

(51) International Patent Classification:
B29C 65/50 (2006.01) *B64C 1/00* (2006.01)(21) International Application Number:
PCT/US2009/064055(22) International Filing Date:
11 November 2009 (11.11.2009)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
12/325,460 1 December 2008 (01.12.2008) US(71) Applicant (for all designated States except US): **THE BOEING COMPANY** [US/US]; 100 North Riverside Plaza, Chicago, Illinois 60606-2016 (US).

(72) Inventors; and

(75) Inventors/Applicants (for US only): **KELLEHER, Kevin Patrick** [US/US]; 10909 101st Place NE, Kirkland, Washington 98033 (US). **COON, Aaron Golden** [US/US]; 7628 66th Place NE, Marysville, Washington 98270 (US).(74) Agents: **HALPERIN, Brett L** et al.; The Boeing Company, P.O. Box 2515, MC 110-SD54, Seal Beach, California 90740-1515 (US).

(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PE, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:

— with international search report (Art. 21(3))

(54) Title: COMPOSITE HONEYCOMB SANDWICH PANEL SPLICING

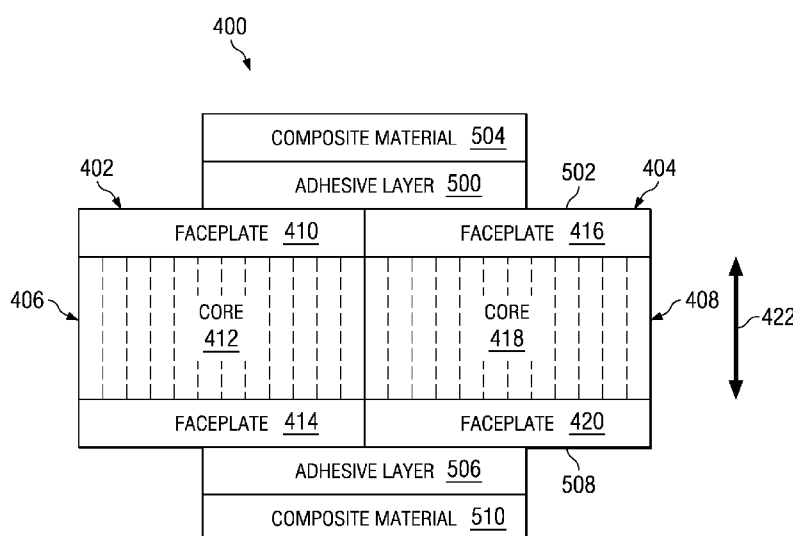


FIG. 5

(57) Abstract: A method and apparatus for joining composite parts (302, 304) is present. A first composite part (302) is aligned with a second composite part (304) to form an aligned structure (306) with a splice line (308). An adhesive layer (310) is placed on the splice line (308). A composite material (316) is placed on the adhesive layer (310). The aligned structure (306) is cured with the adhesive layer (310) and the composite material (316) to form a joined structure.

COMPOSITE HONEYCOMB SANDWICH PANEL SPLICING

BACKGROUND INFORMATION

5 **Field:**

The present disclosure relates generally to manufacturing and, in particular, to a method and apparatus for joining parts to each other. Still more particularly, the present disclosure relates to a method and apparatus for joining composite parts to each other.

10 **Background:**

Aircraft are being designed and manufactured with greater and greater percentages of composite materials. Some aircraft may have more than fifty percent of their primary structure made from composite materials. Composite materials may be used in aircraft to decrease the weight of the aircraft. This decreased weight may improve payload capacities and fuel
15 efficiencies. Further, composite materials may provide longer service life for various components in an aircraft.

Composite materials may be strong, light-weight materials, created by combining two or more dissimilar components. For example, without limitation, a composite may include fibers and resins. The fibers and resins may be combined to form a cured composite material.

20 Composite materials such as, for example, without limitation, composite honeycomb sandwich panels may be used in the interior of an aircraft. These panels may be used for walls, floors, light covers, and other suitable structures for the interior of an aircraft. A composite sandwich panel may have a honeycomb core with a faceplate (face sheet) on either side of the honeycomb core. This faceplate may be, for example, without limitation, a laminate and/or other
25 composite material.

In some cases, it may be desirable to join or attach composite parts to each other. For example, without limitation, with light shields, these types of panels may be made of a carbon fiber skin with a honeycomb core. The ends of these light shields may be rounded. These panels also may have different length requirements depending on the interior configuration of a
30 passenger cabin.

Rather than purchasing and/or manufacturing a tool for each length, a tool with the longest length may be used to create a panel. This panel may then be cut into parts of the appropriate size. These parts may be joined to each other with a structural bond. This joining of

parts may also be referred to as splicing. This process may involve the use of non-robust materials and may be tedious. As a result, increased out of tolerance and scrap rates may occur.

The current process may involve removing a portion of the honeycomb core out of each part to be joined to each other. The two parts may then be joined by applying a potting and/or adhesive material within the core. The parts may be clamped to each other for several hours. Thereafter, the parts may be sanded for the application of a decorative layer.

For example, the parts may be cured for around 24 hours to fully join the parts to each other. This type of process may have less than desirable out of tolerance rates during assembly and/or installation of these panels. The time needed to join the parts to each other also may slow down the speed at which an aircraft may be assembled as well as possibly increase assembly costs.

Therefore, it would be advantageous to have a method and apparatus that overcomes one or more of the issues discussed above.

SUMMARY

In one advantageous embodiment, a method for joining composite parts may be present. A first composite part may be aligned with a second composite part to form an aligned structure with a splice line. An adhesive layer may cover the splice line. A composite material may be placed on the adhesive layer. The aligned structure may be cured with the adhesive layer and the composite material to form a joined structure.

In another advantageous embodiment, a method for manufacturing a composite honeycomb sandwich panel may be present. A first composite honeycomb sandwich panel may be aligned with a second composite honeycomb sandwich panel to form an aligned structure with a splice line. An epoxy film may be placed on the splice line. A fabric with an embedded resin may be placed on the epoxy film. The aligned structure may have a first side and a second side. The epoxy film and the fabric with the embedded resin may be placed on the first side and the second side. The fabric may be selected from one of a fiberglass fabric and a carbon fabric. The resin may be selected from one of a phenolic resin and an epoxy resin. The aligned structure with the epoxy film and the fabric with the embedded resin may be placed in a die. The die may cover the splice line. The aligned structure in the die may be heated under pressure to form a joined structure. A decorative layer may be applied on the joined structure. The completed structure may be selected from one of a composite panel, a wall panel, and a light shield.

In yet another advantageous embodiment, an apparatus may comprise a first composite part, a second composite part, an adhesive layer, a composite material, and a tool. The first composite part may be aligned with a second composite part to form an aligned structure with a splice line. The adhesive layer may cover the splice line. The composite material may be
5 located on the adhesive layer. The tool may be capable of holding the aligned structure with the adhesive layer covering the splice line and the composite material located on the adhesive layer.

In still yet another advantageous embodiment, an apparatus for splicing honeycomb composite parts may comprise a first composite honeycomb sandwich panel, a second composite honeycomb sandwich panel, an epoxy film, a fabric, and a tool. The first composite honeycomb
10 sandwich panel may be aligned with a second composite honeycomb sandwich panel to form an aligned structure with a splice line. The epoxy film may cover the splice line. The fabric with an embedded resin may be located on the epoxy film. The tool may be capable of holding the aligned structure with the epoxy film located on the splice line and the fabric with the embedded resin. The fabric may be selected from one of a fiberglass fabric and a carbon fabric. The resin
15 may be selected from one of a phenolic resin and an epoxy resin. The joined structure may be selected from one of a composite panel, a wall panel, and a light shield.

14. A method for manufacturing a composite honeycomb sandwich panel, the method comprising:

20 aligning a first composite honeycomb sandwich panel with a second composite honeycomb sandwich panel to form an aligned structure with a splice line;

placing an epoxy film on the splice line, wherein the epoxy film covers the splice line;

placing a fabric with an embedded resin on the epoxy film, wherein the aligned structure has a first side and a second side, wherein the epoxy film and the fabric with the embedded resin
25 are placed on the first side and the second side, wherein the fabric is selected from one of a fiberglass fabric and a carbon fabric, and wherein the resin is selected from one of a phenolic resin and an epoxy resin;

placing the aligned structure with the epoxy film and the fabric with the embedded resin in a die, wherein the die covers the splice line;

30 heating the aligned structure in the die under pressure to form a joined structure; and
applying a decorative layer on the joined structure, wherein the completed structure is selected from one of a composite panel, a wall panel, and a light shield.

15. An apparatus comprising:

a first composite part aligned with a second composite part to form an aligned structure with a splice line;

an adhesive layer covering the splice line;

a composite material located on the adhesive layer;

5 a tool capable of holding the aligned structure with the adhesive layer covering the splice line and the composite material located on the adhesive layer.

16. The apparatus of claim 15, wherein the adhesive layer is selected from one of an adhesive film and

10 an epoxy film.

17. The apparatus of claim 17, wherein the aligned structure is an aircraft part.

18. The apparatus of claim 15, wherein the composite material is a fabric with an
15 impregnated resin.

19. The apparatus of claim 18, wherein the fabric is selected from one of a fiberglass fabric and a carbon fabric.

20 20. The apparatus of claim 18, wherein the resin is selected from one of a phenolic resin and an epoxy resin.

21. The apparatus of claim 15, wherein the joined structure is selected from one of a composite panel, a wall panel, divider panel, a floor panel, and a light shield.

25

22. The apparatus of claim 15, wherein the first composite part is a first honeycomb sandwich panel, and the second composite part is a second honeycomb sandwich panel.

23. An apparatus for splicing honeycomb composite parts, the apparatus comprising:

30 a first composite honeycomb sandwich panel aligned with a second composite honeycomb sandwich panel to form an aligned structure with a splice line;

an epoxy film located on the splice line;

a fabric with an embedded resin located on the epoxy film;

a tool capable of holding the aligned structure with the epoxy film located on the splice line and the fabric with the embedded resin, wherein the tool is a match mold die capable of receiving the aligned structure and capable generating pressure on the aligned structure.

5 The features, functions, and advantages may be achieved independently in various embodiments of the present disclosure or may be combined in yet other embodiments in which further details can be seen with reference to the following description and drawings.

10 BRIEF DESCRIPTION OF THE DRAWINGS

The novel features believed characteristic of the advantageous embodiments are set forth in the appended claims. The advantageous embodiments, however, as well as a preferred mode of use, further objectives, and advantages thereof, will best be understood by reference to the following detailed description of an advantageous embodiment of the present disclosure when
15 read in conjunction with the accompanying drawings, wherein:

Figure 1 is a diagram illustrating an aircraft manufacturing and service method in accordance with an advantageous embodiment;

Figure 2 is a diagram of an aircraft in which an advantageous embodiment may be
20 implemented;

Figure 3 is a diagram of a splicing environment in accordance with an advantageous embodiment;

Figure 4 is a diagram of a cross-sectional view of an aligned structure in accordance with an advantageous embodiment;

Figure 5 is a diagram of a cross-sectional view illustrating layers of materials for joining composite parts in accordance with an advantageous embodiment;

Figure 6 is a diagram of a cross-sectional view illustrating a completed structure in accordance with an advantageous embodiment;

Figure 7 is a diagram of a composite honeycomb panel in accordance with an
30 advantageous embodiment;

Figure 8 is a diagram illustrating application of an adhesive layer in accordance with an advantageous embodiment;

Figure 9 is a diagram illustrating an application of a composite material to a structure in accordance with an advantageous embodiment;

Figure 10 is a diagram illustrating application of a composite material to a structure in accordance with an advantageous embodiment;

5 **Figure 11** is a diagram illustrating an aligned structure on a tool in accordance with an advantageous embodiment;

Figure 12 is a diagram illustrating a cured aligned structure in accordance with an advantageous embodiment;

10 **Figure 13** is a diagram of an aligned structure in accordance with an advantageous embodiment; and

Figure 14 is a flowchart of a process for joining composite parts in accordance with an advantageous embodiment.

DETAILED DESCRIPTION

15 Referring more particularly to the drawings, embodiments of the disclosure may be described in the context of aircraft manufacturing and service method **100** as shown in **Figure 1** and aircraft **200** as shown in **Figure 2**. Turning first to **Figure 1**, a diagram illustrating an aircraft manufacturing and service method is depicted in accordance with an advantageous
20 embodiment. During pre-production, exemplary aircraft manufacturing and service method **100** may include specification and design **102** of aircraft **200** in **Figure 2** and material procurement **104**.

During production, component and subassembly manufacturing **106** and system integration **108** of aircraft **200** in **Figure 2** takes place. Thereafter, aircraft **200** in **Figure 2** may
25 go through certification and delivery **110** in order to be placed in service **112**. While in service by a customer, aircraft **200** in **Figure 2** is scheduled for routine maintenance and service **114**, which may include modification, reconfiguration, refurbishment, and other maintenance or service.

Each of the processes of aircraft manufacturing and service method **100** may be
30 performed or carried out by a system integrator, a third party, and/or an operator. In these examples, the operator may be a customer. For the purposes of this description, a system integrator may include, without limitation, any number of aircraft manufacturers and major-system subcontractors; a third party may include, without limitation, any number of vendors,

subcontractors, and suppliers; and an operator may be an airline, leasing company, military entity, service organization, and so on.

With reference now to **Figure 2**, a diagram of an aircraft is depicted in which an advantageous embodiment may be implemented. In this example, aircraft **200** is produced by aircraft manufacturing and service method **100** in **Figure 1** and may include airframe **202** with a plurality of systems **204** and interior **206**. Examples of systems **204** include one or more of propulsion system **208**, electrical system **210**, hydraulic system **212**, and environmental system **214**. Any number of other systems may be included. Although an aerospace example is shown, different advantageous embodiments may be applied to other industries, such as the automotive industry.

Apparatus and methods embodied herein may be employed during any one or more of the stages of aircraft manufacturing and service method **100** in **Figure 1**. For example, components or subassemblies produced in component and subassembly manufacturing **106** in **Figure 1** may be fabricated or manufactured in a manner similar to components or subassemblies produced while aircraft **200** is in service **112** in **Figure 1**.

Also, one or more apparatus embodiments, method embodiments, or a combination thereof may be utilized during production stages, such as component and subassembly manufacturing **106** and system integration **108** in **Figure 1**, for example, without limitation, by substantially expediting the assembly of or reducing the cost of aircraft **200**. Similarly, one or more of apparatus embodiments, method embodiments, or a combination thereof may be utilized while aircraft **200** is in service **112** or during maintenance and service **114** in **Figure 1**.

For example, without limitation, advantageous embodiments may be used for drawing composite parts together during component and subassembly manufacturing, system integration, and/or maintenance and service **114**. The different advantageous embodiments may be used to join these composite parts for use within interior **206** of aircraft **200** in these illustrative examples.

The different advantageous embodiments recognize and take into account that the currently used processes for joining composite parts to each other may be time consuming and costly. The different advantageous embodiments recognize and take into account that the currently used processes may also result in higher than desired out of tolerance joints of the joined parts.

Thus, the different advantageous embodiments provide a method and apparatus for joining composite parts to each other. A first composite part may be aligned with a second

composite part to form an aligned structure with a splice line. An adhesive layer may be placed on the splice line to cover the splice line. A composite material may be placed on the adhesive layer. The aligned structure may be cured with the adhesive layer and the composite material to form a joined structure.

5 With reference now to **Figure 3**, a diagram of a splicing environment is depicted in accordance with an advantageous embodiment. Splicing environment **300** may be used to join composite part **302** to composite part **304**. Composite part **302** may be aligned with composite part **304** to form aligned structure **306** with splice line **308**. Aligned structure **306** may be an aircraft structure for use within interior **206** of aircraft **200** in these illustrative examples.

10 In this depicted example, adhesive layer **310** may be placed onto surface **312** of aligned structure **306** such that adhesive layer **310** covers splice line **308**. Adhesive layer **310** may be, for example, without limitation, adhesive film **314**. Adhesive film **314** may be, for example, without limitation, an epoxy film or some other suitable type of adhesive film.

15 Composite material **316** may be placed onto adhesive film **314**. Composite material **316** may be fabric **318** impregnated with resin **320**. In the different advantageous embodiments, fabric **318** may be, for example, without limitation, a fiberglass fabric, a carbon fabric, and/or some other suitable fabric. Resin **320** may be, for example, without limitation, a phenolic resin, an epoxy resin, or some other suitable resin.

20 In the different advantageous embodiments, tool **322** may secure aligned structure **306**, adhesive layer **310**, and composite material **316** in place. Tool **322** may be, for example, without limitation, a die that may cover or secure only a portion of aligned structure **306** on which adhesive layer **310** and composite material **316** may be located. Tool **322** may be, for example, without limitation, a contoured aluminum die, a caul plate, or some other suitable tool. Tool **322** may receive and/or hold aligned structure **306** in place during a curing process. Tool **322** also
25 may provide pressure by clamping aligned structure **306** before and/or during the curing process.

Aligned structure **306** with adhesive layer **310** and composite material **316** may be placed on tool **322** and cured using heat source **324**. Heat source **324** may be implemented using a number of different types of devices. For example, without limitation, heat source **324** may be heating elements attached to and/or embedded in tool **322**. In other advantageous embodiments,
30 tool **322** may be placed into heat source **324** when heat source **324** takes the form of an autoclave oven. Of course, heat source **324** may take other forms and may heat tool **322** and aligned structure **306** in a number of different ways including, for example, without limitation, heated

oil, steam, electricity, and other suitable heating mechanisms. Additionally, heat source **324** also may apply pressure during the curing process.

With the use of adhesive layer **310** and composite material **316**, curing aligned structure **306** with adhesive layer **310** and composite material **316** may only require around eight minutes
5 instead of the currently used 24 hours with current processes to splice parts to each other.

After aligned structure **306** has been cured with adhesive layer **310** and composite material **316**, aligned structure **306** may become joined structure **326**. Decorative layer **328** may be bonded onto joined structure **326** to form completed structure **330**.

The illustration of splicing environment **300** in **Figure 3** is not meant to imply
10 architectural or physical limitations to the manner in which different advantageous embodiments may be implemented. Some advantageous embodiments may have other components in addition to, or in place of, the ones illustrated. In other advantageous embodiments, some components may be unnecessary. For example, without limitation, additional composite parts, in addition to composite parts **302** and **304**, may be spliced together to form joined structure **326**. In these
15 examples, composite part **302** and composite part **304** may be similar structures such as, for example, without limitation, light shields. In yet other advantageous embodiments, composite part **302** and composite part **304** may be dissimilar structures joined to each other using adhesive layer **310** and composite material **316**.

In another illustrative example, splicing environment **300** may employ another heat
20 source other than heat source **324**. For example, a heat blanket and/or inductive heating also may be used, depending on the particular implementation.

With reference now to **Figure 4**, a diagram of a cross-sectional view of an aligned structure is depicted in accordance with an advantageous embodiment. In this example, aligned structure **400** may include composite part **402** and composite part **404**. Composite part **402** may
25 be honeycomb sandwich **406**, while composite part **404** may be honeycomb sandwich **408**.

Honeycomb sandwich **406** may comprise faceplate **410**, core **412**, and faceplate **414**. Honeycomb sandwich **408** may comprise faceplate **416**, core **418**, and faceplate **420**. Faceplate **410**, faceplate **414**, faceplate **416**, and faceplate **420** may be composite materials in the form of laminates.

30 Core **412** and core **418** may be honeycomb cores with cells aligned in the direction of arrow **422**. Aligned structure **400** may take various forms. For example, without limitation, aligned structure **400** may be a light shield, a wall panel, a composite panel, a divider panel, a floor panel, or some other suitable structure. A light shield may be a cover that may be placed

over a light source. The light shield may diffuse light from a light source and/or provide a protective barrier.

With reference now to **Figure 5**, a diagram of a cross-sectional view illustrating layers of materials for joining composite parts is depicted in accordance with an advantageous embodiment. In this example, adhesive layer **500** may be placed on surface **502** of aligned structure **400**. Composite material **504** may be placed onto adhesive layer **500**. In a similar fashion, adhesive layer **506** may be placed on surface **508** of aligned structure **400**. Composite material **510** may be placed onto adhesive layer **506**. Of course, in some advantageous embodiments, adhesive layer **506** and composite material **510** may be unnecessary, depending on the particular implementation.

With reference now to **Figure 6**, a diagram of a cross-sectional view illustrating a completed structure is depicted in accordance with an advantageous embodiment. In **Figure 6**, decorative layer **600** may be applied to aligned structure **400** after adhesive layer **500**, composite material **504**, adhesive layer **506**, and composite material **510** have been cured.

With reference now to **Figures 7-11**, diagrams illustrating joining composite parts to each other are depicted in accordance with an advantageous embodiment. With reference first to **Figure 7**, composite honeycomb panel **700** and composite honeycomb panel **702** may be aligned with each other to form aligned structure **704**. This alignment may form splice area **706** with splice line **708**.

In this illustration, adhesive layer **710** may take the form of epoxy film **712**. Epoxy film **712** may be placed onto top side **714** of aligned structure **704** in splice area **706** to cover splice line **708**.

Turning next to **Figure 8**, a diagram illustrating application of an adhesive layer is depicted in accordance with an advantageous embodiment. In this example, epoxy film **800** may be applied to bottom side **802** of aligned structure **704** over splice line **708** in splice area **706**.

With reference now to **Figure 9**, a diagram illustrating an application of a composite material to a structure is depicted in accordance with an advantageous embodiment. In this operation, composite material **900** may take the form of reinforced prepreg **902**. Reinforced prepreg **902** may be placed onto epoxy film **712** on top side **714** of aligned structure **704**.

With reference now to **Figure 10**, a diagram illustrating application of a composite material to a structure is depicted in accordance with an advantageous embodiment. In this illustration, reinforced prepreg **1000** may be applied to bottom side **802** of aligned structure **704** over splice line **708** in splice area **706**.

In **Figure 11**, a diagram illustrating an aligned structure on a tool is depicted in accordance with an advantageous embodiment. In this illustrative example, aligned structure **704** with epoxy film **712**, epoxy film **800** (not shown), reinforced prepreg **902**, and reinforced prepreg **1000** (not shown) on splice line **708** in splice area **706** is illustrated on match mold die **1100**. Match mold die **1100** is an example of one implementation of tool **322** in **Figure 3**.

Match mold die **1100** includes part **1102** and part **1104**. Match mold die **1100** may be designed to fit over a portion of aligned structure **704**. Match mold die **1100** may cover splice line **708** and splice area **706**. Match mold die **1100** may be heated to apply heat to splice area **706**. Match mold die **1100** also may apply pressure to splice area **706**.

Turning to **Figure 12**, a diagram illustrating a cured aligned structure is depicted in accordance with an advantageous embodiment. In this example, aligned structure **704** with epoxy film **712** and reinforced prepreg **902** on top side **714** may have been cured to join composite honeycomb panel **700** to composite honeycomb panel **702**. With reference to **Figure 13**, aligned structure **704** may be seen with decorative layer **1300** applied to top side **714**.

The different features and/or operations illustrated in **Figures 7-13** are not meant to imply limitations to the manner in which composite components may be joined to each other. For example, in other advantageous embodiments, other types of composite components other than honeycomb panels may be joined to each other. In yet other advantageous embodiments, layers of materials rather than film adhesives or tape may be used to apply the different materials to splice area **706**.

With reference now to **Figure 14**, a flowchart of a process for joining composite parts is depicted in accordance with an advantageous embodiment. The process illustrated in **Figure 14** may be implemented in a splicing environment such as, for example, splicing environment **300** in **Figure 3**.

The process may begin by aligning a first composite part with a second composite part to form an aligned structure with a splice line (operation **1400**). The process may then place an adhesive layer on the splice line (operation **1402**). This adhesive layer may be, for example, without limitation, an epoxy film. The process may place a composite material on the adhesive layer (operation **1404**). The composite material may be, for example, without limitation, a reinforced prepreg.

The aligned structure with the adhesive layer and the composite material may be cured to form a joined structure (operation **1406**). A decorative layer may then be applied to the joined structure to form a completed structure (operation **1408**), with the process terminating thereafter.

The illustration of operations in **Figure 14** is not meant to limit the manner in which different advantageous embodiments may be implemented. In other advantageous embodiments, other operations in addition to, or in place of, the ones illustrated may be used. Further, in some advantageous embodiments, some operations may be unnecessary. For example, the placing of the adhesive layer and the composite material may be on both sides of an aligned structure in some advantageous embodiments. In still other advantageous embodiments, the aligned structure with the adhesive layer and the composite material may be placed into a die prior to the curing operation.

Thus, the different advantageous embodiments provide a method and apparatus for joining composite parts to each other. The different advantageous embodiments may provide a quicker process for joining composite parts. Further, the different advantageous embodiments also may provide for better joining or splicing of parts and/or less out of tolerance occurrences as compared to currently used processes.

The description of the different advantageous embodiments has been presented for purposes of illustration and description, and it is not intended to be exhaustive or limited to the embodiments in the form disclosed. Many modifications and variations will be apparent to those of ordinary skill in the art. Further, different advantageous embodiments may provide different advantages as compared to other advantageous embodiments.

Although the different advantageous embodiments have been described with respect to aircraft, other advantageous embodiments may be applied to other types of objects. For example, without limitation, other advantageous embodiments may be applied to a mobile platform, a stationary platform, a land-based structure, an aquatic-based structure, a space-based structure, and/or some other suitable object.

More specifically, the different advantageous embodiments may be applied to, for example, without limitation, a submarine, a bus, a personnel carrier, a tank, a train, an automobile, a spacecraft, a space station, a satellite, a surface ship, a power plant, a dam, a manufacturing facility, a building, and/or some other suitable object.

The embodiment or embodiments selected are chosen and described in order to best explain the principles of the embodiments, the practical application, and to enable others of ordinary skill in the art to understand the disclosure for various embodiments with various modifications as are suited to the particular use contemplated.

CLAIMS

What is claimed is:

5

1. A method for joining composite parts, the method comprising:
aligning a first composite part with a second composite part to form an aligned structure
with a splice line;

10

placing an adhesive layer on the splice line;
placing a composite material on the adhesive layer;
curing the aligned structure with the adhesive layer and the composite material to form a
joined structure.

15

2. The method of claim 1, wherein the curing step comprises:
placing the aligned structure with the adhesive layer and the composite material in a die;
and
heating the aligned structure in the die.

20

3. The method of claim 2, wherein the heating step comprises:
heating the aligned structure in the die with the aligned structure under pressure.

4. The method of claim 1 further comprising:
applying a decorative layer to the joined structure.

25

5. The method of claim 1, wherein the aligned structure has as a first side and a second side,
wherein the adhesive layer and the composite material are placed on the first side and the second
side, and wherein the adhesive layer and the composite material are placed on the second side.

30

6. The method of claim 2, wherein the die covers the splice line after the adhesive layer and
the composite material have been placed on the splice line.

7. The method of claim 1, wherein the adhesive layer is selected from one of an adhesive
film and an epoxy film.

8. The method of claim 1, wherein the aligned structure is an aircraft structure.

9. The method of claim 1, wherein the composite material is a fabric with an impregnated
5 resin.

10. The method of claim 9, wherein the fabric is selected from one of a fiberglass fabric and
a carbon fabric.

10 11. The method of claim 9, wherein the resin is selected from one of a phenolic resin and an
epoxy resin.

12. The method of claim 1, wherein the joined structure is selected from one of a composite
panel, a wall panel, divider panel, a floor panel, and a light shield.

15 13. The method of claim 1, wherein the first composite part is a first honeycomb sandwich
panel and the second part is a second honeycomb sandwich panel.

14. An apparatus comprising:

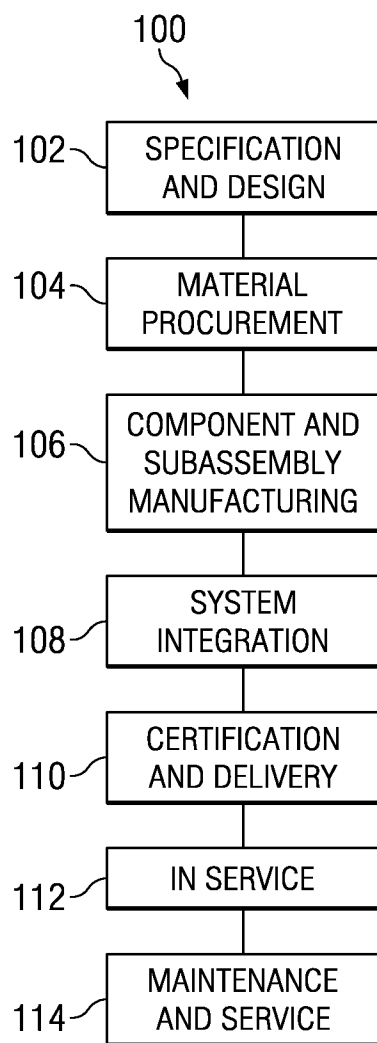
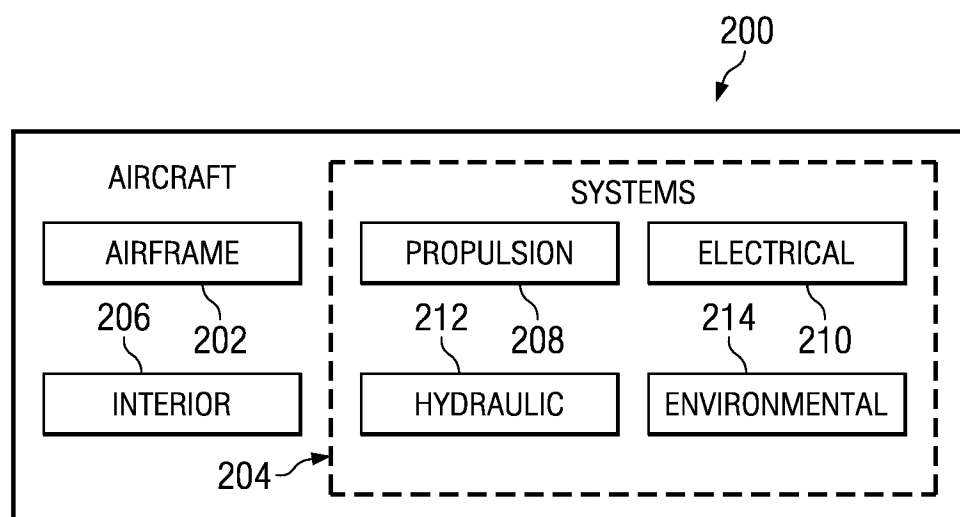
20 a first composite part aligned with a second composite part to form an aligned structure
with a splice line;

an adhesive layer covering the splice line;

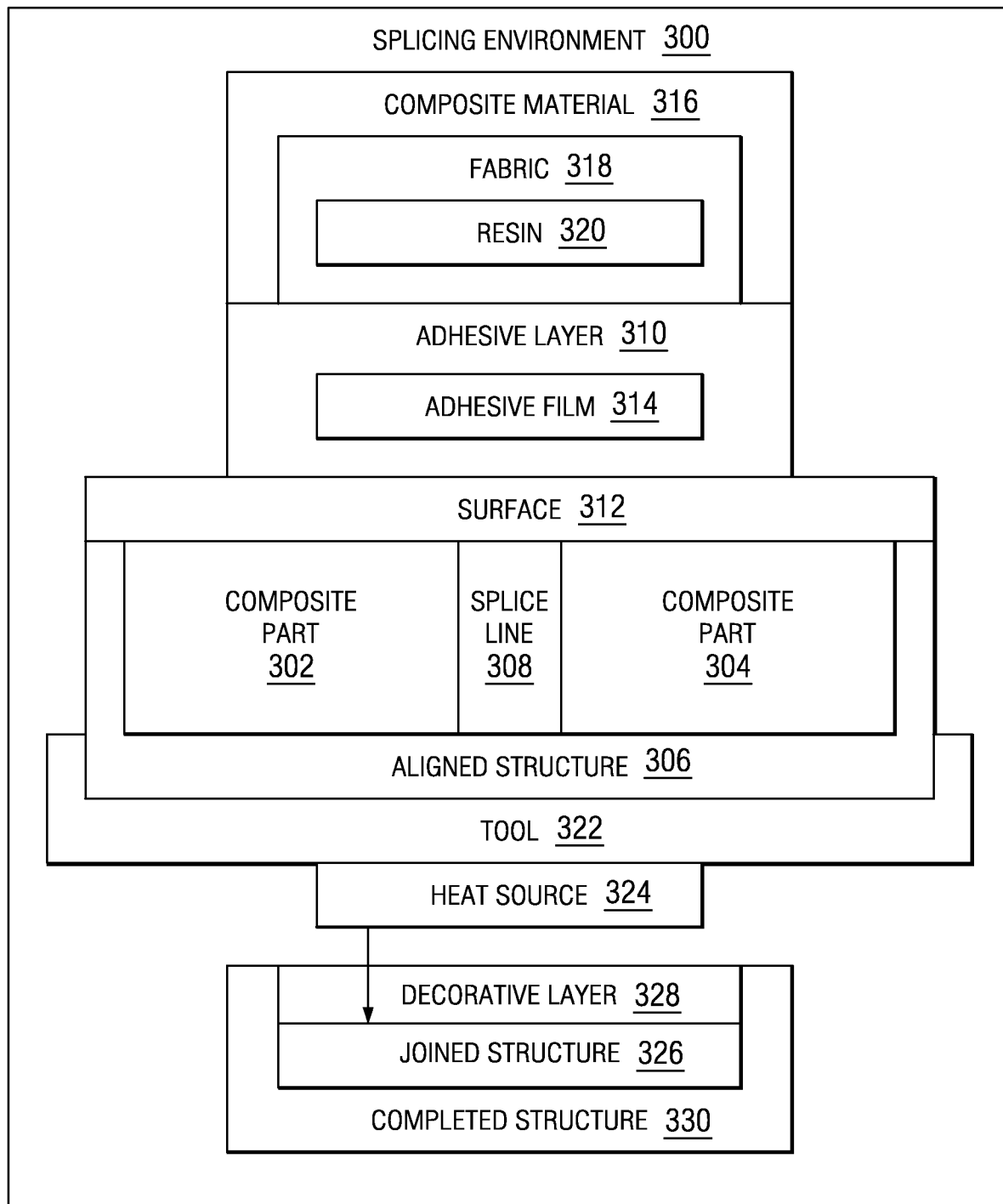
a composite material located on the adhesive layer;

25 a tool capable of holding the aligned structure with the adhesive layer covering the splice
line and the composite material located on the adhesive layer.

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*FIG. 1**FIG. 2*

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*FIG. 3*

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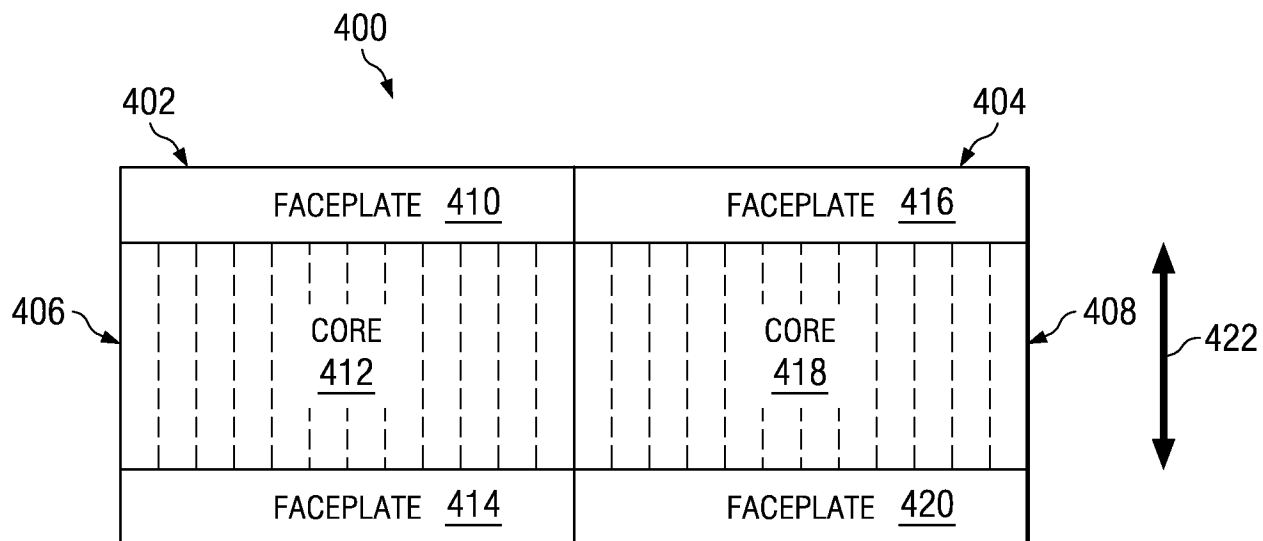


FIG. 4

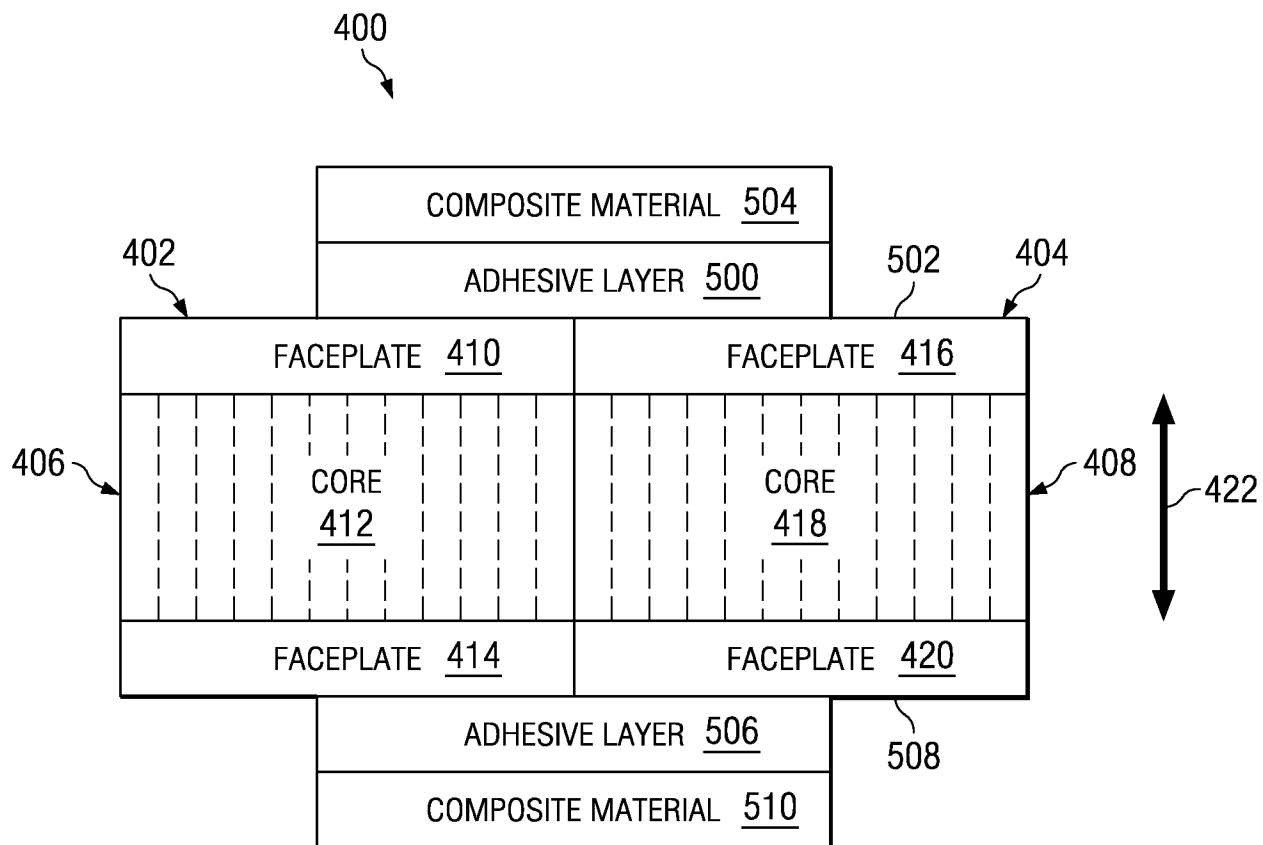


FIG. 5

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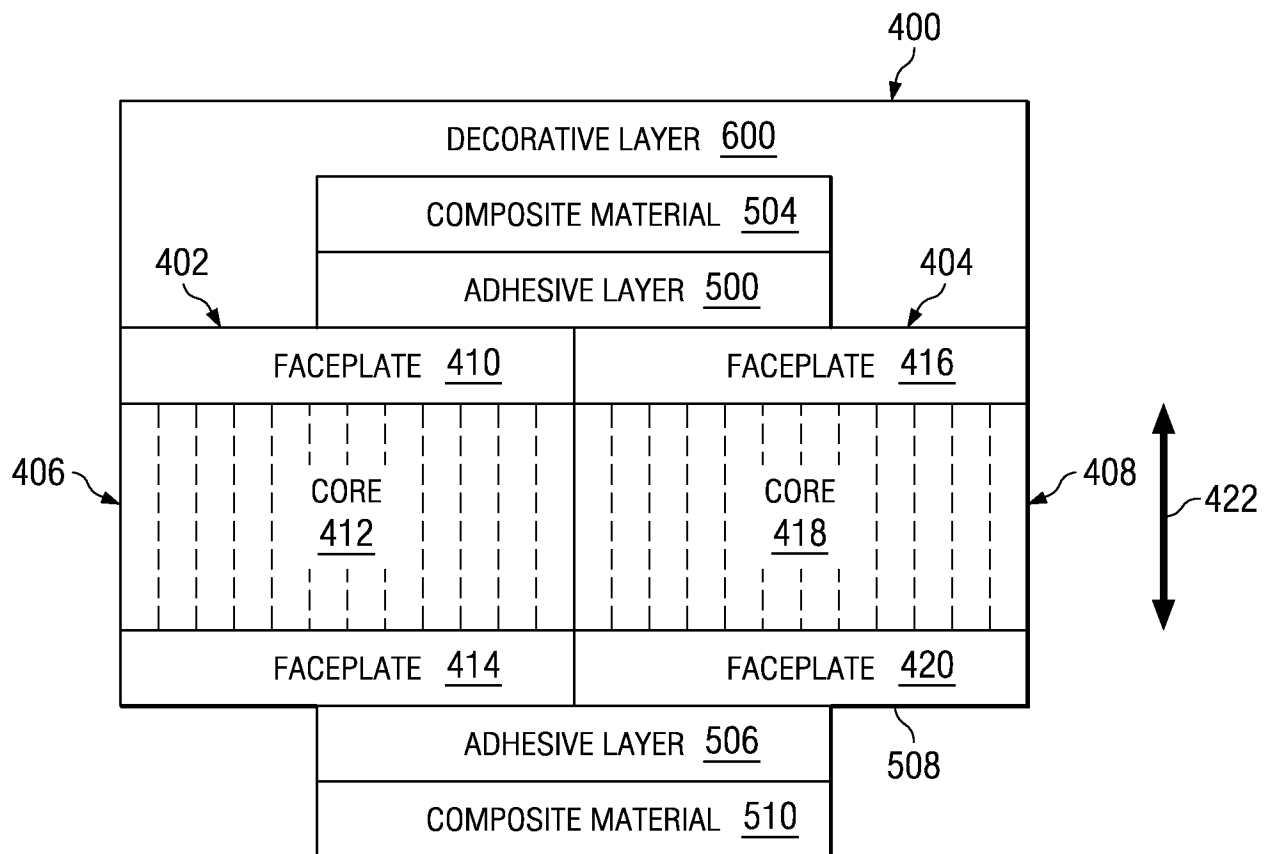


FIG. 6

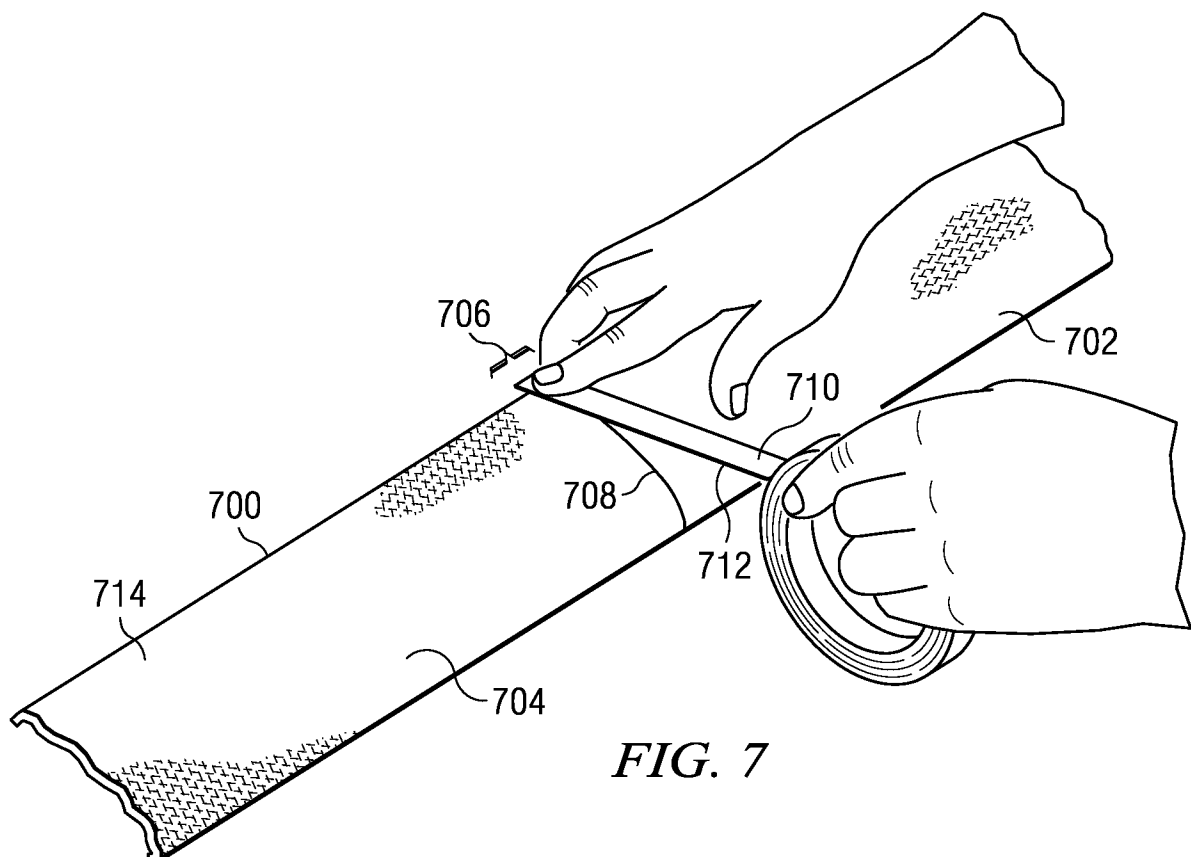
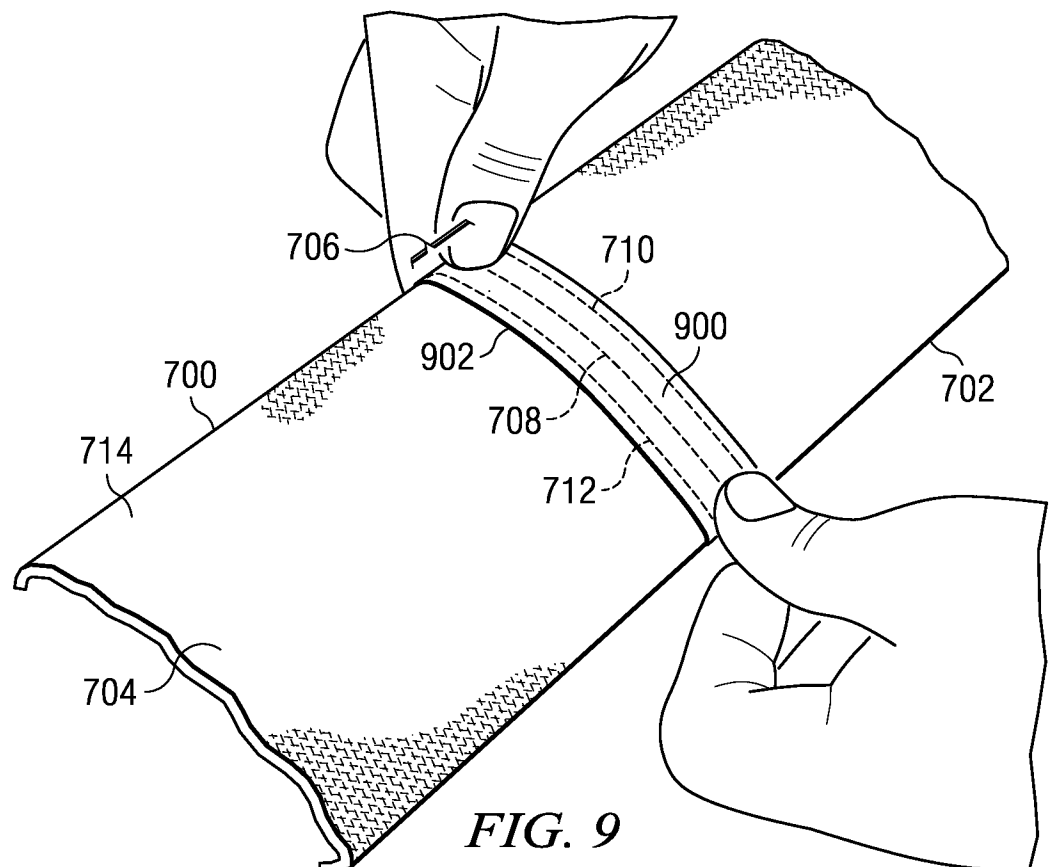
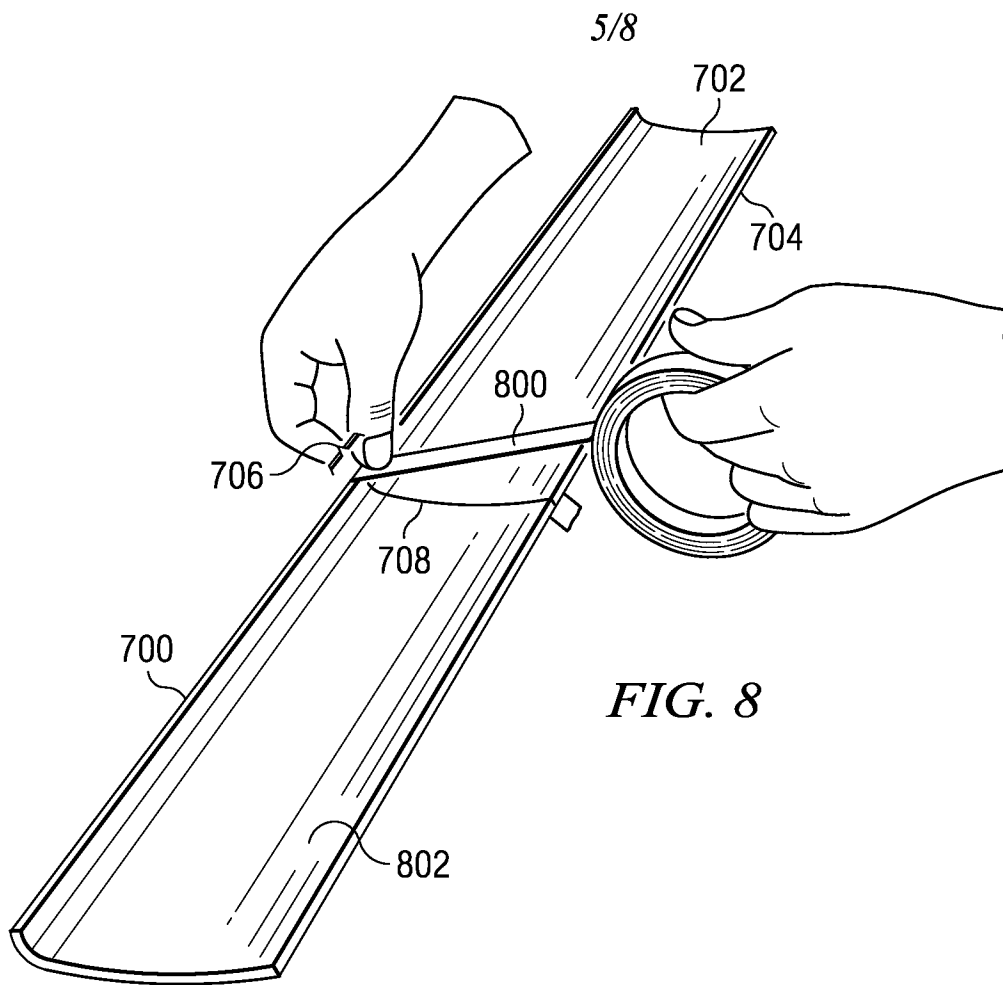
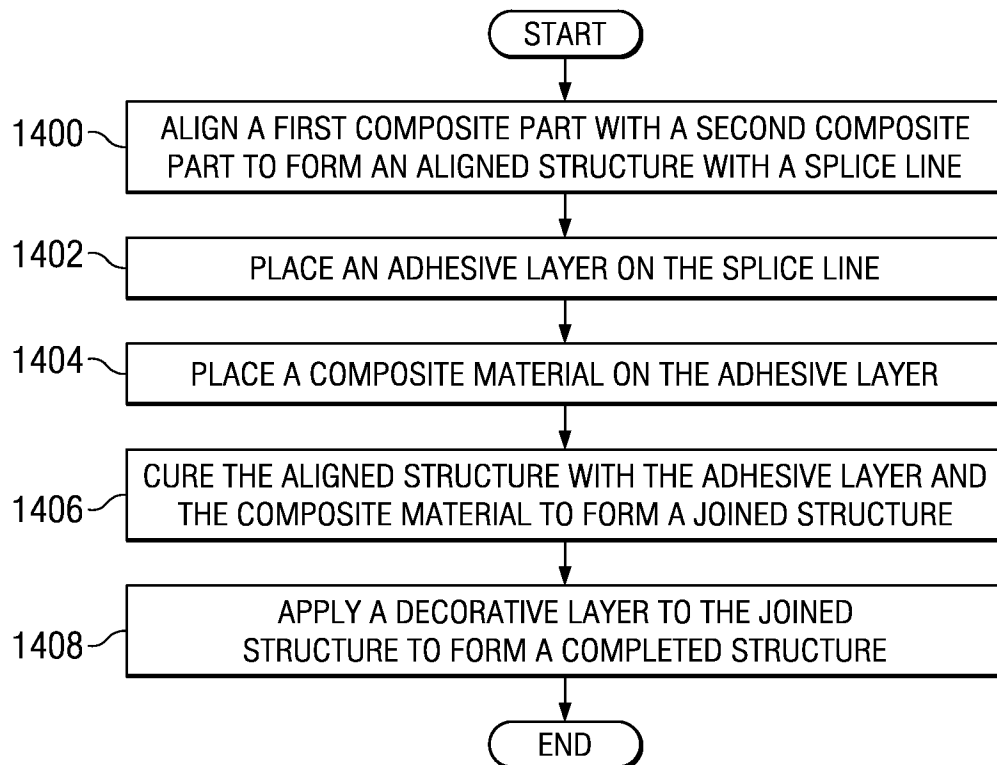
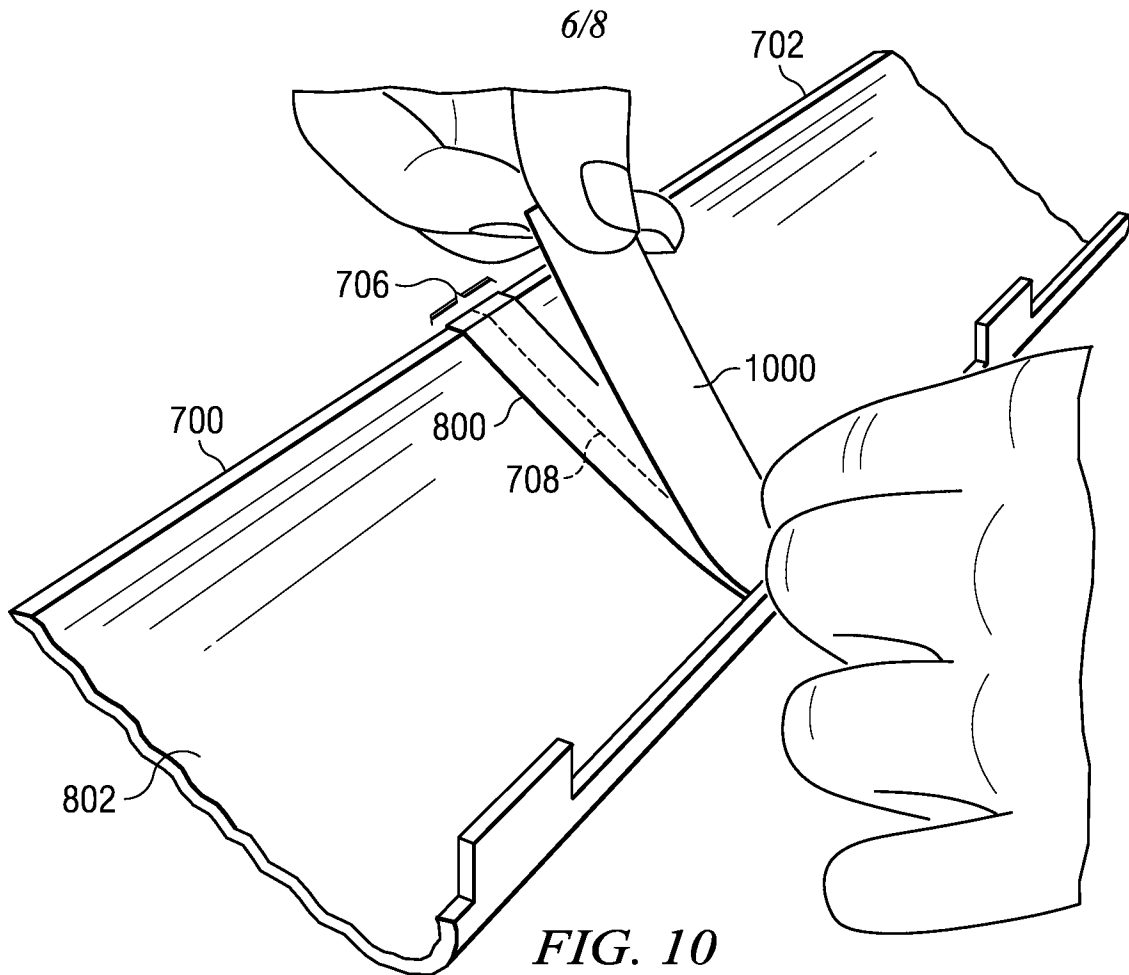
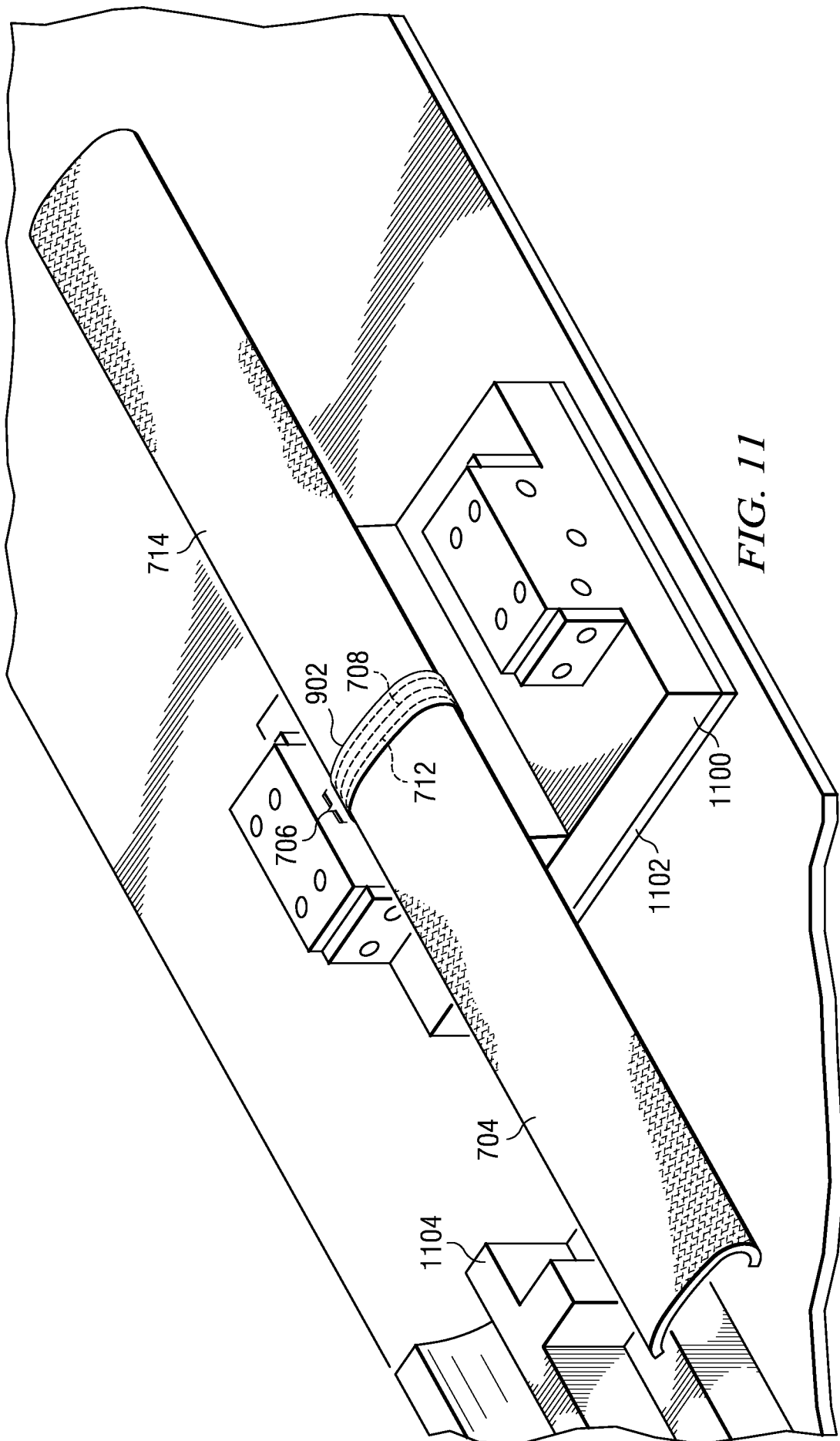


FIG. 7





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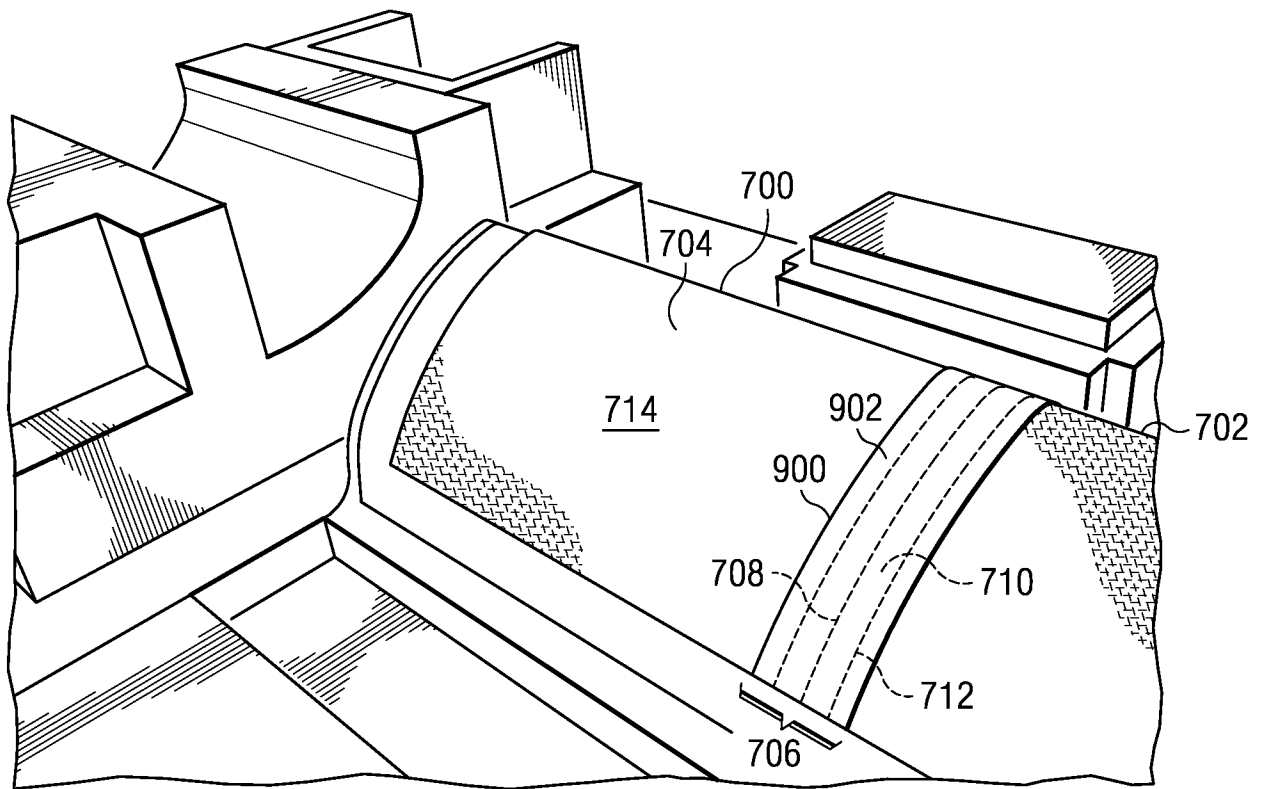


FIG. 12

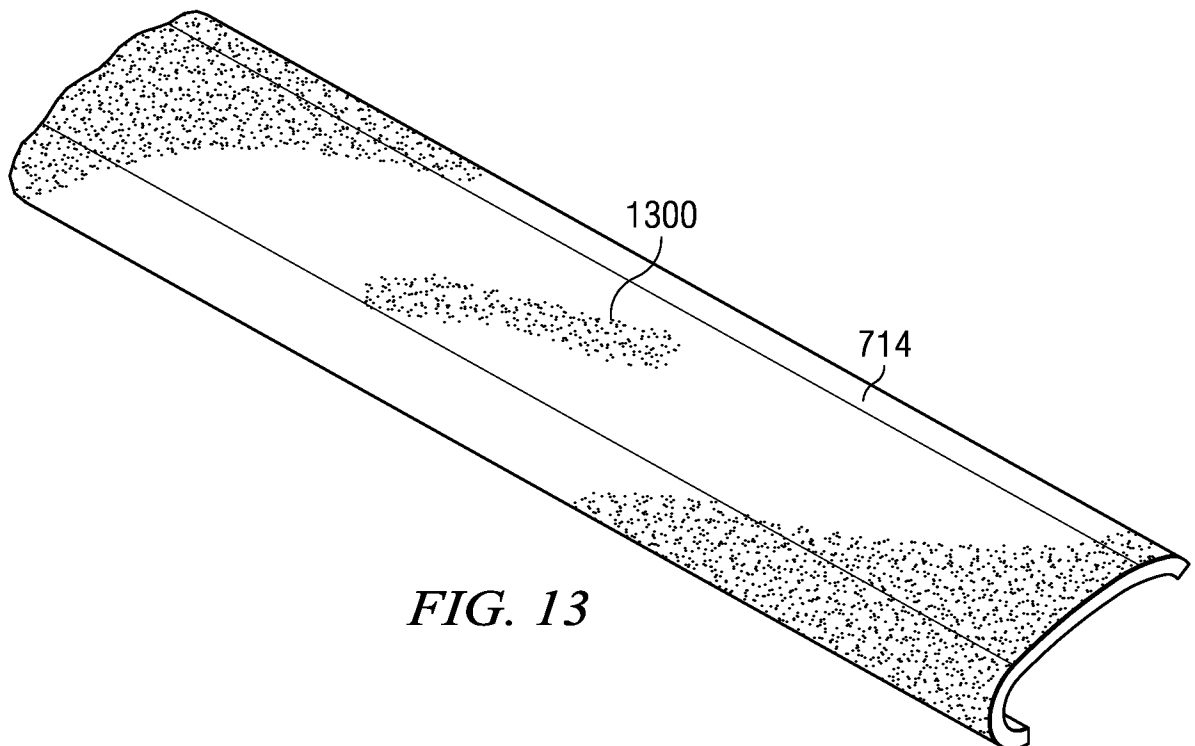


FIG. 13

INTERNATIONAL SEARCH REPORT

International application No

PCT/US2009/064055

A. CLASSIFICATION OF SUBJECT MATTER

INV. B29C65/50

ADD. B64C1/00

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)

B29C

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 practical, search terms used)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	GB 1 236 229 A (GOODYEAR TIRE & RUBBER [US]) 23 June 1971 (1971-06-23) page 2, lines 60-62,79-84,124-128; figure 2 page 3, lines 1-9,56-60	1-3,6-7, 9
X	FR 2 429 661 A1 (ADRIEN CLAUDE [FR]) 25 January 1980 (1980-01-25) page 3, lines 8-9,14-17; figures 4-6 page 5, lines 13-24,29-31 page 6, lines 2-6	1-3,6-7, 9-11,14
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Further documents are listed in the continuation of Box C.



See patent family annex.

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Date of the actual completion of the international search

25 January 2010

Date of mailing of the international search report

01/03/2010

Name and mailing address of the ISA/

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040,
Fax: (+31-70) 340-3016

Authorized officer

Carré, Jérôme

INTERNATIONAL SEARCH REPORT

International application No

PCT/US2009/064055

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

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