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- *as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))*

(54) Title: COMPOSITE CARBON FIBER SHEETS

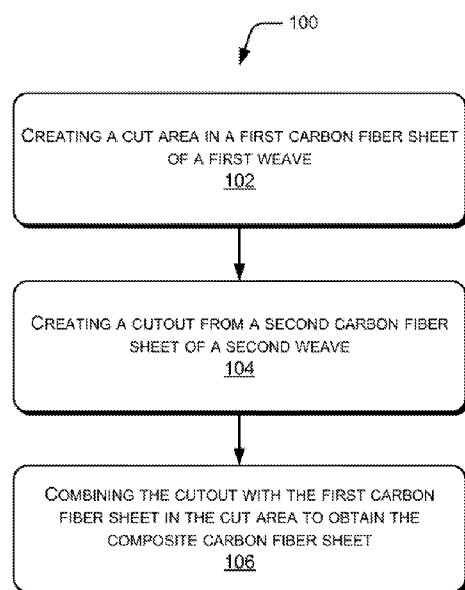


Fig. 1

(57) Abstract: The present subject matter relates to composite carbon fiber sheets and methods for preparing the composite carbon fiber sheets. The composite carbon fiber sheet comprises a first carbon fiber sheet of a first weave and a second carbon fiber sheet of a second weave. A cut area is created in a first carbon fiber sheet of a first weave. A cutout is created from a second carbon fiber sheet of a second weave. The cutout is combined with the first carbon fiber sheet in the cut area to obtain the composite carbon fiber sheet.

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## COMPOSITE CARBON FIBER SHEETS

## BACKGROUND

[0001] Electronic devices, such as laptops and mobile devices, include various thin parts, such as base covers. Carbon fiber sheets are used for manufacturing such thin parts. Based on the number of filaments per fiber, carbon fiber sheets can be classified as 1K, 3K, 12K sheets and the like, where 1K means there are 1000 filaments per fiber, 3K means there are 3000 filaments per fiber, and 12K means there are 12000 filaments per fiber. Further, based on weave, carbon fiber sheets are classified, for example, as having unidirectional (UD) and multi-directional weave. In UD carbon fiber sheets, fibers run parallel to each other whereas in multi-directional carbon fiber sheets, fibers cross at an angle to each other. Multi-directional carbon fiber sheets may include bidirectional carbon fiber sheets, tridirectional carbon fiber sheets, and the like.

## BRIEF DESCRIPTION OF DRAWINGS

[0002] The following detailed description references the figures, wherein:

[0003] Fig. 1 illustrates an example method of preparing a composite carbon fiber sheet, according to an example implementation of the present subject matter.

[0004] Fig. 2 is an example schematic of a method of preparing a composite carbon fiber sheet, according to an example implementation of the present subject matter.

[0005] Fig. 3 illustrates a cross-section of a composite carbon fiber sheet, according to an example implementation of the present subject matter.

[0006] Fig. 4 is an example schematic of a method of preparing a composite carbon fiber sheet, according to an example implementation of the present subject matter.

## DETAILED DESCRIPTION

[0007] Thin parts of machines, such as laptop back covers and the like, are fabricated from carbon fiber sheets. Carbon fiber sheets provide flexural strength without causing an increase in weight of the parts.

[0008] Generally, carbon fiber sheets having unidirectional (UD) weave, hereinafter referred to as UD carbon fiber sheets, are used for manufacturing the thin parts. However, UD carbon fiber sheets have a lower strength compared to carbon fiber sheets with multi-directional weave. Some regions of the thin parts may require higher strength than that provided by the UD carbon fiber sheets. Multiple layers of UD carbon fiber sheets can be used to fabricate such regions. However, this increases the weight and cost of the manufactured thin part. To overcome this, multi-directional (MD) carbon fiber sheets may be used to manufacture the thin parts. However, MD carbon fiber sheets are more expensive than UD carbon fiber sheet. Further, UD carbon fiber sheets have better machinability than MD carbon fiber sheets.

[0009] The present subject matter relates to methods of preparing composite carbon fiber sheets. With the implementations of the present subject matter, the composite carbon fiber sheets obtained are cost-effective, machinable, and have a high strength.

[0010] In accordance with an example implementation, a cut area is created in a first carbon fiber sheet of a first weave. A cutout is created from a second carbon fiber sheet of a second weave. The cutout is combined with the first carbon fiber sheet in the cut area to obtain the composite carbon fiber sheet. In one example, the first weave is a UD weave and the second weave is a multi-directional (MD) weave. The cutout may include a single layer or multiple layers stacked together. The cutout and the first carbon fiber sheet are combined in the cut area by thermally fusing the cutout in the cut area of the first carbon fiber sheet. The composite carbon fiber sheet may also be surface treated to cover the marks and irregularities that may be formed due to the thermal fusion process.

[0011] The present subject matter provides a composite carbon fiber sheet with localized increase in strength. Therefore, the composite carbon fiber sheet can be used to fabricate thin parts that require higher strength in certain regions

without substantially increasing weight, cost, or thickness, while also not affecting machinability. For example, the composite carbon fiber sheet can be used to fabricate laptop base covers with a higher strength in a fan region by placing the multi-dimensional carbon fiber sheet cutout in that region.

[0012] The following description refers to the accompanying drawings. Wherever possible, the same reference numbers are used in the drawings and the following description to refer to the same or similar parts. While several examples are described in the description, modifications, adaptations, and other implementations are possible. Accordingly, the following detailed description does not limit the disclosed examples. Instead, the proper scope of the disclosed examples may be defined by the appended claims.

[0013] Example implementations of the present subject matter are described with regard to personal computers (PCs) and laptop computers. Although not described, it will be understood that the implementations of the present subject matter can be used with other types of electronic devices with thin parts as well, such as television, tablet, smartphone device, and the like.

[0014] Fig. 1 illustrates an example method 100 of preparing a composite carbon fiber sheet, according to an example implementation of the present subject matter. The method 100 includes creating a cut area in a first carbon fiber sheet of a first weave at block 102. In an example, the first weave is a unidirectional (UD) weave. The cut area may be created in the first carbon fiber sheet, for example, by stamping or punching. In an example, the cut area may be created by using a Computer Numeric Control (CNC) punching press. Dimensions, such as size and shape, of the cut area depends on the region in which higher strength is to be provided.

[0015] At block 104, the method 100 comprises creating a cutout from a second carbon fiber sheet of a second weave. In an example, the second weave is a multi-directional (MD) weave. In an example, the second carbon fiber sheet comprises 3K carbon fibers. For example, the second weave may be a 3K bidirectional weave. Creating the cutout can include stamping, punching, cutting, or trimming the second carbon fiber sheet to obtain the cutout. In an example, the cutout may be a single layer whose dimensions are substantially similar to the

dimensions of the cut area. In another example, the cutout comprises multiple layers of the second carbon fiber sheet.

[0016] At block 106, the method 100 comprises combining the cutout with the first carbon fiber sheet in the cut area to obtain the composite carbon fiber sheet. In an example, the combining comprises thermally fusing the cutout in the cut area to obtain the composite carbon fiber sheet. The cutout and the first carbon fiber sheet may be subjected to high temperature and pressure after placing the cutout in the cut area. In an example, the combining is performed at a temperature in a range of about 230 °C – 250 °C and a pressure in a range of about 90 - 110 Torr (T) for a cycle time of about 240 - 300 seconds. Thus, a composite carbon fiber sheet having localized higher strength provided by the cutouts in the cut area can be formed. In an example, the composite carbon fiber sheet can be surface treated for aesthetic purposes, such as masking any marks or irregularities formed due to thermal fusion.

[0017] Fig. 2 is an example schematic of a method of preparing a composite carbon fiber sheet, according to an example implementation of the present subject matter. Schematic 200(a) depicts a cut area 202 in a first carbon fiber sheet 204 of a first weave. In an example, the first weave is a unidirectional weave. Although schematic 200(a) depicts a square shaped cut area 202, other shapes can also be created as will be understood. Further, although schematic 200(a) depicts a single cut area 202, multiple cut areas can be created as will be understood. Schematic 200(b) depicts a cross-sectional view of the first carbon fiber sheet 204 as viewed along line A-A.

[0018] Schematic 200(c) depicts a cross-section view of a cutout 206 created from a second carbon fiber sheet of a second weave. In an example, the second weave is a multi-directional weave. For example, the multi-directional weave can be a 3K bidirectional weave. However, other multi-directional weaves may be used in other implementations.

[0019] In an example, dimensions of the cutout 206 are substantially similar to that of the cut area 202. The cutout 206 may be suitably cut or trimmed so that the dimensions are substantially similar to that of the cut area 202. In an example,

dimensions of the cutout 206 can be slightly bigger than the cut area 202 to ensure form fit of the cutout 206 in the cut area 202 after combining.

[0020] Schematic 200(d) depicts a cross-section view of the cutout 206 placed in the cut area 202 for combining. Combining of the cut area 202 in the cutout 206 includes thermally fusing the cutout 206 in the cut area 202 to obtain a composite carbon fiber sheet 208 as depicted in schematic 200(e). Thermally fusing the cutout 206 in the cut area 202 is achieved by subjecting the cutout 206 and the first carbon fiber sheet 204 to high temperature and pressure. The high temperature causes the cutout 206 and the first carbon fiber sheet 204 to form molten portions. The molten portions fuse to form the composite carbon fiber sheet 208 under high pressure.

[0021] Schematic 200(e) depicts the composite carbon fiber sheet 208 which comprises the first carbon fiber sheet 204 of the first weave and the cutout 206 of the second carbon fiber sheet of the second weave. Schematic 200(f) depicts a cross-sectional view of the composite carbon fiber sheet 208 along line B-B of schematic 200(e). Combining the cutout 206 within the cut area 202 provides localized strength, without increasing the thickness of the first carbon fiber sheet 204. Further, the obtained composite carbon fiber sheet 208 can have differential strength as compared to the first carbon fiber sheet 204 without affecting properties of the first carbon fiber sheet 204. In addition, since the composite carbon fiber sheet 208 substantially comprises the first carbon fiber sheet 204, overall machinability remains unaffected. The obtained composite carbon fiber 208 can also be surface treated to improve its aesthetic appearance.

[0022] Although, Fig. 2 has been explained with respect to the first weave being a unidirectional weave and the second weave being a multi-directional weave, other weaves and combinations are possible as will be understood. For example, the first carbon fiber sheet can be of lower strength than the second carbon fiber sheet. Further, different cutouts 206 of different weaves may be thermally fused with different cut areas 202 depending on the strength to be provided in that region.

[0023] Fig. 3 illustrates a cross-section of a composite carbon fiber sheet 300, according to one example of the principles described herein. The composite

carbon fiber sheet 300 comprises a first part 302 made of the first carbon fiber sheet 204 of a first weave and a second part 304 made of the second carbon fiber sheet 202 of a second weave. The first part 302 and the second part 304 are thermally fused to each other.

[0024] The composite carbon fiber sheet 300 also comprises a surface treatment layer 306 over at least a portion of the first part 302 and the second part 304 on at least one side of the composite carbon fiber sheet 300. The surface treatment layer 306 can be formed from one of painting, dyeing, printing, and combinations thereof. In an example, the surface treatment layer 306 is provided over an entire surface area of the fused first part 302 and second part 304. In another example, the surface treatment layer 306 may be provided on thermally fused portions 310. The surface treatment layer 306 helps in masking marks or scars or other irregularities formed due to thermal fusing on the composite carbon fiber sheet 300. In another example, the surface treatment layer 306 can be provided as a pattern formed on the composite carbon fiber sheet 300. Although Fig. 3 depicts the surface treatment layer 306 as a single layer, a plurality of layers can be provided in different portions of the composite carbon fiber sheet 300 as will be understood.

[0025] Fig. 4 illustrates an example schematic of a method 400 of preparing a composite carbon fiber sheet, according to an example implementation of the present subject matter. The method 400 comprises creating a cut area in a first carbon fiber sheet of a first weave. Schematic 400(a) depicts cut areas 404a and 404b created in a first carbon fiber sheet 402 of a first weave. Although schematic 400(a) depicts two cut areas 404a and 404b, more than two cut areas can also be created. Further, although schematic 400(a) depicts square-shaped cut areas 404a and 404b, other shapes are possible as will be understood. Schematic 400(b) depicts a cross-sectional view of the first carbon fiber sheet 402 as viewed along line C-C of schematic 400(a).

[0026] The method 400 comprises creating a plurality of cut portions from a second carbon fiber sheet of a second weave. Schematic 400(c) depicts the plurality of cut portions 406. In an example, the plurality of cut portions 406 comprises a first set 406a of cut portions 406 and a second set 406b of cut

portions 406. In one example, an area of a cut portion 406 of the second set 406b is less than an area of a cut portion 406 of the first set 406a. In an example, the first set 406a may comprise cut portions 406 of different weaves. In another example, the cut portions 406 in the first set 406a and the second set 406b may be of different weaves.

[0027] The method 400 comprises stacking the plurality of cut portions 406 in the cut area. Schematic 400(d) depicts the plurality of cut portions 406 stacked in the cut areas 404a and 404b. In an example, stacking comprises placing the cut portions 406 of the second set 406b between the cut portions 406 of the first set 406a. As the second set 406b has a lesser area than first set 406a, a gap 407 is formed between the cut portions of the second set 406b and the cut area 404. The gap 407 allows more uniform thermal fusion by providing space for melting and settling of the cut portions 406 in the cut area 404.

[0028] The number of cut portions 406 to be stacked in the cut area 404 depends on a thickness of the first carbon fiber sheet 402 and a thickness of each of the plurality of the cut portions 406. In an example, the first carbon fiber sheet 402 has a thickness in a range of about 0.6 - 0.8 millimeter (mm) and the second carbon fiber sheet has a thickness in a range of about 0.2 - 0.3 mm. For example, if the first carbon fiber sheet 402 has a thickness of 0.6 mm and the second carbon fiber sheet has a thickness of 0.2mm, three layers of cut portions 406 can be stacked in the cut area 404. The plurality of cut portions 406 are stacked such that a thickness of a stack obtained is substantially equal to the thickness of the cut area 404.

[0029] The method 400 comprises combining the plurality of cut portions 406 with the first carbon fiber sheet 402 in the cut area 404 to obtain the composite carbon fiber sheet 408 as shown in schematic 400(e). In an example, combining the plurality of cut portions 406 with the first carbon fiber sheet 402 is done by thermally fusing them. In an example, thermally fusing comprises subjecting the plurality of cut portions 406 and the first carbon fiber sheet to high temperature and high pressure which causes fusion of the plurality of cut portions 406 and the first carbon fiber sheet 402.

[0030] The method 400 further comprises surface treating the composite carbon fiber sheet. Schematic 400(f) depicts a cross-sectional view of the composite carbon fiber sheet 408 comprising a surface treatment layer 410. In an example, the surface treating is performed over the entire surface area of the composite carbon fiber sheet 408. In another example, the surface treating may be performed on thermally fused portions 412. Surface treating helps in covering marks or scars formed on the composite carbon fiber sheet 208 due to the thermal fusing. Surface treating can be performed by one of painting, dyeing, printing, and combinations thereof.

[0031] Therefore, the composite carbon fiber sheet obtained using the method of the present subject has localized increase in strength in the cut area comprising the cutout. Further, cost of the composite carbon fiber sheet does not substantially increase in comparison to the first carbon fiber sheet as only certain regions have been replaced by the cutouts or cut portions of the second carbon fiber sheet.

[0032] The preceding description has been presented to illustrate and describe examples of the principles described. This description is not intended to be exhaustive or to limit these principles to any precise form disclosed. Many modifications and variations are possible in light of the above teaching.

## Claims:

1. A method of preparing a composite carbon fiber sheet, the method comprising:  
creating a cut area in a first carbon fiber sheet of a first weave;  
creating a cutout from a second carbon fiber sheet of a second weave; and  
combining the cutout with the first carbon fiber sheet in the cut area to obtain the composite carbon fiber sheet.
2. The method of claim 1, wherein the combining comprises thermally fusing the cutout in the cut area to obtain the composite carbon fiber sheet.
3. The method of claim 1, wherein the first weave is a unidirectional weave.
4. The method of claim 1, wherein the second weave is a multi-directional weave.
5. The method of claim 1, wherein the second carbon fiber sheet comprises 3K carbon fibers.
6. The method of claim 1, wherein the combining is performed at a temperature in a range of about 230 °C - 250 °C and a pressure in a range of about 90 - 110 T for a cycle time of about 240-300 seconds.
7. The method of claim 1, wherein the cutout comprises multiple layers of the second carbon fiber sheet.
8. A method of preparing a composite carbon fiber sheet, the method comprising:  
creating a cut area in a first carbon fiber sheet of a first weave;  
creating a plurality of cut portions from a second carbon fiber sheet of a second weave;  
stacking the plurality of cut portions in the cut area;  
combining the plurality of cut portions with the first carbon fiber sheet in the cut area to obtain the composite carbon fiber sheet; and

surface treating the composite carbon fiber sheet.

9. The method of claim 8, wherein the surface treating is performed by one of painting, dyeing, printing, and combinations thereof.
10. The method of claim 8, wherein the plurality of cut portions comprises a first set of cut portions and a second set of cut portions, and wherein an area of a cut portion of the second set is less than an area of a cut portion of the first set.
11. The method of claim 10, wherein the stacking comprises placing the cut portions of the second set between the cut portions of the first set.
12. The method of claim 8, wherein the first carbon fiber sheet has a thickness in a range of about 0.6 - 0.8 mm.
13. The method of claim 8, wherein the second carbon fiber sheet has a thickness in a range of about 0.2 - 0.3 mm.
14. A composite carbon fiber sheet comprising:
  - a first part made of a first carbon fiber sheet of a first weave;
  - a second part made of a second carbon fiber sheet of a second weave,wherein the first part and the second part are thermally fused to each other;  
and
  - a surface treatment layer over at least a portion of the first part and the second part on at least one side of the composite carbon fiber sheet.
15. The composite carbon fiber sheet of claim 14, wherein the first weave is a unidirectional weave and the second weave is a multi-directional weave.

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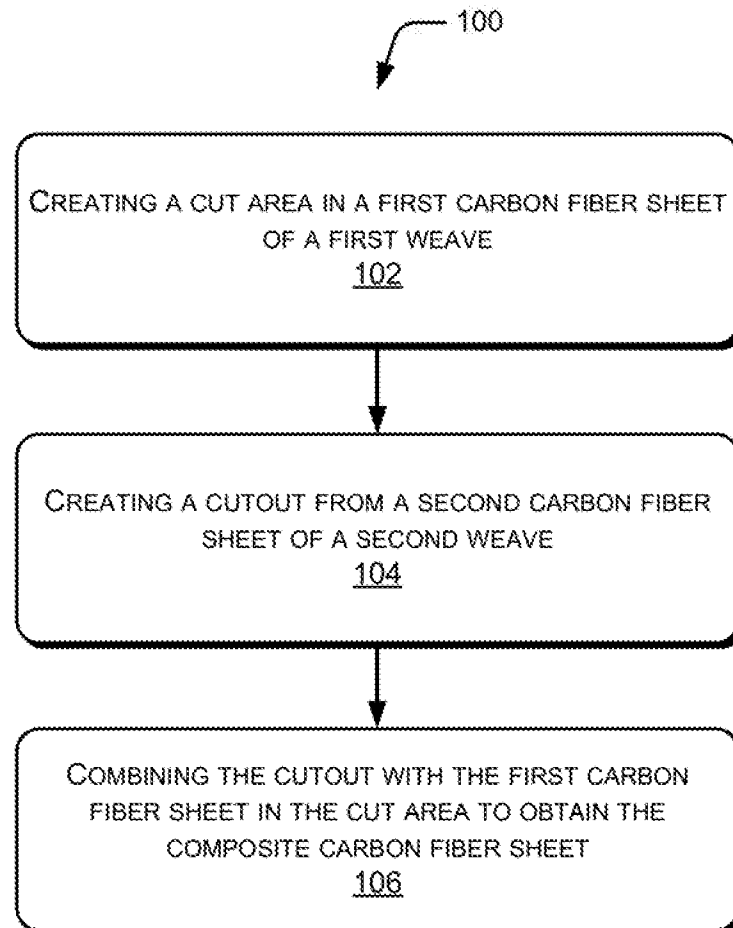


Fig. 1

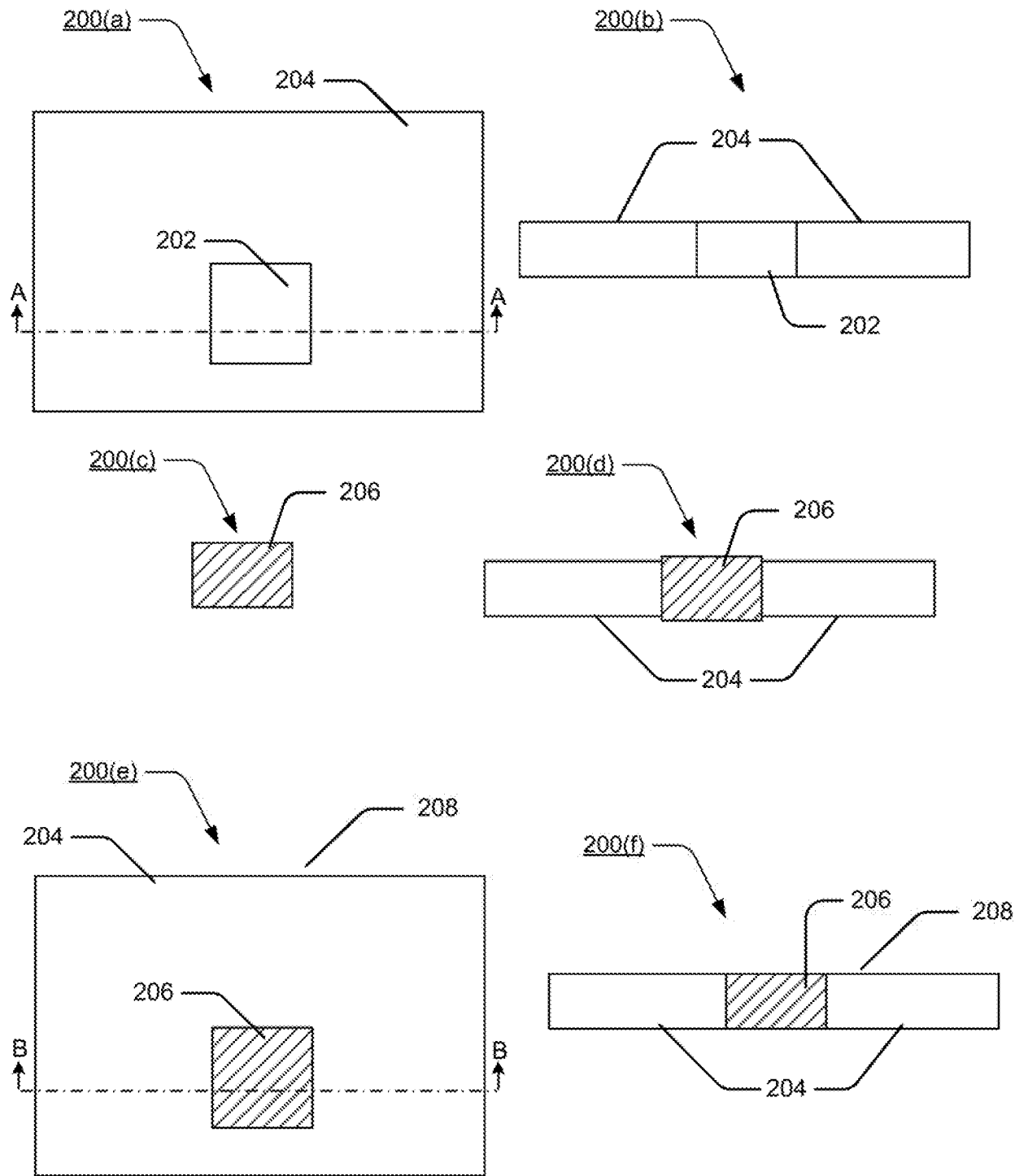


Fig. 2

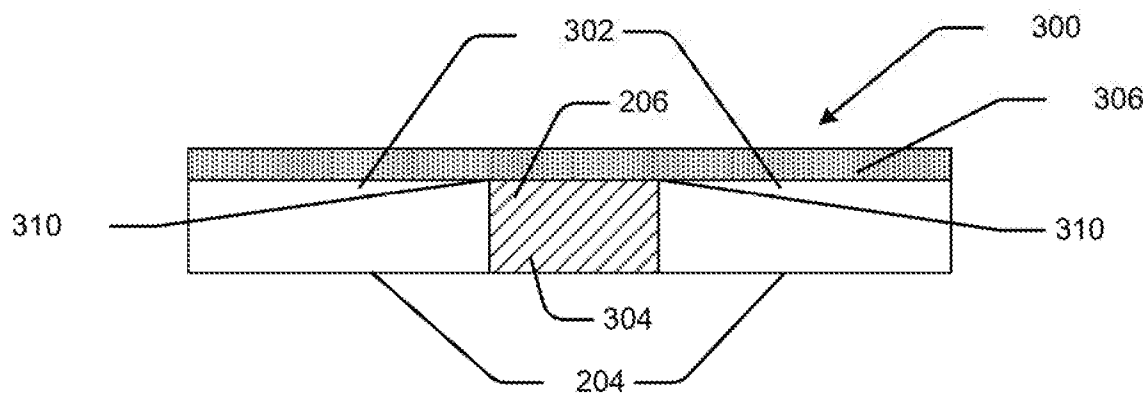


Fig. 3

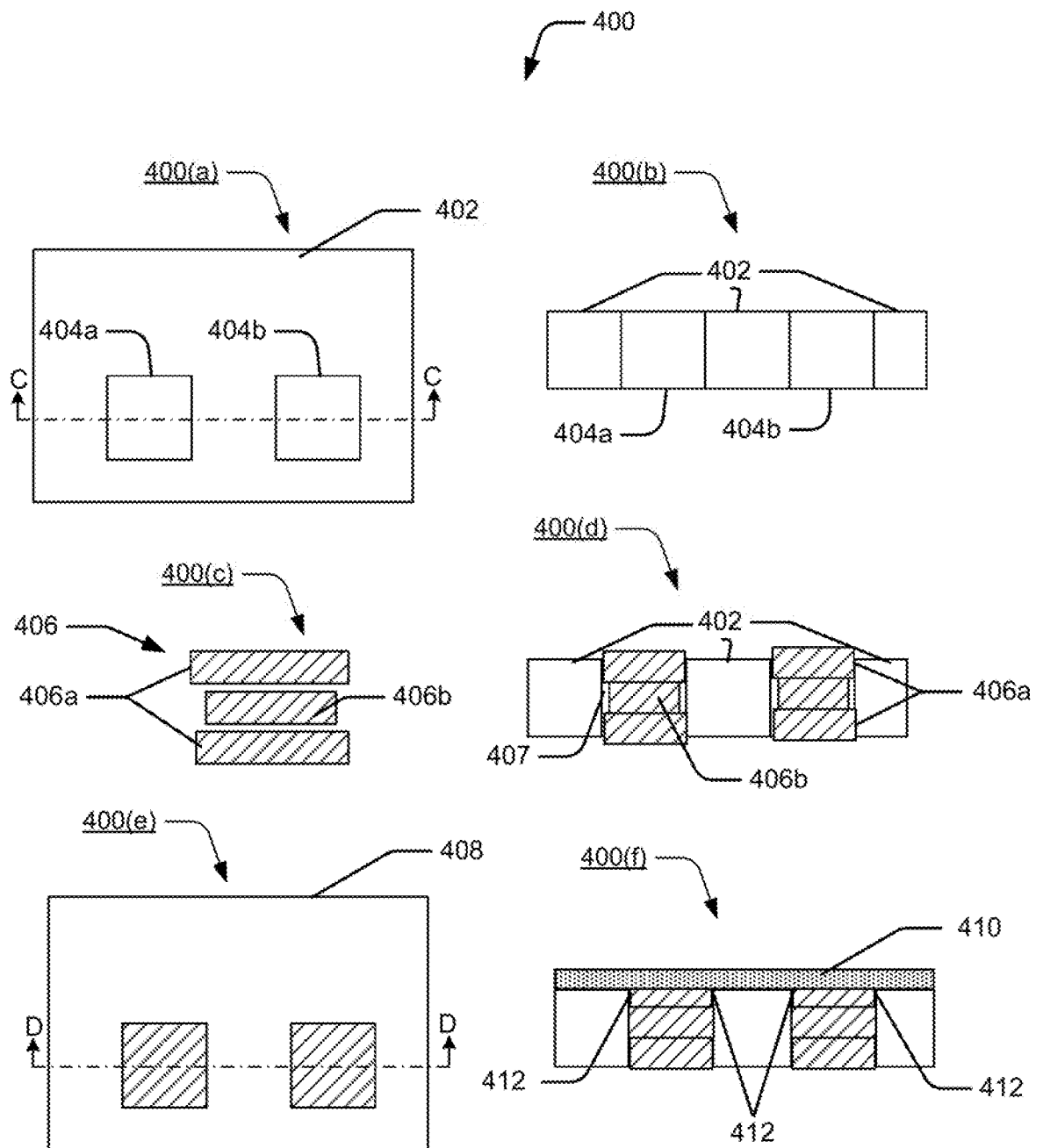


Fig. 4

# INTERNATIONAL SEARCH REPORT

International application No.

PCT/US 2017/056158

| <b>A. CLASSIFICATION OF SUBJECT MATTER</b><br>(see extra sheet)<br>According to International Patent Classification (IPC) or to both national classification and IPC                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                 |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------|
| <b>B. FIELDS SEARCHED</b><br>Minimum documentation searched (classification system followed by classification symbols)<br>C04B 35/00, 35/80, B29C 70/00, 70/18, 73/00, 73/10, D06M 10/00, 101/40, B32B 5/12, 5/26, 9/00<br>Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched<br>Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)<br>PatSearch (RUPTO internal), Esp@cenet, PAJ, USPTO, Information Retrieval System of FIPS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                 |
| <b>C. DOCUMENTS CONSIDERED TO BE RELEVANT</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                 |
| Category*                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Citation of document, with indication, where appropriate, of the relevant passages                                                                                                                                                                                                                                                                                                                                                                                                                                | Relevant to claim No.                                                           |
| Y                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | ВАШУКОВ Ю.А. Технология ракетных и аэрокосмических конструкций из композитных материалов. Самара, 2012, ФГБУ ВПО "Самарский государственный аэрокосмический университет имени академика С.П. Королева" (Национальный исследовательский университет)) non-official translation (VASHUKOV Yu. A. Technology of rocket and aerospace structures from composite materials.) p. 51, drawing 3.8, p. 55, lines 1-5, p. 148, lines 11-13, p. 149, lines 5-19, p. 151, lines 8-13, p. 152, lines 1, 2, 6-16, drawing 7.13 | 1-15                                                                            |
| Y                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | US 5279892 A (GENERAL ELECTRIC COMPANY) 18.01.1994, abstract, col. 1, lines 14, 15, 20-45, col. 2, lines 23-26, col. 3, lines 1-7, 63-65, col. 4, lines 4-11, 35-40, 63-68, fig. 2, 6                                                                                                                                                                                                                                                                                                                             | 1-15                                                                            |
| Y                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | EA 200802202 A1 (DSM IP ASSETS B.V.) 27.02.2009, abstract, p. 2, last paragraph, p. 3, last paragraph, p. 4, last paragraph, p. 9, paragraph 2, p. 10, last paragraph, p. 11, paragraph 1, p. 14, paragraph 3, p. 15, paragraphs 1-2, p. 16, paragraph 1, claims 1, 4                                                                                                                                                                                                                                             | 2, 6-13                                                                         |
| Y                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | RU 2372423 C2 (OBSHESTVO S OGRANICHENNOY OTVETSTVENNOSTYU "ZAVOD UGLERODNYKH I KOMPOZITSIONNYKH MATERIALOV") 10.11.2009, abstract                                                                                                                                                                                                                                                                                                                                                                                 | 5                                                                               |
| <input type="checkbox"/> Further documents are listed in the continuation of Box C. <input type="checkbox"/> See patent family annex.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                 |
| * Special categories of cited documents:<br>"A" document defining the general state of the art which is not considered to be of particular relevance<br>"E" earlier document but published on or after the international filing date<br>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)<br>"O" document referring to an oral disclosure, use, exhibition or other means<br>"P" document published prior to the international filing date but later than the priority date claimed<br>"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<br>"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<br>"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<br>"&" document member of the same patent family |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                 |
| Date of the actual completion of the international search<br>08 June 2018 (08.06.2018)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Date of mailing of the international search report<br>05 July 2018 (05.07.2018) |
| Name and mailing address of the ISA/RU:<br>Federal Institute of Industrial Property,<br>Berezhkovskaya nab., 30-1, Moscow, G-59,<br>GSP-3, Russia, 125993<br>Facsimile No: (8-495) 531-63-18, (8-499) 243-33-37                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Authorized officer<br>N. Kodinets<br>Telephone No. (495)531-64-81               |

**INTERNATIONAL SEARCH REPORT**  
Classification of subject matter

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***B32B 5/12 (2006.01)***  
***B32B 5/26 (2006.01)***  
***B32B 9/00 (2006.01)***  
***D06M 101/40 (2006.01)***