



- (51) International Patent Classification:
B64C 1/18 (2006.01) *B64C 1/00* (2006.01)
- (21) International Application Number:
PCT/US2014/050676
- (22) International Filing Date:
12 August 2014 (12.08.2014)
- (25) Filing Language: English
- (26) Publication Language: English
- (30) Priority Data:
61/895,706 25 October 2013 (25.10.2013) US
14/228,524 28 March 2014 (28.03.2014) US
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- (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, BN, 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, IR, IS, JP, KE, KG, 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, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, 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, LR, LS, MW, MZ, NA, RW, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, 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, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

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(54) Title: DECOMPRESSION PANEL FOR USE IN AN AIRCRAFT

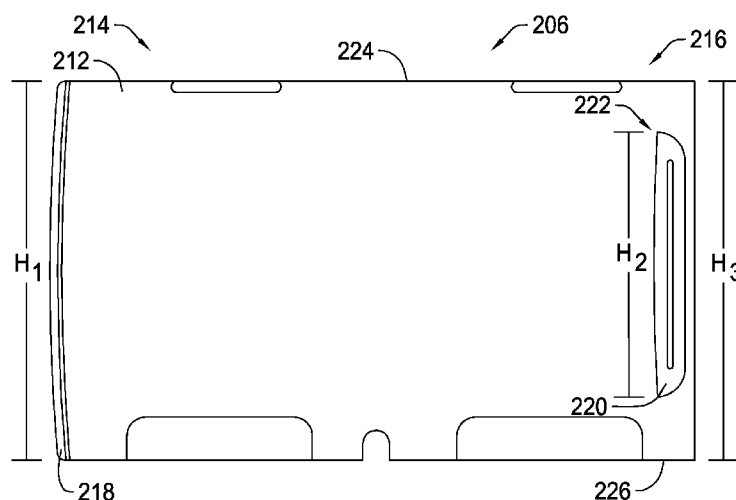


FIG. 4

(57) Abstract: A decompression panel (206) includes a body portion (212) having a first end (214) and a second end (216) opposing the first end (214). The decompression panel (206) also includes a tab (218) extending along the first end (214) and a flange (220) coupled to the body portion (212). The flange (220) defines a slot (222) adjacent to the second end (216). The decompression panel (206) is secured in an airplane cabin by the tab and slot features, such that unwanted access to areas behind such panels is prevented.



Published:

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

DECOMPRESSION PANEL FOR USE IN AN AIRCRAFT

BACKGROUND

5 The field of the present disclosure relates generally to aircraft assemblies and, more specifically, to decompression panels for use in aircraft assemblies.

 At least some known aircraft include several openings defined between a passenger compartment and adjacent compartments of an aircraft cabin. Such known openings serve a dual purpose. During normal operation, the openings define an air
10 flow path that enables conditioned air to be circulated through the aircraft cabin. During a decompression event, the openings allow large quantities of air to flow therethrough to facilitate equalizing the pressure within the aircraft cabin.

 In at least some known aircraft, the openings are covered with several panels including a grille and/or louvers. At least one known method of installing the panels in
15 the aircraft cabin includes shingling the panels together. However, such method does not provide positive retention between adjacent panels nor positive retention between panels and interfacing airplane components. Without positive retention, passengers may deflect panel surfaces to access areas behind the panel. Moreover, the panels may migrate during flight and expose gaps in the cabin.

20 Another method of installing the panels includes using a spring-type clip that mates with a hook feature on an adjacent panel. The clip retains only a center portion of the panel, leaving much of the panel edge unsecured. Adhesive tape and/or security fasteners have also been employed to attach adjacent panels. However, in addition to being unsightly and detracting from the in-cabin experience of the passengers, such
25 methods may be expensive and time consuming to implement and maintain.

BRIEF DESCRIPTION

 In one aspect, a decompression panel for use in an aircraft is provided. The decompression panel includes a body portion having a first end and a second end opposing the first end. The decompression panel also includes a tab extending along

5 the first end and a flange coupled to the body portion. The flange defines a slot adjacent the second end.

In another aspect, an aircraft is provided. The aircraft includes a side wall, a floor panel, and a decompression panel coupled between the side wall and the floor panel. The decompression panel includes a body portion including a first end and an opposing
10 second end. The decompression panel also includes a tab that extends along the first end and a flange that extends from the body portion, wherein the flange defines a slot adjacent the second end.

In yet another aspect, a method of forming a decompression panel for an aircraft is provided. The decompression panel includes a body portion having a first end and an
15 opposing second end. The method includes forming a tab that extends along the first end and forming a flange that extends from the body portion. A slot is defined adjacent the second end, wherein the slot is at least partially formed by the flange.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a flow diagram of an exemplary aircraft production and service methodology.

20 FIG. 2 is a block diagram of an exemplary aircraft.

FIG. 3 is a perspective sectional view of an exemplary aircraft cabin.

FIG. 4 is a backside view of an exemplary decompression panel that may be used in the aircraft cabin shown in FIG. 3.

FIG. 5 is an enlarged top view of a portion of the decompression panel shown in
25 FIG. 4 including a tab.

FIG. 6 is an enlarged top view of a portion of the decompression panel shown in FIG. 4 including a flange.

FIG. 7 is a perspective view of the decompression panel shown in FIG. 6 engaged with a second decompression panel.

5 FIG. 8 is a schematic flow diagram of a method of forming the decompression panel shown in FIG. 6.

DETAILED DESCRIPTION

 The implementations described herein relate to a decompression panel for use in an aircraft assembly. More specifically, the decompression panel includes a recessed tab extending along a first side of the panel and a flange defining a slot near a second edge of the panel. The slot is configured to receive a tab of an adjacent decompression panel to form a secure coupling. The tab is arcuate such that the decompression panel maintains sufficient flexibility to slightly rotate for installation. Moreover, the coupling of the tab within the slot restricts access to an area behind the decompression panel by securing the upper and lower portions of the edges of the decompression panel.

15 Referring to the drawings, implementations of the disclosure may be described in the context of an aircraft manufacturing and service method 100 (shown in FIG. 1) and via an aircraft 102 (shown in FIG. 2). During pre-production, including specification and design 104 data of aircraft 102 may be used during the manufacturing process and other materials associated with the airframe may be procured 106. During production, component and subassembly manufacturing 108 and system integration 110 of aircraft 102 occurs, prior to aircraft 102 entering its certification and delivery process 112. Upon successful satisfaction and completion of airframe certification, aircraft 102 may be placed in service 114. While in service by a customer, aircraft 102 is scheduled for periodic, routine, and scheduled maintenance and service 116, including any modification, reconfiguration, and/or refurbishment, for example. In alternative implementations, manufacturing and service method 100 may be implemented via vehicles other than an aircraft.

 Each portion and process associated with aircraft manufacturing and/or service 100 may be performed or completed by a system integrator, a third party, and/or an operator (e.g., 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,

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

As shown in FIG. 2, aircraft 102 produced via method 100 may include an airframe 118 having a plurality of systems 120 and an interior 122. Examples of high-level systems 120 include one or more of a propulsion system 124, an electrical system
10 126, a hydraulic system 128, and/or an environmental system 130. Any number of other systems may be included.

Apparatus and methods embodied herein may be employed during any one or more of the stages of method 100. For example, components or subassemblies corresponding to component production process 108 may be fabricated or
15 manufactured in a manner similar to components or subassemblies produced while aircraft 102 is in service. Also, one or more apparatus implementations, method implementations, or a combination thereof may be utilized during the production stages 108 and 110, for example, by substantially expediting assembly of, and/or reducing the cost of assembly of aircraft 102. Similarly, one or more of apparatus implementations,
20 method implementations, or a combination thereof may be utilized while aircraft 102 is being serviced or maintained, for example, during scheduled maintenance and service 116.

As used herein, the term “aircraft” may include, but is not limited to only including, airplanes, unmanned aerial vehicles (UAVs), gliders, helicopters, and/or any
25 other object that travels through airspace. Further, in an alternative implementation, the aircraft manufacturing and service method described herein may be used in any manufacturing and/or service operation.

FIG. 3 is a perspective sectional view of an exemplary aircraft cabin 200 that may be used in aircraft 102. In the exemplary implementation, aircraft cabin 200 includes a
30 side wall 202, a floor panel 204, and decompression panels 206 coupled therebetween that at least partially define an interior 208 of aircraft cabin 200. Side wall 202 also includes a window opening 210 defined therein. In operation, decompression panels 206 facilitate circulating conditioned air through aircraft cabin 200 and/or facilitate equalizing the pressure in aircraft cabin 200 during a decompression event.

5 FIG. 4 is a rear view of decompression panel 206 that may be used in aircraft cabin 200. FIG. 5 is an enlarged top view of a portion of decompression panel 206 including a tab 218. FIG. 6 is an enlarged top view of a portion of decompression panel 206 including a flange 220. FIG. 7 is a perspective view of decompression panel 206 engaged with a second decompression panel.

10 In the exemplary implementation, decompression panel 206 includes a body portion 212 having a first end 214 and a second end 216. Decompression panel 206 also includes a tab 218 that extends along first end 214 and a flange 220 that extends from body portion 212 adjacent second end 216 to define a slot 222.

 Decompression panel 206 may be fabricated from any suitable material. Exemplary materials include, but are not limited to, thermoplastic polymeric materials. As such, decompression panel 206 may be fabricated in a single die injection molding process.

 In the exemplary implementation, tab 218 extends an entire height H_1 of first end 214 such that tab 218 includes a height that is substantially similar to height H_1 of first end 214. Tab 218 has an arcuate shape, curving outwardly to accommodate for build variations and to enable engagement and/or disengagement of decompression panel 206 with a second, adjacent decompression panel 250 that is configured similarly to decompression panel 206. More specifically, the curved mating edge of tab 218 provides allowance for variations and differences, in what is primarily the vertically oriented direction of angular alignment along height H_1 , among adjacent decompression panels 206. Furthermore, tab 218 includes a tapered cross section such that a thickness T of tab 218 decreases at an angle Θ along a length L . The arcuate shape of tab 218, along with the tapered cross section, provides first end 214 with sufficient flexibility such that it can be slightly rotated and removed from slot 222. Tab 218 is recessed such that when decompression panel 206 is coupled to an adjacent second decompression panel 250, recessed first end 214 of decompression panel 206 slides behind second decompression panel 250 so as to not be visible from within interior 208 of aircraft cabin 200 (shown in FIG. 3).

5 In the exemplary implementation, flange 220 has a height H_2 and extends at least one-half of a height H_3 of second end 216. Furthermore, flange 220 is oriented approximately mid-way along second end 216 such that flange 220 is evenly spaced between an upper edge 224 and a lower edge 226 of body portion 212 of decompression panel 206. Flange 220 protrudes a suitable distance away from body
10 portion 212 in an axial direction to define slot 222. For example, in the exemplary implementation, slot 222 has a width W that related to thickness T by a ratio of approximately 1.0 to 1.2. Slot 222 is configured to receive tab 218 of an adjacent decompression panel 250 and provide a secure coupling between them. An engagement depth D between tab 218 and flange 220 is configured to enable panels
15 206 and 250 to be securely locked together when engaged, but also to enable build tolerance variation for each panel in a horizontal direction. Because the engagement between tab 218 and flange 220 extends along at least half of second end H_2 , a more secure coupling is created, restricting access to behind the decompression panel by securing upper and lower edges of the decompression panel.

20 During installation, tab 218 is inserted into the slot of second decompression panel 250. In some implementations, tab 218 is recessed, forming a flush fit between decompression panel 206 and second decompression panel 250 so as to provide a pleasing aesthetic appearance to passengers (not shown) seated in aircraft cabin 200 (shown in FIG. 3). In some implementations, a securing or clamping device 260 may be
25 used in combination with tab 218 and flange 220 to further secure decompression panel 206 within aircraft cabin 200. In one implementation, when clamping device 260 is engaged with decompression panel 206, decompression panel 206 and second decompression panel 250 are secured together with sufficient rigidity to prevent rotation of decompression panel 206 and removal tab 218 from slot 222. Upon clamping device
30 260 being disengaged, decompression panel 206 and second decompression panel 250 may be rotated enough to remove tab 218 from slot 222. Moreover, flange 220 includes a channel feature 228, such that when clamp 260 is disengaged, flange 220 is deformable to allow disengagement of arcuate tab 218 from slot 222. In the exemplary implementation, channel feature 228 is shown as a rounded rectangular slot, however
35 any alternate profile is also considered that would provide flange 220 with sufficient flexibility during disengagement of tab 218.

5 FIG. 8 is a schematic flow diagram of a method 300 of forming a decompression panel, such as decompression panel 206 (shown in FIG. 6). Method 300 includes providing 302 a body portion, such as body portion 212 (shown in FIG. 6) that includes a first end, such as first end 214 (shown in FIG. 6) and an opposing second end, such as second end 216 (shown in FIG. 6). Method 300 also includes forming 304 a tab, 10 such as tab 218 (shown in FIG. 6), that extends along the first end, wherein the tab is formed 304 such that the tab extends substantially an entire height of the first end. Furthermore, a flange, such as flange 220 (shown in FIG. 6), is formed 306 such that the flange extends from the body portion. Method 300 further includes defining 308 a slot, such as slot 222 (shown in FIG. 6), adjacent the second end, wherein the slot is at 15 least partially defined by the flange. The flange is formed 306 such that the flange includes a height that is at least half of a height of the second end and such that the flange is evenly spaced between an upper edge and a lower edge of the decompression panel. The slot is defined 308 such that the slot includes a width that is related to the thickness of the tab by a ratio of approximately 1.0 to 1.2.

20 The decompression panel described herein includes a recessed tab extending along an entire first side edge of the panel and a flange defining a slot near a second edge of the panel that facilitate at least one of (a) increasing a strength of an engagement between the decompression panel and an adjacent decompression panel; (b) maintaining flexibility of the decompression panel for installation; and (c) restricting 25 access to behind the decompression panel by securing upper and lower portions of the edges of the decompression panel.

Further, the disclosure comprises the embodiments according to the following clauses:

30 Clause 1. A decompression panel for use in an aircraft, said decompression panel comprising: a body portion comprising a first end and an opposing second end; a tab extending along said first end; and a flange extending from said body portion, said flange defining a slot adjacent said second end.

5 Clause 2. The decompression panel in accordance with Clause 1, wherein said first end includes a first height and said tab includes a height that is substantially similar to said first height.

 Clause 3. The decompression panel in accordance with Clause 1, wherein said second end includes a first height and said flange includes a second height that is at
10 least half of said first height.

 Clause 4. The decompression panel in accordance with Clause 1, wherein said slot is configured to receive a tab of an adjacent decompression panel to provide a secure engagement therebetween.

 Clause 5. The decompression panel in accordance with Clause 1, wherein said
15 tab is arcuate to facilitate installation of said decompression panel.

 Clause 6. The decompression panel in accordance with Clause 1, wherein said body portion further comprises an upper edge and an opposing lower edge, said flange being evenly spaced between said upper and said lower edges.

 Clause 7. The decompression panel in accordance with Clause 1, wherein said
20 tab includes a thickness and said slot includes a width that is related to said tab thickness by a ratio of approximately 1.0 to 1.2.

 Clause 8. An aircraft comprising: a side wall; a floor panel; and a decompression panel coupled between said side wall and said floor panel, said decompression panel comprising: body portion comprising a first end and a second end opposing said first
25 end; a tab extending along said first end; and a flange extending from said body portion, said flange defining a slot adjacent said second end.

 Clause 9. The aircraft in accordance with Clause 8 further comprising a second decompression panel coupled adjacent to said decompression panel, wherein said second decompression panel comprises a second tab and a second flange that defines
30 a second slot.

5 Clause 10. The aircraft in accordance with Clause 9, wherein said second slot is configured to receive said tab to provide a secure engagement between said decompression panel and said adjacent second decompression panel.

 Clause 11. The aircraft in accordance with Clause 9, wherein said tab is recessed such that, when coupled together, said first end of said decompression panel
10 is positioned behind said second decompression panel.

 Clause 12. The aircraft in accordance with Clause 8, wherein said second end includes a first height and said flange includes a second height that is at least half of said first height.

 Clause 13. The aircraft in accordance with Clause 8, wherein said first end
15 includes a first height and said tab includes a height that is substantially similar to said first height.

 Clause 14. The aircraft in accordance with Clause 8, wherein said tab is arcuate to facilitate installation of said decompression panel.

 Clause 15. The aircraft in accordance with Clause 8, wherein said body portion
20 further comprises an upper edge and an opposing lower edge, said flange being evenly spaced between said upper and said lower edges.

 Clause 16. A method of forming a decompression panel for an aircraft, the decompression panel including a body portion having a first end and an opposing second end, said method comprising: forming a tab that extends along the first end;
25 forming a flange that extends from the body portion; and defining a slot adjacent the second end, wherein the slot is at least partially formed by the flange.

 Clause 17. The method in accordance with Clause 16, wherein forming a tab further comprises forming the tab such that the tab extends substantially an entire height of the first end.

 Clause 18. The method in accordance with Clause 16, wherein forming a flange
30 further comprises forming the flange such that the flange includes a height that is at least half of a height of the second end.

5 Clause 19. The method in accordance with Clause 16, wherein forming a flange further comprises forming the flange such that the flange is evenly spaced between an upper edge and a lower edge of the decompression panel.

 Clause 20. The method in accordance with Clause 16, wherein forming a flange further comprises forming the flange such that the tab includes a thickness and the slot
10 includes a width that is related to the tab thickness by a ratio of approximately 1.0 to 1.2.

 This written description uses examples to disclose various implementations, including the best mode, and also to enable any person skilled in the art to practice the various implementations, including making and using any devices or systems and
15 performing any incorporated methods. The patentable scope of the disclosure is defined by the claims, and may include other examples that occur to those skilled in the art. Such other examples are intended to be within the scope of the claims if they have structural elements that do not differ from the literal language of the claims, or if they include equivalent structural elements with insubstantial differences from the literal
20 language of the claims.

WHAT IS CLAIMED IS:

- 5 1. A decompression panel (206) for use in an aircraft (102), said decompression panel comprising:
- a body portion (212) comprising a first end (214) and an opposing second end (216);
- a tab (218) extending along said first end; and
- 10 a flange (220) extending from said body portion, said flange defining a slot (222) adjacent said second end.
2. The decompression panel (206) in accordance with Claim 1, wherein said first end (214) includes a first height (H_1) and said tab (218) includes a height that is substantially similar to said first height.
- 15 3. The decompression panel (206) in accordance with Claim 1 or 2, wherein said second end (216) includes a third height (H_3) and said flange (220) includes a second height (H_2) that is at least half of said third height.
4. The decompression panel (206) in accordance with any of Claims 1-3, wherein said slot (222) is configured to receive a tab (218) of an adjacent
- 20 decompression panel (250) to provide a secure engagement therebetween.
5. The decompression panel (206) in accordance with any of Claims 1-4, wherein said tab (218) is arcuate to facilitate installation of said decompression panel.
6. The decompression panel (206) in accordance with any of Claims 1-5, wherein said body portion (212) further comprises an upper edge (224) and an
- 25 opposing lower edge (226), said flange (220) being evenly spaced between said upper and said lower edges.
7. The decompression panel (206) in accordance with any of Claims 1-6, wherein said tab (218) includes a thickness (T) and said slot (222) includes a width (W) that is related to said tab thickness by a ratio of approximately 1.0 to 1.2.

5 8. An aircraft (102) comprising:

a side wall (202);

a floor panel (204); and

the decompression panel (206) of any of Claims 1-7 coupled between said side wall and said floor panel.

10 9. The aircraft (102) in accordance with Claim 8 further comprising a second decompression panel (250) coupled adjacent to said decompression panel (206), wherein said second decompression panel comprises a second tab (218) and a second flange (220) that defines a second slot (222).

15 10. The aircraft (102) in accordance with Claim 9, wherein said second slot (222) is configured to receive said tab (218) of decompression panel (206) to provide a secure engagement between said decompression panel and said adjacent second decompression panel (250).

20 11. The aircraft (102) in accordance with Claim 9 or 10, wherein said tab (218) of decompression panel (206) is recessed such that, when coupled together, said first end (214) of said decompression panel is positioned behind said second decompression panel (250).

12. A method (300) of forming a decompression panel (206) for an aircraft (102), the decompression panel including a body portion (212) having a first end (214) and an opposing second end (216), said method comprising:

25 forming (304) a tab (218) that extends along the first end;

forming (306) a flange (220) that extends from the body portion; and

defining (308) a slot (222) adjacent the second end, wherein the slot is at least partially formed by the flange.

5 13. The method (300) in accordance with Claim 12, wherein forming (304) a tab (218) further comprises forming the tab such that the tab extends substantially an entire height (H_1) of the first end (214).

 14. The method (300) in accordance with Claim 12 or 13, wherein forming (306) a flange (220) further comprises forming the flange such that the flange includes a
10 height (H_2) that is at least half of a height (H_3) of the second end (216).

 15. The method (300) in accordance with any of Claims 12-14, wherein forming (306) a flange (220) further comprises forming the flange such that the flange is evenly spaced between an upper edge (224) and a lower edge (226) of the decompression panel (206).

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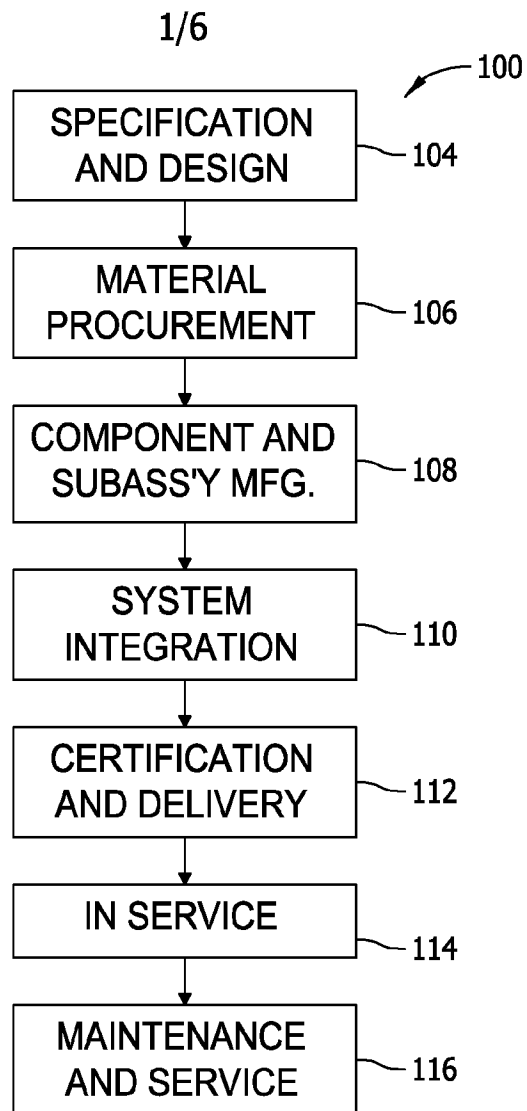


FIG. 1

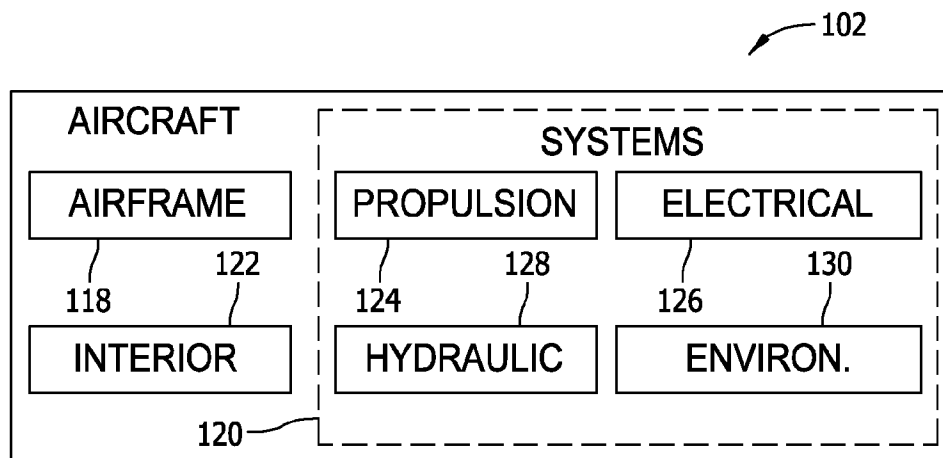


FIG. 2

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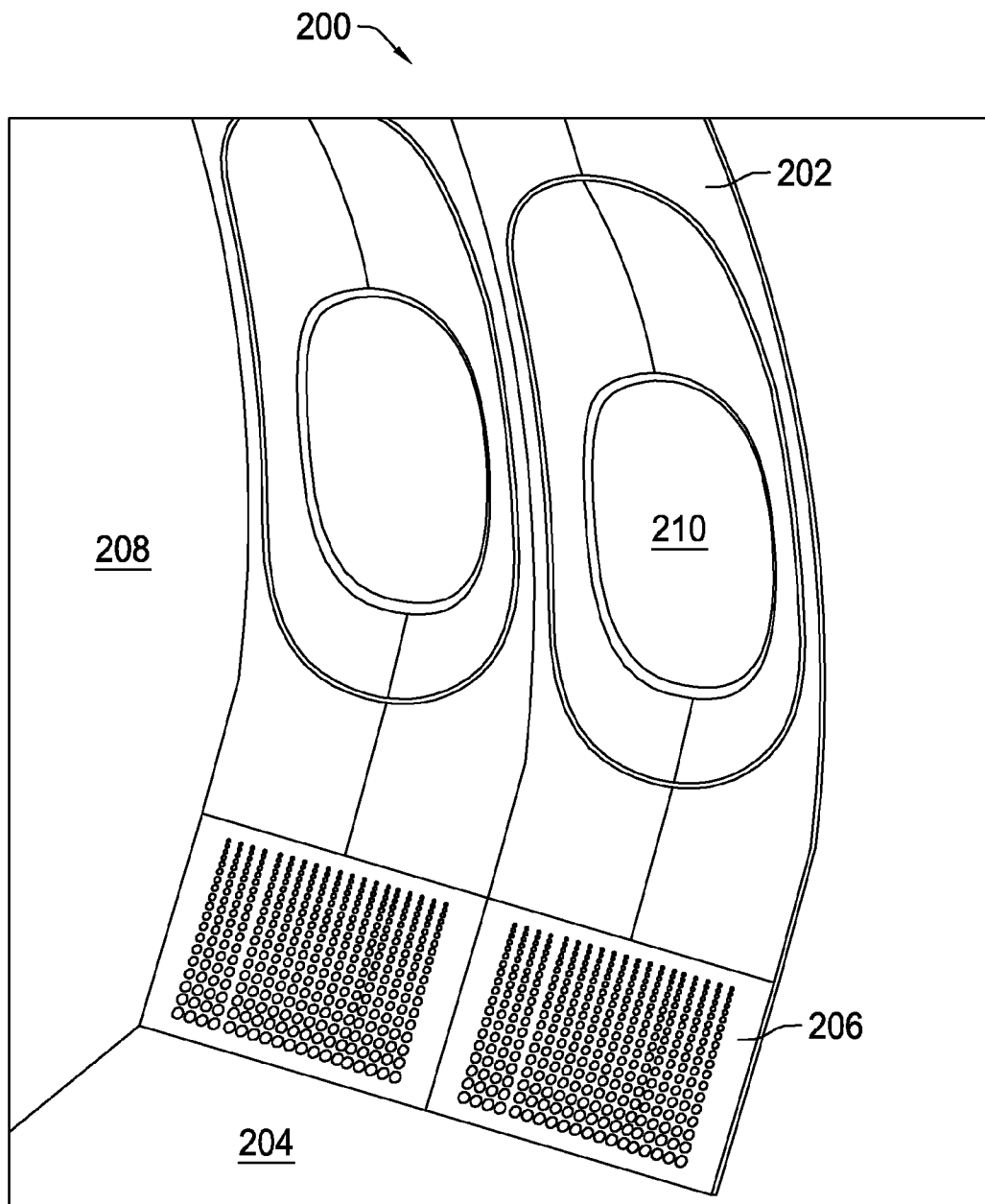


FIG. 3

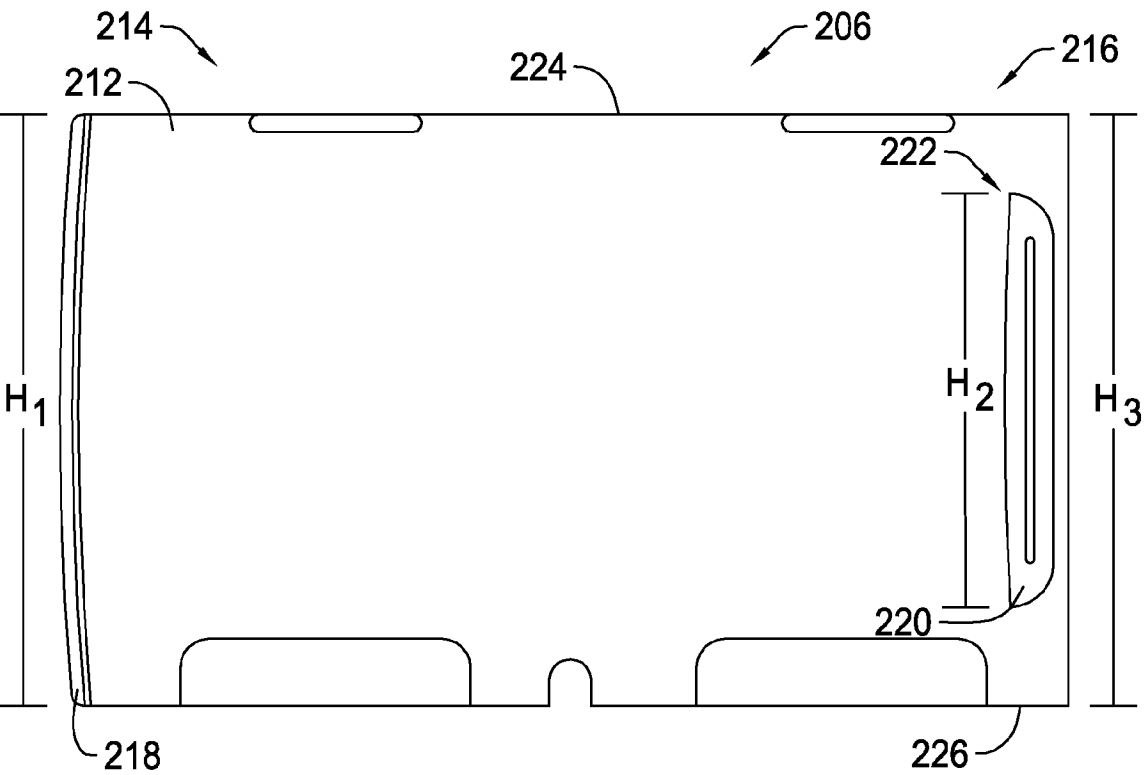


FIG. 4

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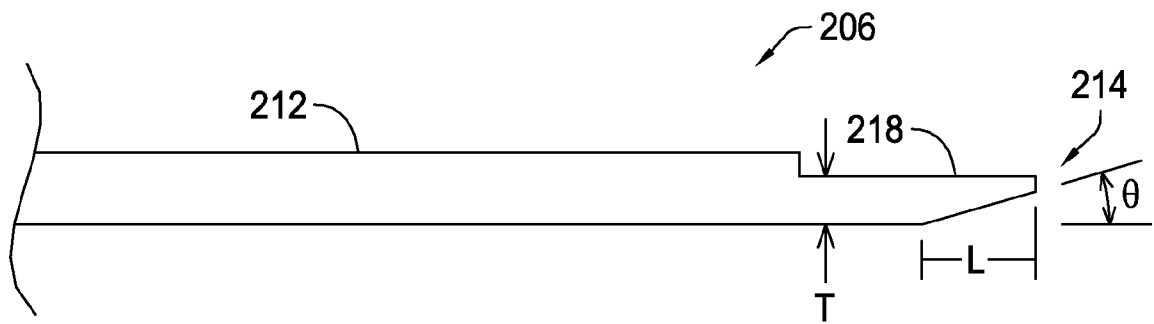


FIG. 5

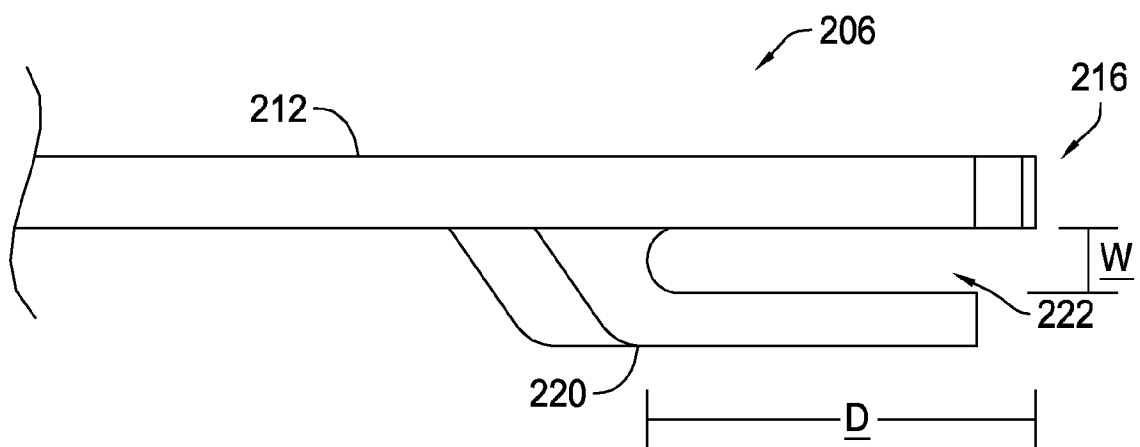


FIG. 6

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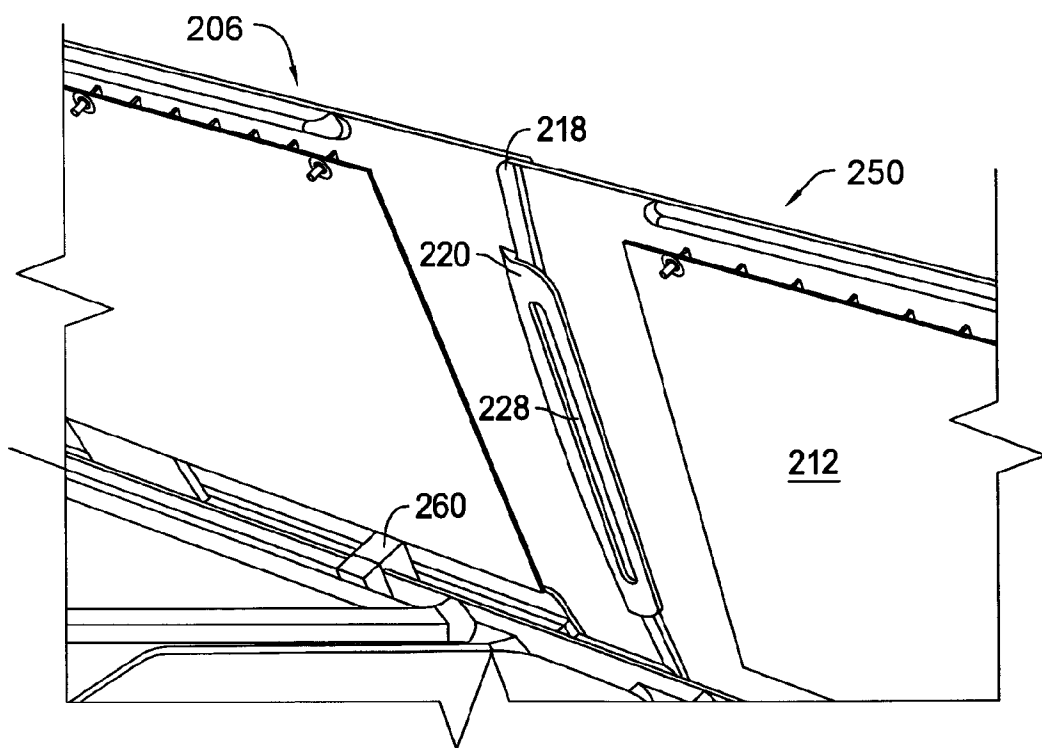


FIG. 7

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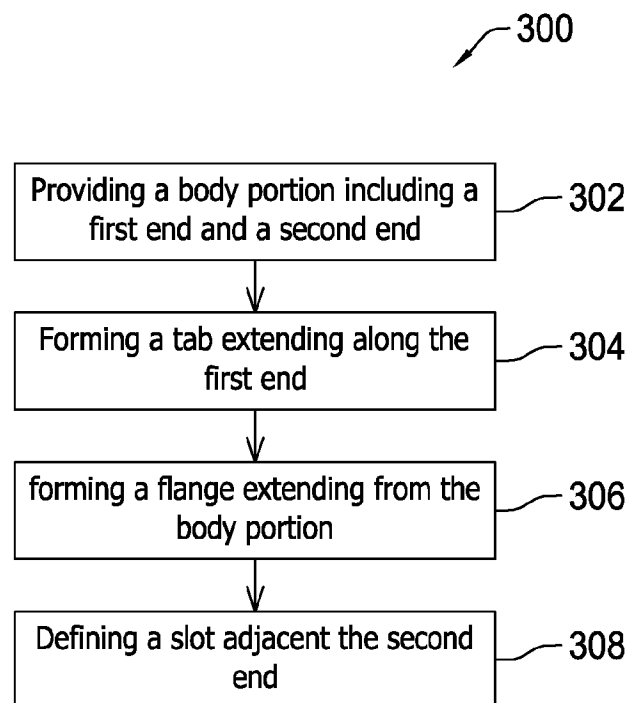


FIG. 8

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2014/050676

A. CLASSIFICATION OF SUBJECT MATTER
INV. B64C1/18 B64C1/00
ADD.

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)
B64C B64D

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)

EP0-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 6 435 455 B1 (HOLMAN WRENN P [US] ET AL) 20 August 2002 (2002-08-20) column 4, line 13 - line 47 column 5, line 25 - line 44; figures 1,2 -----	1-3,6, 12-15
X	US 2009/008502 A1 (LYNAS CHRISTOPHER [GB]) 8 January 2009 (2009-01-08) page 7, paragraph 60; figures 2a-5c -----	1-15
A	US 5 137 231 A (BOSS WILLIAM L [US]) 11 August 1992 (1992-08-11) the whole document -----	1-15
A	US 8 460 419 B1 (HOBBS CLIFF [US]) 11 June 2013 (2013-06-11) the whole document -----	1-15



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

4 November 2014

Date of mailing of the international search report

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Name and mailing address of the ISA/

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/US2014/050676

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