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(54) Title: PARTS HAVING CORNERS WITH FIXATION MEMBERS

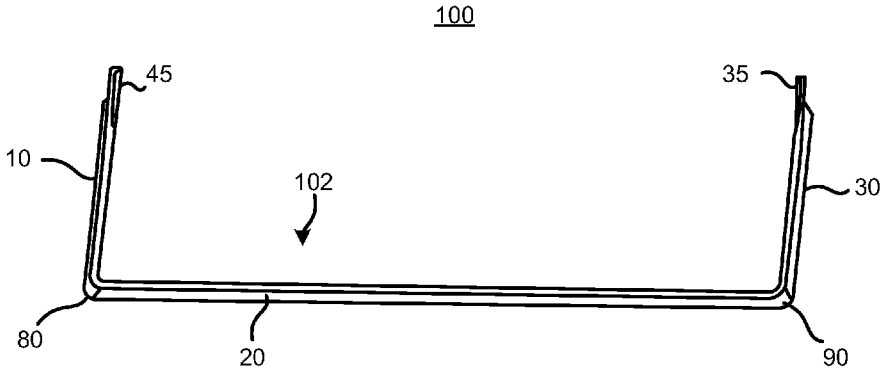


FIG. 1

(57) Abstract: A part for an electronic device may have a first portion (10) including a first angled end (60) and a first end having a first connection member (45) for connection to an electronic device, a second portion (20) including a second angled end (40) and a third angled end (50) opposite the second angled end (40), and a third portion (30) including a fourth angled end (70) and a second end having a second connection member (35) for connection to the electronic device. The first angled end (60) may abut the second angled end (40) to form a first corner (80) and the third angled end (50) may abut the fourth angled end (70) to form a second corner (90). In addition, the first corner (80) may include a first fixation member (25) within a first slot (15) in the first corner (80) and the second corner (90) may include a second fixation member (27) within a second slot (65) in the second corner (90). The part may be formed from a material including aluminum alloy, carbon fiber, magnesium alloy, stainless steel, copper, or a combination thereof.

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[Continued on next page]

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PARTS HAVING CORNERS WITH FIXATION MEMBERS

BACKGROUND

[0001] Many parts, such as stands for electronic devices, may be formed using various fabrication techniques, such as a full computer numeric control (CNC) process and/or a bending process.

BRIEF DESCRIPTION OF THE DRAWING

[0002] Features of the present disclosure are illustrated by way of example and not limited in the following figure(s), in which like numerals indicate like elements, in which:

[0003] FIG. 1 shows an isometric view of an example part having corners with fixation members within slots in the corners;

[0004] FIG. 2 shows an isometric view of a section of the part depicted in FIG. 1 prior to the part being bent to form portions of the part;

[0005] FIGS. 3 and 4, respectively, show diagrams of a first corner of the example part depicted in FIGS. 1 and 2;

[0006] FIG. 5 shows a flow diagram of an example method for forming a part that may include corners with fixation members inserted within slots in the corners; and

[0007] FIG. 6 shows an isometric view of an example apparatus including the example part as shown in FIGS. 1-4 and fabricated according to the example method depicted in FIG. 5.

DETAILED DESCRIPTION

[0008] For simplicity and illustrative purposes, the present disclosure is described by an example thereof. In the following description, numerous specific details are set forth in order to provide a thorough understanding of the present disclosure. It will be readily apparent however, that the present disclosure may be practiced without limitation to these specific details. In other instances, some methods and structures have not been described in detail so as not to unnecessarily obscure the present disclosure. As used herein, the terms "a" and "an" are intended to denote at least one of a particular element, the term "includes" means includes but not limited to, the term "including" means including but not limited to, and the term "based on" means based at least in part on.

[0009] Using a CNC process to fabricate parts for electronic devices may be relatively expensive. In addition, using a bending process to fabricate the parts may be difficult and time consuming. Disclosed herein are parts that may be connected to electronic devices and/or to removable casings for electronic devices and may be fabricated in a relatively simple manner while having a high level of strength and rigidity at the corners of the parts. Also disclosed herein are methods for fabricating the parts. Further disclosed herein are apparatuses, e.g., electronic devices, removable casings, etc., that may include the parts.

[0010] Reference is first made to FIGS. 1 and 2. FIG. 1 shows an isometric view of an example part 100 having corners with fixation members within slots in the corners. The example part 100 may include a first portion 10, a second portion 20, and a third portion 30. FIG. 2 shows an isometric view of a section of the part 100 prior to the part 100 being bent to form the portions 10-30 of the part. The first portion may include a first angled end and a first end having a first connection member for connection to an electronic device. The second portion may include a second angled end and a third angled end opposite the second angled end. The third portion may include a fourth angled end and a second end having a second connection member for connection to the electronic device. In an aspect, the first angled end may abut the second angled end to form a first corner and the third angled end may abut the fourth angled end to form a second

corner. The first corner may include a first fixation member within a first lot in the first corner and the second corner may include a second fixation member within a second slot in the second corner. The part may be formed from a material including aluminum alloy, carbon fiber, magnesium alloy, stainless steel, copper, or a combination thereof. It should be understood that the example part 100 depicted in FIGS. 1 and 2 may include additional components and that some of the components described herein may be removed and/or modified without departing from the scope of the example part 100 disclosed herein.

[0011] As shown in FIG. 1, an elongated piece of material 102 may be bent to form the first portion 10, the second portion 20, and the third portion 30. That is, the piece of material 102 may be bent to form a first corner 80 between first portion 10 and the second portion 20. In addition, the piece of material 102 may be bent to form a second corner 90 between the second portion 20 and the third portion 30. The first portion 10, the second portion 20, and the third portion 30 may share a continuous surface. As discussed herein, notches 75, 85 may be formed in the piece of material 102 at the corners 80, 90 to aid in the bending of the piece of material 102, e.g., to enable the piece of material 102 to be bent with a minimized or reduced level of resistance at the locations of the notches 75, 85. In addition, slots 15, 65 may be formed in the notches 75, 85 such that fixation members 25, 27 may respectively be inserted into the slots 15, 65.

[0012] An end opposite the first corner 80 of the first portion 10 may include a first connection member 45 and an end opposite the second corner 90 of the third portion 30 may include a second connection member 35. The connection members 45, 35 may include features that may enable the connection members 45, 35 to attach to mating features on a housing 150 (shown in FIG. 6) to enable the part 100 to be rotatably attached to the housing 150. The housing 150 may be an electronic device, such as a tablet computer, a smartphone, or the like. Alternatively, the housing 150 may be a removable casing for an electronic device.

[0013] As shown in FIG. 2, prior to the piece of material 102 being bent, the first portion 10 of the piece of material 102 may be formed to include a first angled

end 60, the second portion 20 may be formed to include a second angled end 40 and a third angled end 50 opposite the second angled end 40, and the third portion 30 may be formed to include a fourth angled end 70. The first angled end 60 may share a common edge with the second angled end 40 to form a first notch 75. In addition, the third angled end 50 may share a common edge with the fourth angled end 70 to form a second notch 85. The locations of the piece of material 102 at which the first angled end 60 shares an edge with the second angled end 40 and the third angled end 50 shares an edge with the fourth angled end 70 may remain connected such that notches 75 and 85 do not extend through the entire area of the piece of material 102.

[0014] As shown, a first slot 15 may be formed in the first angled end 60 and the second angled end 40. In addition, a second slot 65 may be formed in the third angled end 50 and the fourth angled end 70. The first slot 15 and the second slot 65 may each be substantially parallel with a top and bottom surface of the part 100. A first fixation member 25 may be inserted into the first slot 15 and a second fixation member 27 may be inserted into the second slot 65. The first slot 15 and the second slot 65 may be shaped and sized to substantially match the shape and size of the first fixation member 25 and the second fixation member 27, respectively. The first fixation member 25 may be held in the first slot 15 and the second fixation member 27 may be held in the second slot 65 through friction fitting and/or through the use of adhesives. The adhesive may include, but is not limited to, polyurethanes, epoxies, resins, and the like.

[0015] The size and the shape of the first slot 15 and the second slot 65 may vary depending upon the size and the shape of the first fixation member 25 and the second fixation member 27. For example, the first slot 15 may be in the shape of a polygon, such as a square, when the first angled end 60 abuts the second angled end 40 to form a first corner 80.

[0016] Likewise, the size and the shape of the first fixation member 25 and the second fixation member 27 may vary depending upon the size and the shape of the first slot 15 and the second slot 65. The fixation members 25, 27 may be provided in the slots 15, 65 to provide one or more of the following attributes:

minimize metal deformation of the part 100, provide strength to the first corner 80 and the second corner 90, reduce production costs, etc. In some examples, the fixation members 25 and 27 may be formed of a relatively stronger material than the piece of material 102 and may thus provide additional strength to the part 100 at the corners 80, 90.

[0017] During a part 100 fabrication process, the first portion 10 may be bent with respect to the second portion 20 to cause a surface of the first angled end 60 to abut a surface of the second angled end 40 and thus form the first corner 80. As the first portion 10 is bent towards the second portion 20, the first fixation member 25 may be inserted into the portions of the first slot 15 formed in the first angled end 60 and the second angled end 40. In addition, the third portion 30 may be bent toward the second portion 20 to cause a surface of the third angled end 50 to abut a surface of the fourth angled end 70. As the third portion 30 is bent towards the second portion 20, the second fixation member 27 may be inserted into the portions of the second slot 65 formed in the third angled end 50 and the fourth angled end 70.

[0018] The first angled end 60, the second angled end 40, the third angled end 50, and the fourth angled end 70 may each independently have the same angle or may have a different angle with respect to each other. For example, the first angled end 60 and the second angled end 40 may each be about 45° or may be about 30° and about 60°, respectively. In an aspect, each of the first angled end 60, the second angled end 40, the third angled end 50, and the fourth angled end 70 may be any angle including any angle between about 0° and about 90°. However, the first angled end 60 and the second angled end 40 together, may form an angle that is about 90° such that when the first angled end 60 and the second angled end 40 abut each other, the first portion 10 forms about a 90° angle, e.g., about a right angle, with respect to the second portion 20. The third angled end 50 and the fourth angled end 70 may have a similar relationship such that when the third angled end 50 and the fourth angled end 70 abut each other, the third portion 30 forms about a 90° angle with respect to the second portion 20.

[0019] The first angled end 60 may abut with the second angled end 40 to

form the first corner 80. The third angled end 50 may abut with the fourth angled end 70 to form the second corner 90. In an aspect, the first corner 80 and the second corner 90 may each form a right angle, i.e., 90°. In another aspect, each of the first corner 80 and the second corner may form an angle other than a right angle, such as about 89°, about 91°, including any angle from about 0° to about 180°.

[0020] With reference now to FIGS. 3 and 4, there are respectively shown diagrams of a first corner 80 of the example part 100 depicted in FIGS. 1 and 2. As discussed herein, the first portion 10 and the second portion 20 may form the first corner 80 and a first fixation member 25 may be present within the first corner 80, e.g., within the first slot 15. When the first angled end 60 abuts the second angled end 40, a micro-gap 55 may be present in the first corner 80. Similarly, when the third angled end 50 abuts the fourth angle end 70, a micro-gap 55 may be present in the second corner 90.

[0021] According to examples, a filler may be applied to the micro-gap 55. The filler may be used to fill the micro-gap 55 such that the appearance of the micro-gap 55 may be reduced, which may provide an appearance of a continuous piece of material. Any suitable filler may be used and non-limiting examples may include a putty, an epoxy, paint, or the like. In an aspect, a combination of fillers may be used. For example, a putty may be applied to the micro-gap 55 and a paint may be applied over the putty to color-match with the part 100. The filler may be used to improve the aesthetics of the first corner 80 and the second corner 90.

[0022] In some examples, the piece of material 102 from which the part 100 may be fabricated and the fixation members 25, 27 may include the same material. In other examples, the piece of material 102 and the fixation members 25, 27 may include different materials. In any of these examples, the material may be selected from the group consisting of metals, metal alloys, and ceramics. Non-limiting examples of metals include alkali metals, alkaline earth metals, transition metals, post-transition metals, lanthanides, and actinides. The alkali metals may include lithium, sodium, potassium, rubidium, cesium, and francium.

The alkaline earth metals may include beryllium, magnesium, calcium, strontium, barium, and radium. The transition metals may include scandium, titanium, vanadium, chromium, manganese, iron, cobalt, nickel, copper, zinc, yttrium, zirconium, niobium, molybdenum, technetium, ruthenium, rhodium, palladium, silver, cadmium, hafnium, tantalum, tungsten, rhenium, osmium, iridium, platinum, and gold. The post-transition metals include aluminum, indium, tin, thallium, lead, and bismuth.

[0023] Non-limiting examples of metal alloys include steel, solder, pewter, duralumin, phosphor bronze, amalgams, stainless steel alloys 303, 304, 310, 316, 321, 347, 410, 420, 430, 440, PH13~ 8,17~4PH; Fe / Ni, Fe / Si, Fe / Al, Fe / Si / Al, Fe / Co, magnetic alloys containing Fe / Co / V; satellite 6 cobalt alloy including satellites 12; copper, copper alloys, bronze (Cu / Sn), brass (Cu / Zn), tin, lead, gold, silver, platinum, palladium, iridium, titanium, tantalum, iron, aluminum alloys, magnesium including alloys, iron alloys, nickel alloys, chromium alloys, silicon alloys, zirconium alloys, gold alloys, and any suitable combination.

[0024] In an example, the piece of material 102 may include aluminum, copper, Ti_6Al_4V, $AlSi_{10}Mg$, bronze alloys, stainless steel, Inconel, and cobalt-chromium, nickel-molybdenum-chromium alloys, or the like. In another example, the piece of material 102 may include an aluminum alloy, carbon fiber, magnesium alloy, stainless steel, copper, or a combination thereof. In a further example, the piece of material 102 may include (i) the magnesium alloy including a major portion of magnesium and a minor portion of elements chosen from aluminum, zinc, silicon, manganese, copper, iron, beryllium, calcium, and nickel; or (ii) the aluminum alloy including a major portion of aluminum and a minor portion of elements chosen from aluminum, silicon, copper, magnesium, and chromium. A “major portion” is understood to mean greater than or equal to 50% of a whole portion. A “minor portion” is understood to mean less than 50% of a whole portion. By way of particular example, the piece of material 102 may be formed from a material including aluminum alloy, carbon fiber, magnesium alloy, stainless steel, copper, or a combination thereof.

[0025] With reference to FIG. 5, there is shown a flow diagram of an

example method 200 for forming a part 100 that may include corners with fixation members 25, 27 inserted within slots in the corners. It should be apparent to those of ordinary skill in the art that the method 200 may represent a generalized illustration and that other operations may be added or existing operations may be removed, modified, or rearranged without departing from a scope of the method 200. The description of the method 200 is made with respect to FIGS. 1-4.

[0026] At block 202, a first notch 75 may be formed in a piece of material 102 to partially separate a first portion 10 from a second portion 20 on the piece of material 102. Thus, the first notch 75 may be formed at a location along the piece of material 102 at which the first corner 80 is to be formed. The first notch 75 may be formed through any suitable cutting process and/or molding process, such as, a CNC process that may utilize water, sand, laser beams, or the like, to cut the first notch 75 into the piece of material 102.

[0027] The piece of material 102 may be formed to have an elongated shape and to extend linearly. For instance, the piece of materiall 102 may be cut from a sheet of material through any suitable cutting process, such as, a CNC process that may utilize water, sand, laser beams, or the like, to cut the pieces of material 102 from the sheet. The piece of material 102 may additionally or alternatively be formed through any of an extrusion, a stamping, a molding, or the like, process. In any regard, a first connection member 45 on the first portion 10 and a second connection member 35 on the third portion 30 may be formed on the piece of material 102, e.g., during the process of forming the piece of material 102, for connection to a housing 150 of an apparatus 300 electronic device. In these examples, the first notch 75 may be formed following the formation of the connection members 45, 35. In other examples, however, the first notch 75 may be formed prior to the formation of the connection members 45, 35.

[0028] At block 204, a second notch 85 may be formed in the piece of material 102 to partially separate the second portion 20 from a third portion 30. Thus, the second notch 85 may be formed at a location along the piece of material 102 at which the second corner 90 is to be formed. The second notch 85 may be formed through the same cutting process as the first notch 75.

[0029] At block 206, a first slot 15 may be formed in the first notch 75. In addition, at block 208, a second slot 65 may be formed in the second notch 85. According to examples, the piece of material 102 may be rotated 90° prior to formation of the first slot 15 and the second slot 65. Following rotation of the piece of material 102, the first slot 15 and the second slot 65 may be formed through a suitable cutting process, such as, a CNC process that may utilize water, sand, laser beams, or the like. In addition or in other examples, the piece of material 102 may be formed to include the first notch 75, the first slot 15, the second notch 85, and the second slot 65 through a molding process.

[0030] At block 210, a first fixation member 25 may be inserted into the first slot 15 and at block 212, a second fixation member 27 may be inserted into the second slot 65. The first fixation member 25 and the second fixation member 27 may be friction fit into the respective slots 15, 65. In addition, or alternatively, an adhesive may be inserted with the first fixation member 25 and the second fixation member 27 to cause the first fixation member 25 and the second fixation member 27 to be adhered to surfaces inside the respective first and second slots 15, 65.

[0031] At block 214, a first corner 80 may be formed by bending the piece of material 102 at the first notch 75 and at block 216, a second corner 90 may be formed by bending the piece of material 102 at the second notch 85. The notches 75 and 85 may facilitate the bending of the piece of material 102 to form the corners 80, 90. In this manner, the part 100 may be formed in a more time and cost efficient manner with a reduced likelihood of metal deformation at the first corner 80 and the second corner 90. In addition, the fixation members 25, 27 may be held within the slots 15, 65 following the bending the piece of material 102. At block 218, a filler may be applied to micro-gaps present in the first corner 80 and the second corner 90 to cover the micro-gaps. The part 100 may be formed from a material 102 including aluminum alloy, carbon fiber, magnesium alloy, copper, stainless steel, or a combination thereof.

[0032] Following fabrication of the part 100, the first connector 45 and the second connector 35 on the part 100 may be attached to mating connectors on an

apparatus 300 (FIG. 6). FIG. 6 shows an isometric view an example apparatus 300 including the example part 100 as shown in FIGS. 1-4 and fabricated according to the example method depicted in FIG. 5.

[0033] As shown, the apparatus 300, such as an electronic device, may include a housing 150 to which the part 100 may be movably attached. The housing 150 may be a housing of a tablet computer, a smartphone, a laptop computer, a display, or the like. In other examples, the housing 150 may be a removable casing of an electronic device, such as a tablet computer, smartphone, or the like. According to examples, the connection members 45, 35 may enable the part 100 to be rotated with respect to the housing 150. For instance, the part 100 may be rotatably attached to the housing 150 such that the part 100 may be moved between a retracted position and an extended position, as shown in FIG. 6, or any of multiple positions therebetween. In some examples, the part 100 may operate as a stand for the apparatus 300 and may enable the apparatus 300 to be maintained at various viewing angles. The housing 150 may be formed from the same or different material as the part 100.

[0034] Although described specifically throughout the entirety of the instant disclosure, representative examples of the present disclosure have utility over a wide range of applications, and the above discussion is not intended and should not be construed to be limiting, but is offered as an illustrative discussion of aspects of the disclosure.

[0035] What has been described and illustrated herein is an example of the disclosure along with some of its variations. The terms, descriptions and figures used herein are set forth by way of illustration only and are not meant as limitations. Many variations are possible within the spirit and scope of the disclosure, which is intended to be defined by the following claims -- and their equivalents -- in which all terms are meant in their broadest reasonable sense unless otherwise indicated.

What is claimed is:

1. A part for an electronic device, the part comprising:

a first portion including a first angled end and a first end having a first connection member for connection to the electronic device;

a second portion including a second angled end and a third angled end opposite the second angled end; and

a third portion including a fourth angled end and a second end having a second connection member for connection to the electronic device;

wherein the first angled end abuts the second angled end to form a first corner;

wherein the third angled end abuts the fourth angled end to form a second corner;

wherein the first corner includes a first fixation member within a first slot in the first corner and the second corner includes a second fixation member within a second slot in the second corner, and

wherein the part is formed from a material including aluminum alloy, carbon fiber, magnesium alloy, stainless steel, copper, or a combination thereof.

2. The part of claim 1, wherein the first corner and the second corner each form a right angle.

3. The part of claim 1, wherein the first slot is formed in the first angled end and the second angled end and the second slot is formed in the third angled end and the fourth angled end.

4. The part of claim 1, wherein a micro-gap is formed in each of the first corner and the second corner and wherein a filler is applied on the micro-gaps.

5. The part of claim 4, wherein the filler is selected from the group consisting of putty, epoxy, and paint.

6. The part of claim 1, wherein the first fixation member is held within the first slot and the second fixation member is held within the second slot with an adhesive.

7. The part of claim 1, wherein the material comprises (i) the magnesium alloy including a major portion of magnesium and a minor portion of elements chosen from aluminum, zinc, silicon, manganese, copper, iron, beryllium, calcium, and nickel; or (ii) the aluminum alloy including a major portion of aluminum and a minor portion of elements chosen from aluminum, silicon, copper, magnesium, and chromium.

8. The part of claim 1, wherein the first portion, the second portion, and the third portion share a continuous surface.

9. A method for forming a part for an electronic device, the method comprising:

forming a first notch in a piece of material to partially separate a first portion from a second portion of the part;

forming a second notch in the piece of material to partially separate the second portion from a third portion of the part;

forming a first slot in the first notch;

forming a second slot in the second notch;

inserting a first fixation member into the first slot;

inserting a second fixation member into the second slot;

bending the piece of material at the first notch to form a first corner; and

bending the piece of material at the second notch to form a second corner,

wherein the part is formed from a material including aluminum alloy, carbon fiber, magnesium alloy, copper, stainless steel, or a combination thereof.

10. The method of claim 9, further comprising applying a filler to a micro-gap present in the first corner and the second corner.

11. The method of claim 9, wherein forming the first notch, the second notch, the first slot, and the second slot comprises forming the first notch, the second notch, the first slot, and the second slot via a cutting process and/or a molding process.

12. The method of claim 9, further comprising:

applying an adhesive in the first slot and the second slot.

13. The method of claim 9, further comprising:

forming a first connection member on the first portion; and

forming a second connection member on the third portion, the first connection member and the second connection member for connection to a housing of the electronic device.

14. An electronic device comprising:

a housing; and

a part movably attached to the housing, the part including:

a first portion including a first angled end;

a second portion including a second angled end and a third angled end opposite the second angled end; and

a third portion including a fourth angled end;

wherein the first angled end abuts the second angled end to form a first corner;

wherein the third angled end abuts the fourth angled end to form a second corner;

wherein the first corner includes a first fixation member within a first slot and the second corner includes a second fixation member within a second slot, and

wherein the part is formed from a material including aluminum alloy, carbon fiber, magnesium alloy, copper, stainless steel, or a combination thereof.

15. The electronic device of claim 14, wherein the housing is one of a part of an electronic device or a removable casing of the electronic device.

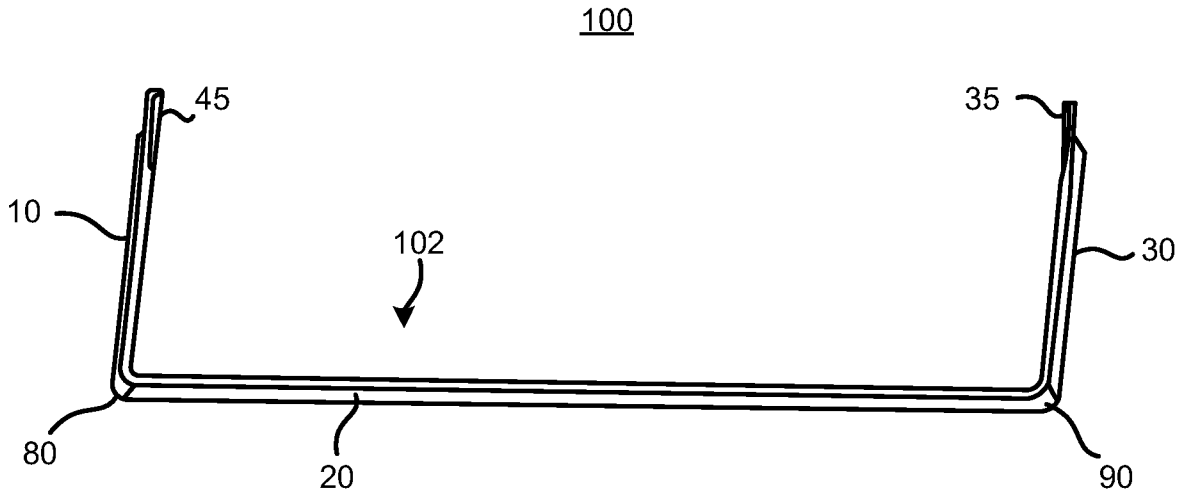

100
45
35
10
102
30
80
20
90

FIG. 1

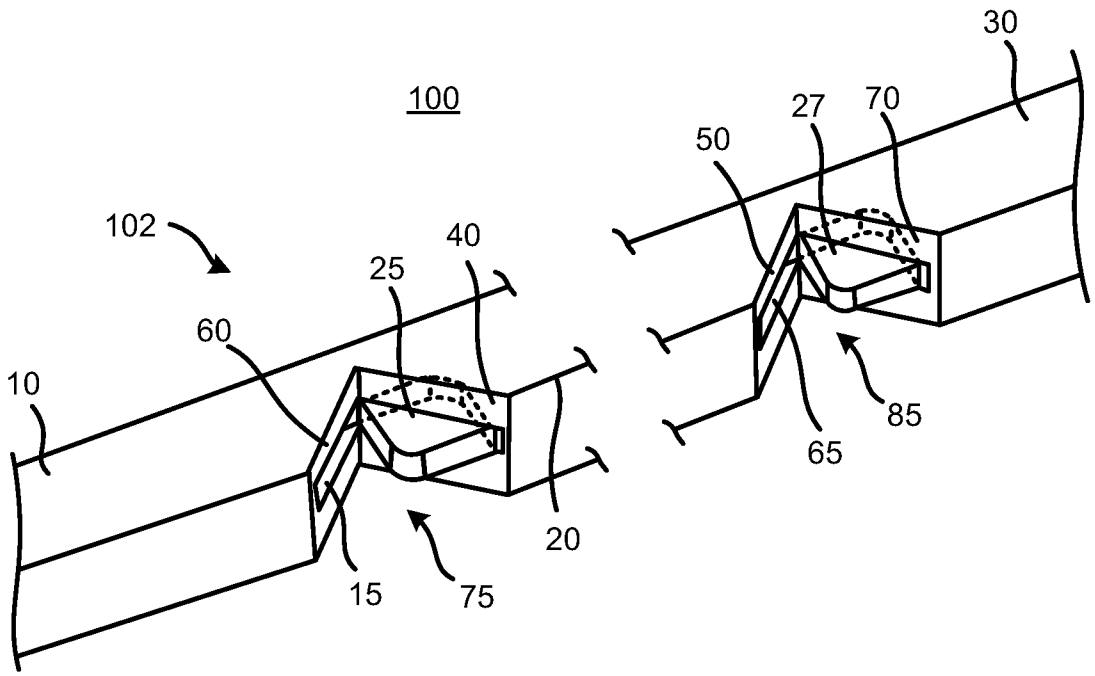

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40
25
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10
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65
20
15
75

FIG. 2

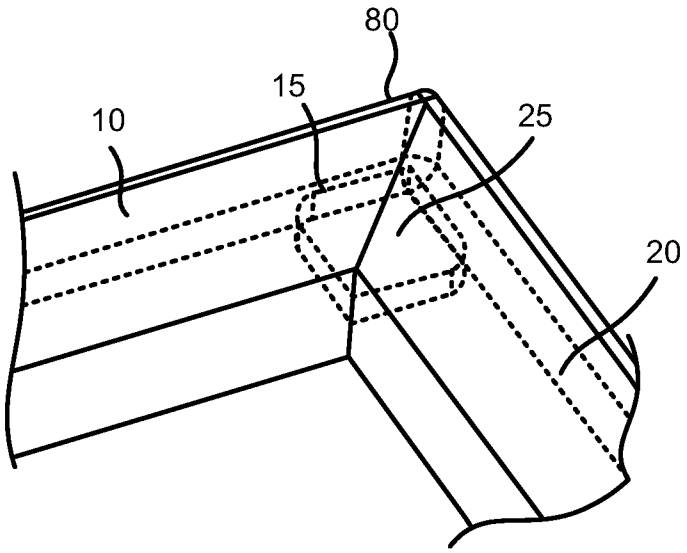


FIG. 3

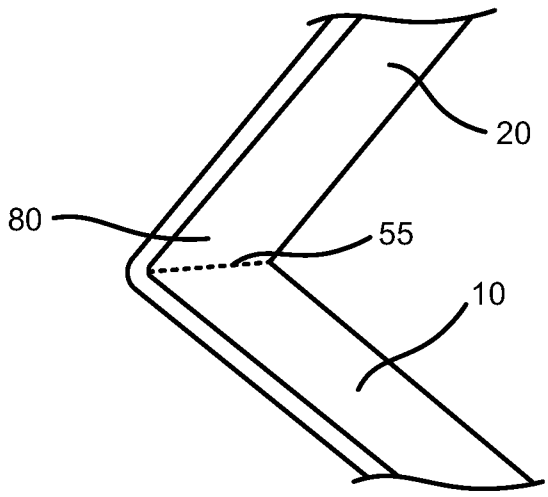


FIG. 4

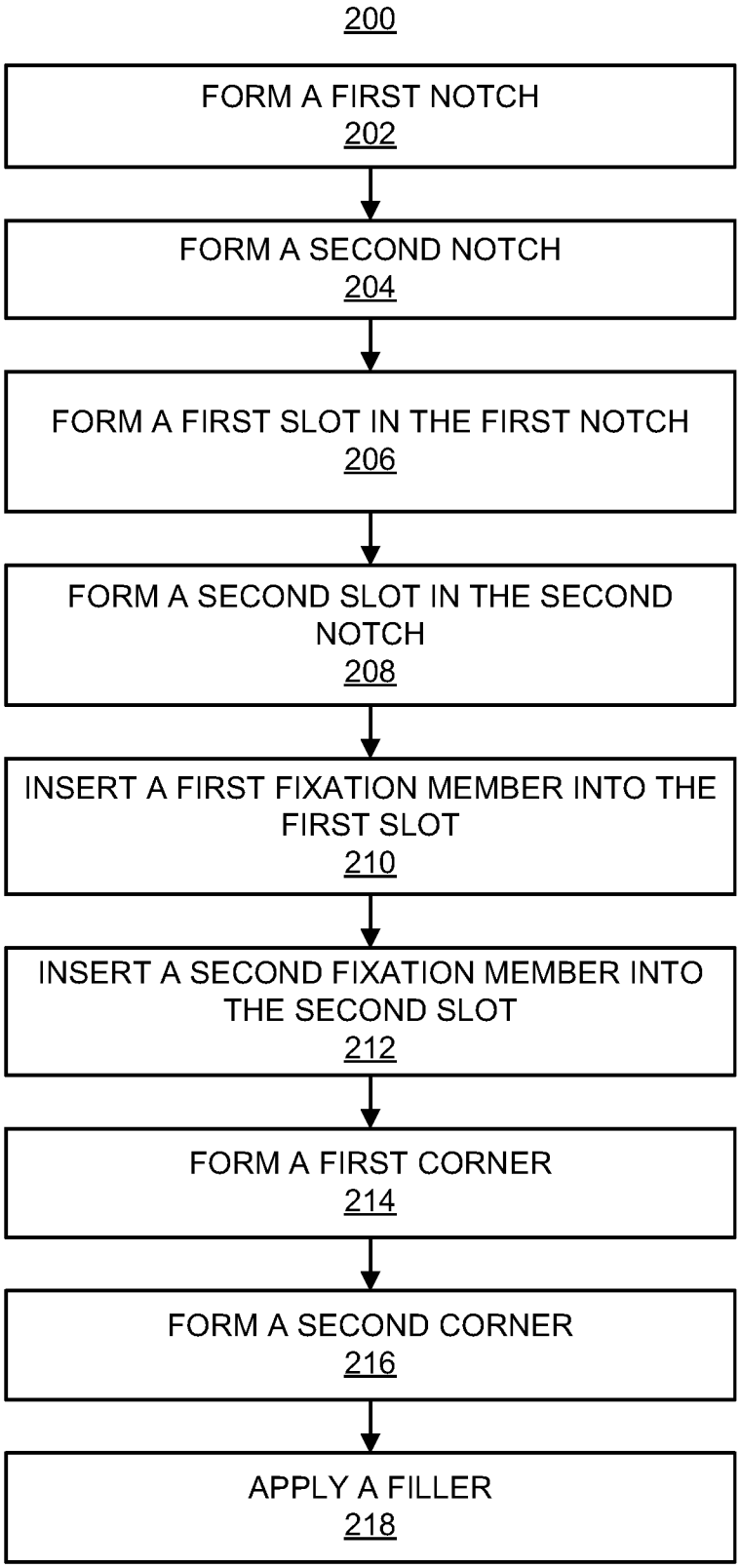

200
FORM A FIRST NOTCH
202
FORM A SECOND NOTCH
204
FORM A FIRST SLOT IN THE FIRST NOTCH
206
FORM A SECOND SLOT IN THE SECOND NOTCH
208
INSERT A FIRST FIXATION MEMBER INTO THE FIRST SLOT
210
INSERT A SECOND FIXATION MEMBER INTO THE SECOND SLOT
212
FORM A FIRST CORNER
214
FORM A SECOND CORNER
216
APPLY A FILLER
218

FIG. 5

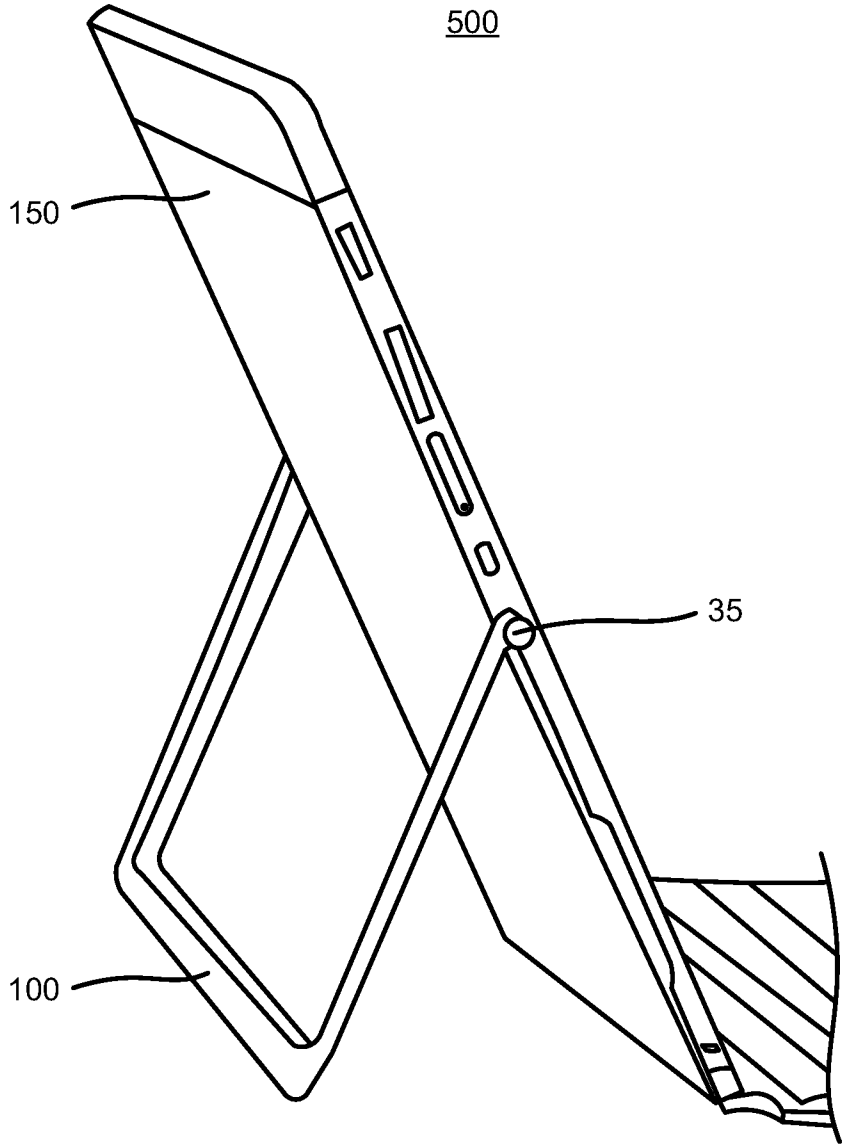


FIG. 6

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2019/070349

A. CLASSIFICATION OF SUBJECT MATTER

G06F 1/16(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

G06F; A47G; F16M

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

DWPI, SIPOABS, CNABS, CNTXT,CNKI,slot?, frame?, insert+, corner?, forming, notch, fix+, electronic, alloy, gap?, filler, corner?,bend+, material

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	CN 205809775 U (SHENZHEN SHANZHUO TECHNOLOGY CO., LTD.) 14 December 2016 (2016-12-14) paragraphs [0031-0032, 0034], figures 5-7	1-15
A	WO 2016085439 A1 (HEWLETT PACKARD DEVELOPMENT CO., L.P.) 02 June 2016 (2016-06-02) paragraphs [0009-0029], figures 1-5	1-15
A	US 5205645 A (LEE, JIN T.) 27 April 1993 (1993-04-27) figures1-4	1-15
A	CN 105556414 A (HEWLETT-PACKARD DEV. CO., L.P.) 04 May 2016 (2016-05-04) paragraphs [0009-0011], figures 1-2	1-15
A	US 2010014239 A1 (SASSOUNIAN, SYLVA A.) 21 January 2010 (2010-01-21) figures1-15	1-15
A	US 5199681 A (REIDY, MARK M.) 06 April 1993 (1993-04-06) claims 1-9, figures1-4	1-15

☐ Further documents are listed in the continuation of Box C. ☑ See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
16 September 2019	**27 September 2019**

Name and mailing address of the ISA/CN	Authorized officer
National Intellectual Property Administration, PRC **6, Xitucheng Rd., Jimen Bridge, Haidian District, Beijing 100088** **China**	**SHI,Yun**
Facsimile No. **(86-10)62019451**	Telephone No. **86-(10)-53962911**

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2019/070349

Patent document cited in search report			Publication date (day/month/year)	Patent family member(s)			Publication date (day/month/year)
CN	205809775	U	14 December 2016	None			
WO	2016085439	A1	02 June 2016	US	9720452	B2	01 August 2017
				US	2016216742	A1	28 July 2016
				CN	105874400	A	17 August 2016
				TW	201514664	A	16 April 2015
				TW	I561963	B	11 December 2016
US	5205645	A	27 April 1993	None			
CN	105556414	A	04 May 2016	WO	2015041696	A1	26 March 2015
				TW	I609148	B	21 December 2017
				TW	201516303	A	01 May 2015
				US	10317936	B2	11 June 2019
				US	2016239045	A1	18 August 2016
US	2010014239	A1	21 January 2010	US	8054618	B2	08 November 2011
US	5199681	A	06 April 1993	None			