from attempting to attain the above-mentioned object may not satisfy this object and/or may satisfy other objects not specifically recited herein.

[0025] Additional and/or alternative features, aspects and advantages of implementations of the present technology will become apparent from the following description, the accompanying drawings and the appended claims.

BRIEF DESCRIPTION OF THE DRAWINGS

[0026] For a better understanding of the present technology, as well as other aspects and further features thereof, reference is made to the following description which is to be used in conjunction with the accompanying drawings, where:

Figure 1 is a top plan view of a metal sheet blank;

Figure 2A is a detailed view of a seam separating adjacent sections of the metal sheet blank of Figure 1;

Figure 2B is detailed view of an alternative implementation of the seam separating adjacent section of the metal blank of Figure 1;

Figure 3 shows part of the metal sheet blank of Figure 1 being bent such that tabs of a section of the metal sheet blank engage corresponding openings in another section of the metal sheet blank; and

Figure 4 is a right side perspective view of a bent sheet component having been bent into shape from the metal sheet blank of Figure 1.

DETAILED DESCRIPTION

[0027] Figure 1 illustrates a rigid sheet blank 10 for bending into a bent sheet component 500 (Figure 4). The rigid sheet blank 10 is a flat piece of sheet that is cut from a sheet of rigid material. In this implementation, the rigid sheet blank 10 is made of a metallic material, notably galvanized steel, and will thus be referred to as a metal sheet blank 10. The metallic material of the metal sheet blank 10 could be any other suitable metallic material in other implementations (e.g., stainless steel, aluminum, etc.). Moreover, it is contemplated that the sheet 10 could be made of a rigid material other than metallic material in alternative implementations (e.g., a polymeric material) so long as the material in question is bendable.

[0028] The metal sheet blank 10 can be cut from a metal sheet in various ways. In this example, the metal sheet blank 10 is laser cut from the metal sheet by a laser cutting machine. The metal sheet blank 10 may be cut in other ways in other examples (e.g., water jet cutting).

[0029] The metal sheet blank 10 has a right side section 14, a left side section 16, a rear side section 18, a front side section 20, a top side section 22 and a bottom side section 24 which are intended to be bent relative to one another to form the bent sheet component 500. Each of the sections is shaped as desired to obtain the bent sheet component 500 once the metal sheet blank 10 is bent. For instance, in this example, the right side section 14, the left side section 16 and the top side section 22 define cut-outs 26.

[0030] In order to facilitate bending of the metal sheet blank 10 into the bent sheet component 500, the metal sheet blank 10 has seams 30 separating adjacent ones of the sections 14, 16, 18, 20, 22, 24. More specifically, the seams 30 locally weaken the metal sheet blank 10 such as to facilitate bending of adjacent ones of the sections 14, 16, 18, 20, 22, 24 relative to one another. In particular, the seams 30 allow the metal sheet blank 10 to be bent by hand without using any implements (i.e., toollessly).

[0031] Each seam 30 extends along a seam axis 32 and includes at least one cut 34 through the material of the metal sheet blank 10. For example, as shown in Figure 2A, the seam 30 between the right side section 14 and the bottom side section 24 includes three cuts 34,

including two end cuts 34_E and one intermediate cut 34_I, which are spaced apart from one another in a direction of the seam axis 32 by a pair of inter-cut material segments 36. Each of the end cuts 34_E is located adjacent a peripheral edge 25 of the metal sheet blank 10 (which is formed by a peripheral edge 56 of each of the sections 14, 16, 18, 20, 22) and is spaced from the peripheral edge 25 by an edge material segment 45. Together, the inter-cut segments 36 and the edge segments 45 form a hinge for bending the right side section 14 and the bottom side section 24 relative to one another.

[0032] The seams 30 can include more or less than three cuts 34. As shown in Figure 1, some of the seams 30 include four cuts 34. Moreover, it is contemplated that, in some implementations, the seams 30 could include a single cut 34.

[0033] With reference to Figure 2A, each cut 34 is generally U-shaped and has a main portion 40 and a pair of extensions 42, 44 extending transversely to the main portion 40. The main portion 40 is elongated such as to extend along a direction parallel to the seam axis 32 (e.g., collinear with the seam axis 32) from a first end 46 to a second end 48. Each of the extensions 42, 44 extends from a respective one of the first and second ends 46, 48 and is generally perpendicular to the main portion 40 (i.e., within $\pm 10^\circ$ of being perpendicular to the main portion 40). The extensions 42, 44 extend on a same side of the main portion 40 (i.e., pointing in the same direction) such that the cut 34 is U-shaped. Each of the extensions 42, 44 has a length L_E that is less than a length L_M of the main portion 40. More specifically, in this implementation, the length L_E of each of the extensions 42, 44 is approximately the same (e.g., within 10% of one another). In this example, a ratio of the length L_E of a given one of the extensions 42, 44 over the length L_M of the main portion 40 is between 0.1 and 0.3.

[0034] In this implementation, the main portions 40 of the cuts 34 of a given seam 30 are collinear. Moreover, in this implementation, the extensions 42, 44 of each of the cuts 34 of a given seam 30 extend toward a selected one of two of the sections 14, 16, 18, 20, 22, 24 which that seam 30 separates. For example, with respect to the seam 30 separating the right side section 14 from the bottom side section 24, the extensions 42, 44 of each cut 34 of that seam 30 extend toward the bottom side section 24. It is contemplated that, in alternative implementations, as shown in Figure 2B, the main portions 40 of the cuts 34 of a given seam 30 may be offset from one another and that the extensions 42, 44 of one or more of the cuts 34 of a given seam 30 could extend toward different ones of two of the sections 14, 16, 18, 20, 22, 24 which that seam 30 separates.

[0035] The configuration of the cuts 34 may allow a more time-efficient procedure for producing the metal sheet blank 10. Notably, when laser cutting the metal sheet to form the metal sheet blank 10, material being cut to form the cuts 34 may more easily fall from the sheet which saves the operator from having to intervene to de-

tach portions of material stuck to the sheet. Moreover, the generally perpendicular orientation of the extensions 42, 44 relative to the main portion 40 causes the inter-cut segments 36 and the edge segments 45 to be relatively straight rectangular segments which allow the hinge formed by the inter-cut segments 36 and the edge segments 45 (or just the edge segments 45 if the seam 30 includes a single cut 34) to direct the bending and provide a proper bend about the seam axis 32.

[0036] The metal sheet blank 10 is provided with interlocking elements for interlocking certain ones of the sections 14, 16, 18, 20, 22, 24 with one another. More specifically, in this implementation, as shown in Figure 1, the right side, rear side and top side sections 14, 18, 22 of the metal sheet blank 10 have tabs 50_A-50_E and the left side, rear side and top side sections 16, 18, 22 define openings 52_A-52_E for receiving respective ones of the tabs 50_A-50_E during bending of the metal sheet blank 10. More specifically, during bending of the metal sheet blank 10, the tabs 50_A-50_E are inserted into corresponding ones of the openings 52_A-52_E (tab 50_A into opening 52_A, tab 50_B into opening 52_B and so on) and then bent to extend generally parallel to the given ones of the sections 14, 16, 18, 20, 22, 24 that comprise the corresponding ones of the openings 52_A-52_E. This can increase the load bearing capacity of the resulting bent sheet component 500. Moreover, the tabs 50_A-50_E can be bent by hand and thus does not require specialized tooling or particularly experienced labour.

[0037] The tabs 50_A-50_E are configured to be bendable by hand such as to avoid using implements when bending the metal sheet blank 10 into the bent sheet component 500.

[0038] To that end, the tabs 50_A-50_E are relatively long. For instance, with reference to Figure 3, each tab 50_x has a length L_T measured along an axis 54 of the tab 50_x (extending centrally and longitudinally of the tab 50_x) that is greater than a width W_T of the tab 50_x measured at an intersection of the tab 50_x with the peripheral edge 56 of a corresponding one of the sections 14, 16, 18, 20, 22. Notably, a ratio L_T/W_T of the length L_T of the tab 50_x over the width W_T of the tab 50_x is between 2 and 5 inclusively. More specifically, in this example, the ratio L_T/W_T is between 3 and 4. As an example, the length L_T of the tab 50_x can be 10 mm and its width W_T can be 3 mm.

[0039] Moreover, each tab 50_x defines a cut 58 adjacent the peripheral edge 56 of the section comprising the tab 50_x in order to facilitate bending of the tab 50_x. In this implementation, the cut 58 is square or rectangular and forms two segments on either side of the cut 58 that act as a hinge when the tab 50_x is bent.

[0040] The tabs 50_A-50_E are thus bendable by applying a relatively low force at an end portion 60 of each tab 50_x. Notably, in this implementation, a force of less than or equal to 100 N applied by hand at the respective end portion 60 of the tabs 50_A-50_E is sufficient for bending the tabs 50_A-50_E. In other words, the force applied by hand by an adult user is sufficient to bend the tabs 50_A-

50_E.

[0041] With reference to Figures 1 and 3, some of the tabs 50_A-50_E are curved such as to be inserted into the corresponding openings 50_A-50_E without reducing the length of the tabs 50_A-50_E which facilitates their bending.

[0042] Notably, the tabs 50_A, 50_B of the right side section 14 are curved about an axis 70 (Figure 3) that is normal to the metal sheet blank 10. As such, the tabs 50_A, 50_B have respective radii R_A, R_B measured from the axis 70 to the respective tab axes 54 of each of the tabs 50_A, 50_B. In this example, each of the radius R_A and the radius R_B of the tab 50_B is between 5 mm and 60 mm. For instance, in this example, the radius R_A is between 5 mm and 10 mm.

[0043] As shown in Figure 3, a curvature of each of the tabs 50_A, 50_B of the right side section 14 is concentric with a bending radius 75 formed when the top side section 22 is bent about the seam axis 32. As such, the bending radius 75 and the curved tabs 50_A, 50_B have the same axis 70 (which can thus be referred to as a bend axis 70). This may facilitate insertion of the tabs 50_A, 50_B into the openings 52_A, 52_B when the top side section 22 is bent about the seam axis 32.

[0044] As will be understood, the curved tabs 50_A, 50_B are comprised by the right side section 14 which is bendable about an axis generally perpendicular to an axis about which the top side section 22, defining the corresponding openings 52_A, 52_B, is bendable. More particularly, the seam axis 32 separating the right side section 14 from the bottom side section 24 and about which the right side section 14 is bendable is generally perpendicular to the seam axis 32 separating the top side section 22 from the front side section 20 and about which the top side section 22 is bendable.

[0045] Similar to the tabs 50_A, 50_B of the right side section 14, the tab 50_E of the rear side section 18 is curved about an axis normal to the metal sheet blank 10. However, it is noted that the tabs 50_C, 50_D of the top side section 22 are straight (i.e., not curved).

[0046] Furthermore, in this implementation, the left side, rear side and top side sections 16, 18, 22 have lobes 80 that form part of the peripheral edge 56 of each of these sections 16, 18, 22. Each of the lobes 80 defines an outermost point of a respective edge of which that lobe 80 forms a part of and contains at least part of a respective one of the openings 52_A-52_E. This may facilitate insertion of the tabs 50_A-50_E into the openings 52_A-52_E.

[0047] Modifications and improvements to the above-described implementations of the present technology may become apparent to those skilled in the art. The foregoing description is intended to be exemplary rather than limiting. The scope of the present technology is therefore intended to be limited solely by the scope of the appended claims.

Claims

1. A rigid sheet blank (10), comprising:

a first section;
a second section adjacent the first section and configured to be bent relative to the first section; and
a seam (30) separating the first section from the second section to facilitate bending of the first and second sections relative to one another, the seam (30) defining a seam axis (32) and including at least one cut (34) through a material of the rigid sheet blank (10), each of the at least one cut (34) comprising:

a main portion (40) that is elongated such as to extend along a direction parallel to the seam axis (32), the main portion (40) having a first end (46) and a second end (48);
a first extension (42) extending from the first end (46) of the main portion (40) and being generally perpendicular to the main portion (40); and
a second extension (44) extending from the second end (48) of the main portion (40) and being generally perpendicular to the main portion (40), the first and second extensions (42, 44) extending on a same side of the main portion (40).

2. The rigid sheet blank of claim 1 being made of a metallic material.

3. The rigid sheet blank of claim 1 or 2, wherein the at least one cut (34) includes a first cut (34) and a second cut (34) spaced apart from one another by an inter-cut segment of material (36), the main portion (40) of the first cut (34) being collinear with the main portion (40) of the second cut (34).

4. The rigid sheet blank of claim 3, wherein the first and second extensions (42, 44) of each of the first cut (34_E) and the second cut (34_I) extend toward a same one of the first and second sections.

5. The rigid sheet blank of claim 3, wherein:

at least one of the first cut (34_E) and the second cut (34_I) is adjacent an edge (56) of the rigid sheet blank and is spaced from the edge (25) of the rigid sheet blank by an edge segment of material (45); and
the inter-cut segment of material (36) and the edge segment of material (45) form a hinge for bending the first and second sections of the rigid sheet blank relative to one another.

6. The rigid sheet blank of any one of claims 1 to 5 being bendable about the seam axis (32) by hand.

7. The rigid sheet blank of claim 1, wherein:

a length (L_E) of the first extension (42) is less than a length (L_M) of the main portion (40); and a length (L_E) of the second extension (44) is less than the length (L_M) of the main portion (40).

8. The rigid sheet blank of claim 7, wherein the length (L_E) of the first extension (42) is approximately the same as the length (L_E) of the second extension (44).

9. The rigid sheet blank of claim 7 or 8, wherein a ratio of the length (L_E) of the first extension over the length (L_M) of the main portion (40) is between 0.1 and 0.3.

10. A method for producing a hand-bendable rigid sheet blank, comprising:

providing a sheet of rigid material;
forming a seam (30) separating a first section of the sheet from a second section of the sheet adjacent to the first section, the seam (30) being configured to facilitate bending of the first and second sections relative to one another, said forming comprising:

cutting through the material of the sheet such as to produce at least one cut (34), each of the at least one cut (34) comprising:

a main portion (40) that is elongated such as to define a seam axis (32) of the seam (30), the main portion (40) having a first end and a second end (48);

a first extension (42) extending from the first end (46) of the main portion (40) and being generally perpendicular to the main portion (40); and

a second extension (44) extending from the second end (48) of the main portion and being generally perpendicular to the main portion (40), the first and second extensions (42, 44) extending on a same side of the main portion (40).

11. The method of claim 10, wherein the material of the sheet is a metallic material.

12. The method of claim 10 or 11, wherein cutting through the material of the sheet to produce the at least one cut (34) includes:

cutting through the material of the sheet to produce a first cut (34_E); and

cutting through the material of the sheet to produce a second cut (34_I) spaced apart from the first cut (34_E) by an inter-cut segment of material (36),

the main portion (40) of the first cut (34_E) being collinear with the main portion (40) of the second cut (34_I).

13. The method of claim 12, wherein the first and second extensions (42, 44) of each of the first cut (34_E) and the second cut extend (34_I) toward a same one of the first and second sections.

14. The method of claim 12, wherein:

at least one of the first cut (34_E) and the second cut (34_I) is adjacent an edge (25) of the rigid sheet blank (10) and is spaced from the edge (25) of the rigid sheet blank (10) by an edge segment of material (45); and the inter-cut segment of material (36) and the edge segment of material (45) form a hinge for bending the first and second sections relative to one another.

15. The method of claim 10, wherein:

a length (L_E) of the first extension (42) is less than a length (L_M) of the main portion (40); and a length (L_E) of the second extension (42) is less than the length (L_M) of the main portion (40).

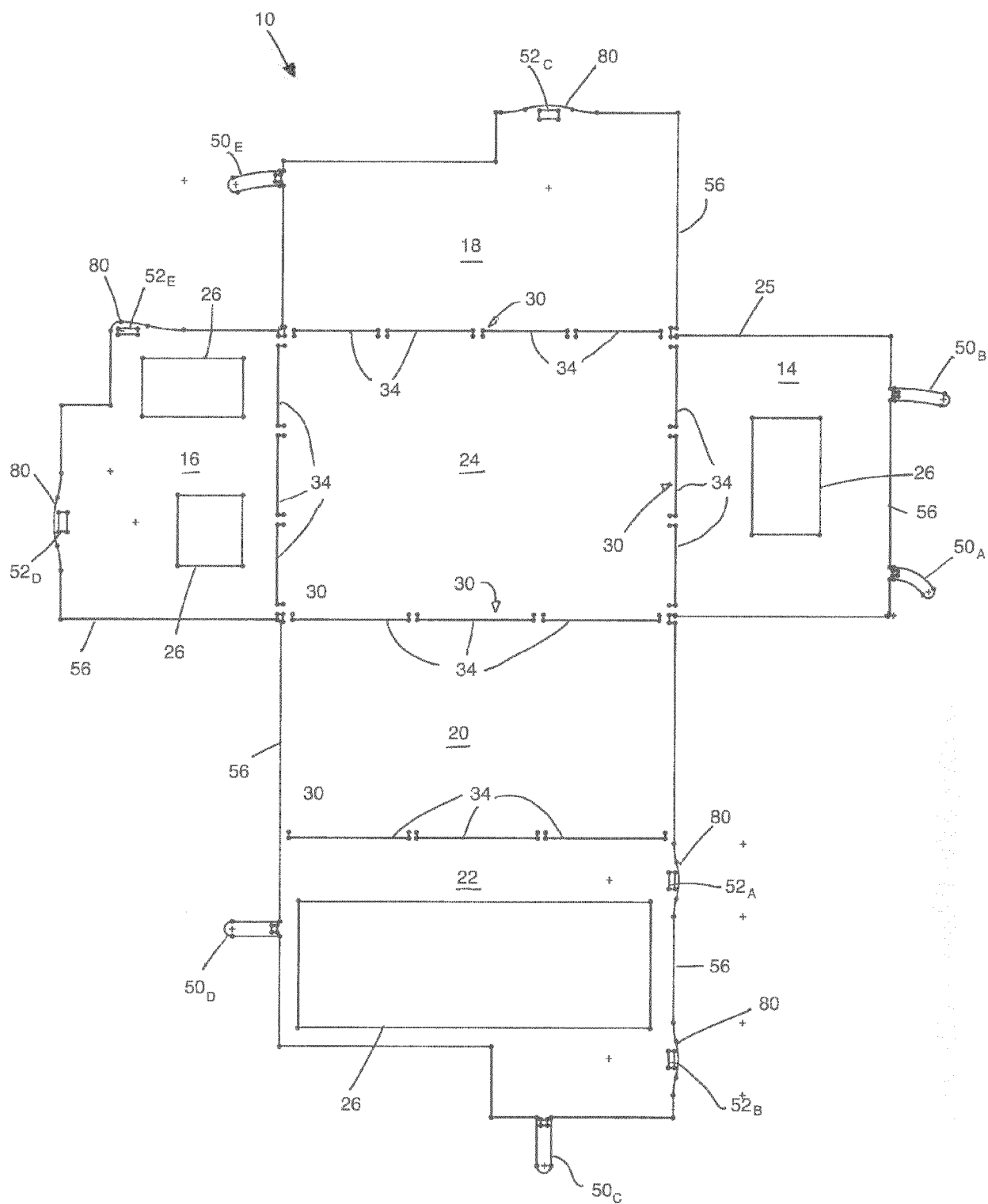


FIG. 1

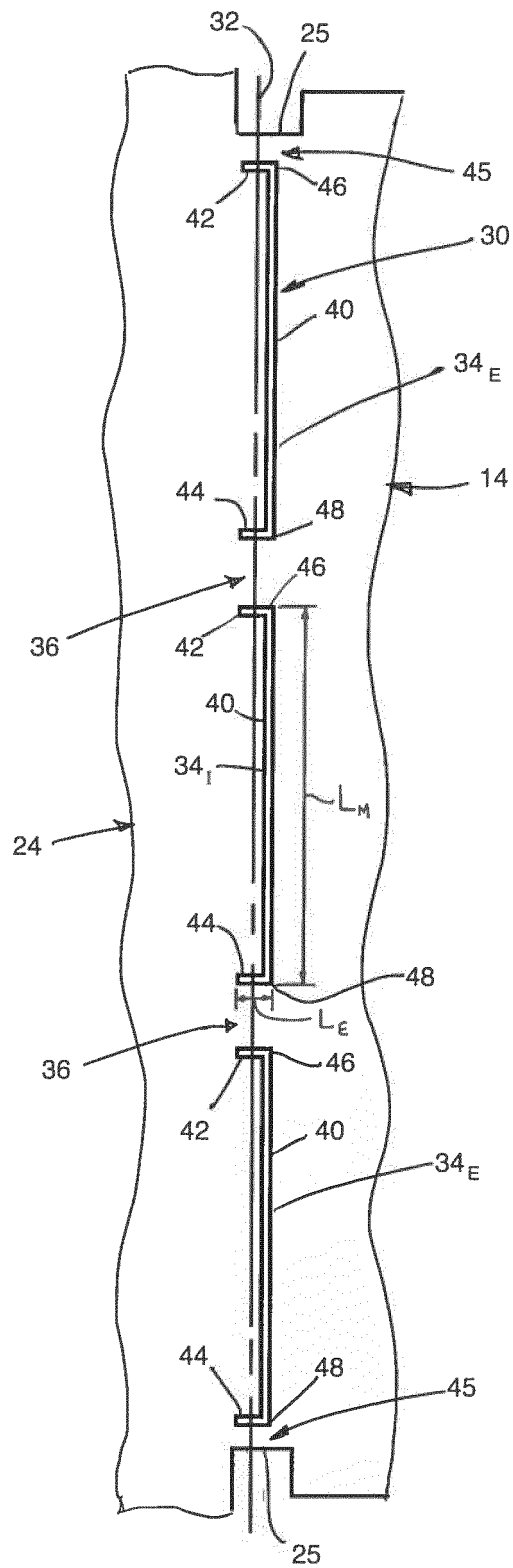


FIG. 2A

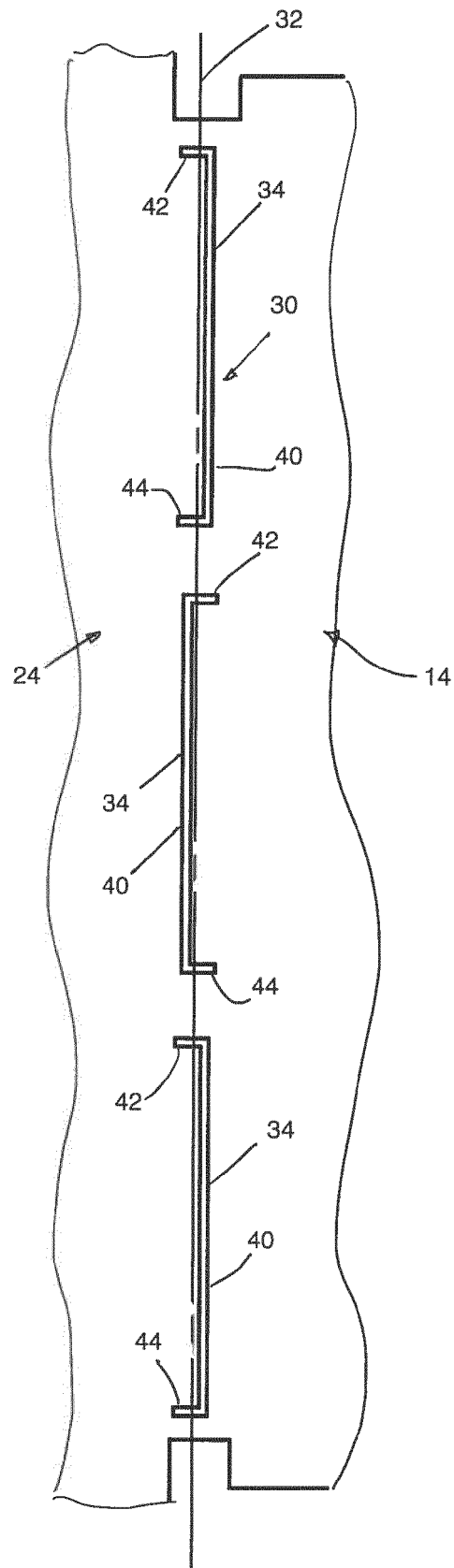


FIG. 2B

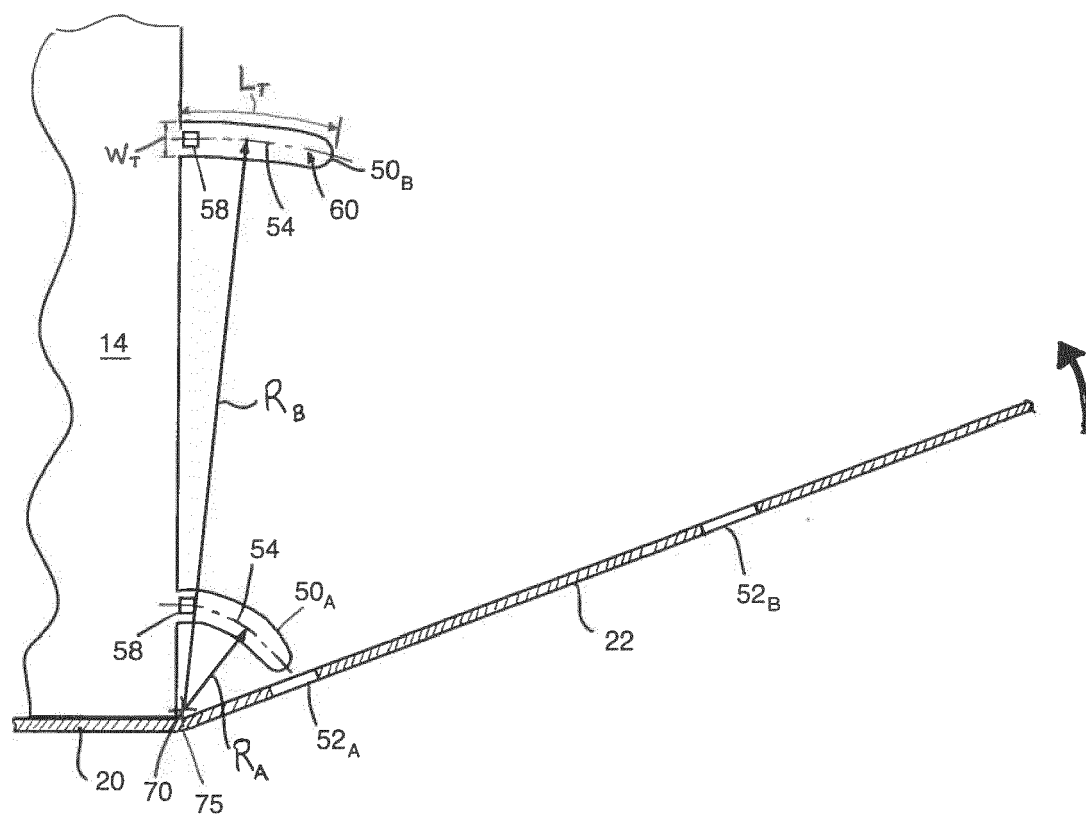


FIG. 3

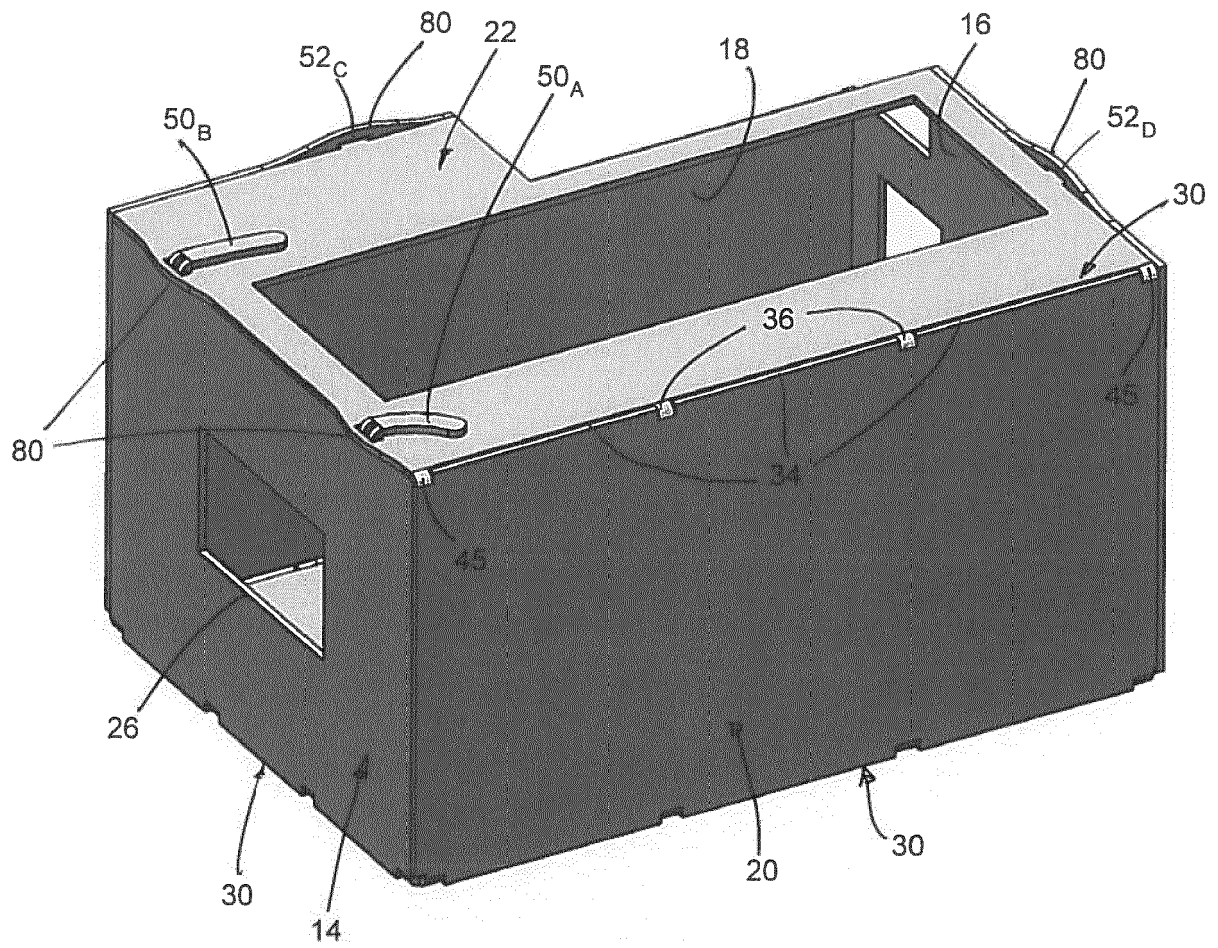


FIG. 4



EUROPEAN SEARCH REPORT

Application Number
EP 17 31 5012

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EPO FORM 1503 03.02 (P04C01)

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The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 15 June 2018	Examiner Pieracci, Andrea
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**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 17 31 5012

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