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CN 112960111 A
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(54) Title of the Invention: **Landing gear doors and installation processes therefor**
Abstract Title: **Aircraft landing gear door and installation processes**

(57) An aircraft landing gear fairing door 300 to releasably cover at least part of an aircraft landing gear bay aperture. The door comprises a base portion 320 having a hinge portion 321, 322, 323 to receive at least one hinge pin along a hinge axis, a body portion 360 to cover at least part of the aperture, and a coupling portion 345 to couple the door with a coupling device 230 coupled to the landing gear such that movement of a leg of the landing gear causes movement of the door about the hinge axis, wherein at least the base and body portions are formed as one integral component. A door assembly to releasably cover an aircraft external aperture comprises a door having a base and body portions, and a connector member connected with the base portion for relative rotation therebetween about a common axis, the connector member fixedly connectable to the aircraft adjacent the aperture to support the door for movement relative to the aircraft about the axis, wherein the door assembly is pre-assembled for subsequent fixing to the aircraft.

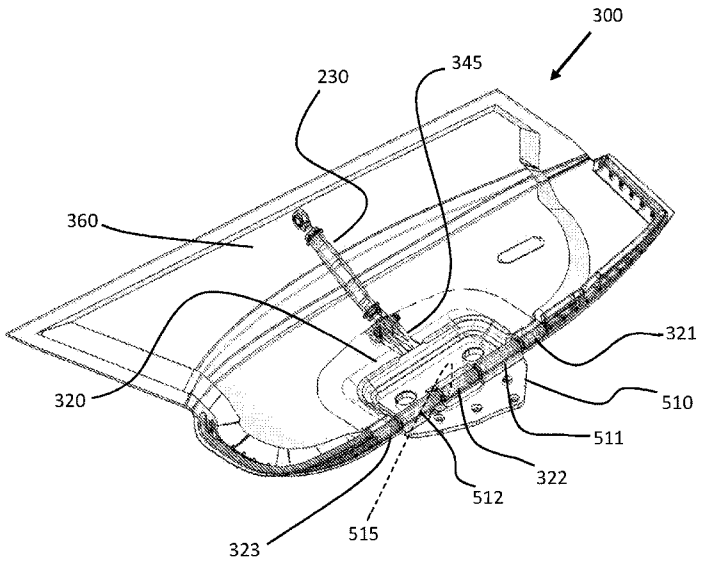

Figure 3

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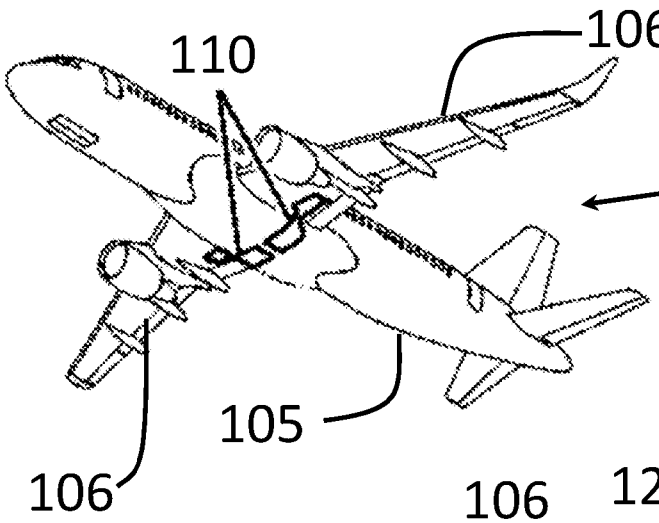

Figure 1a
(Prior Art)

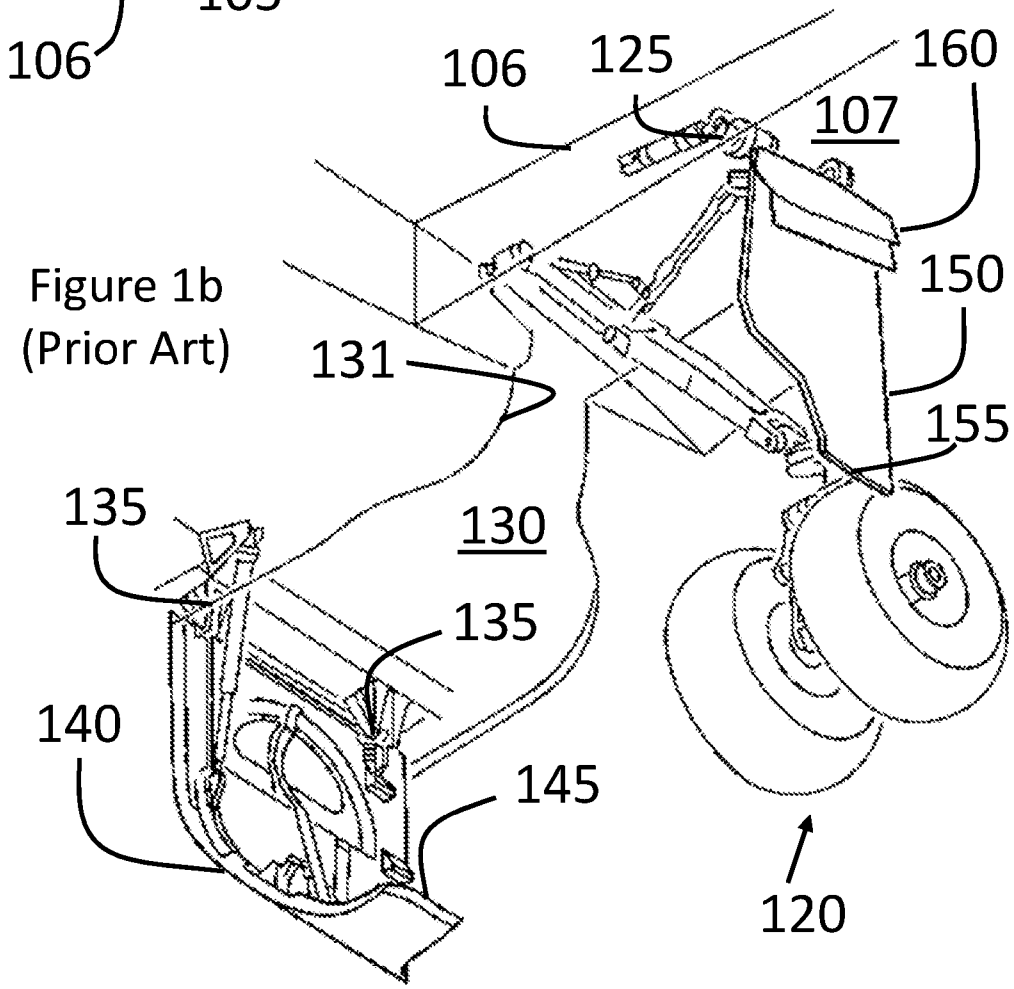

Figure 1b
(Prior Art)

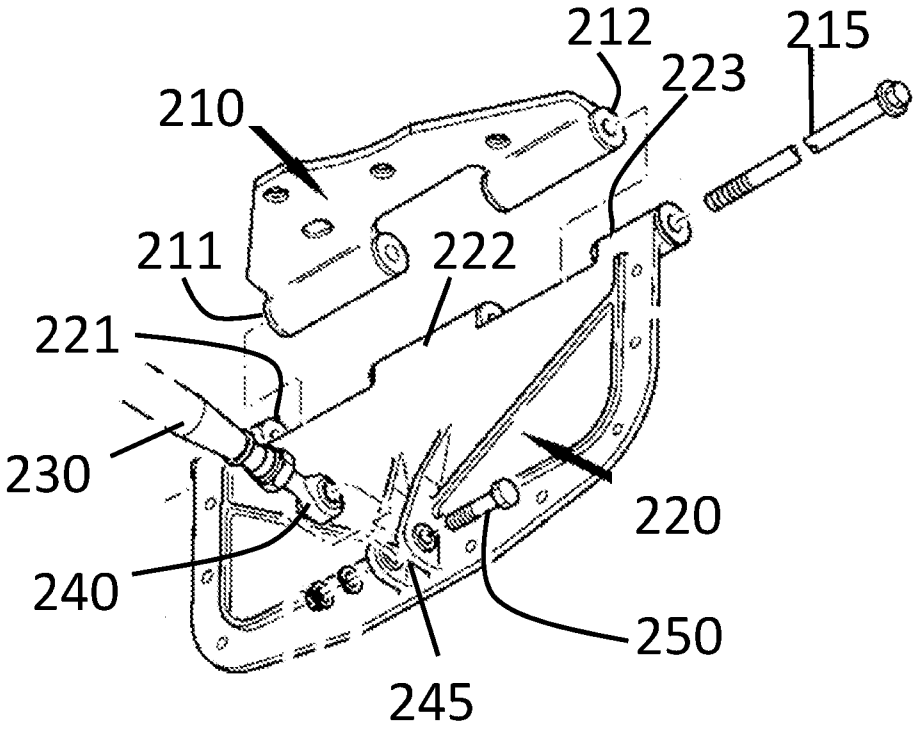

Figure 2a

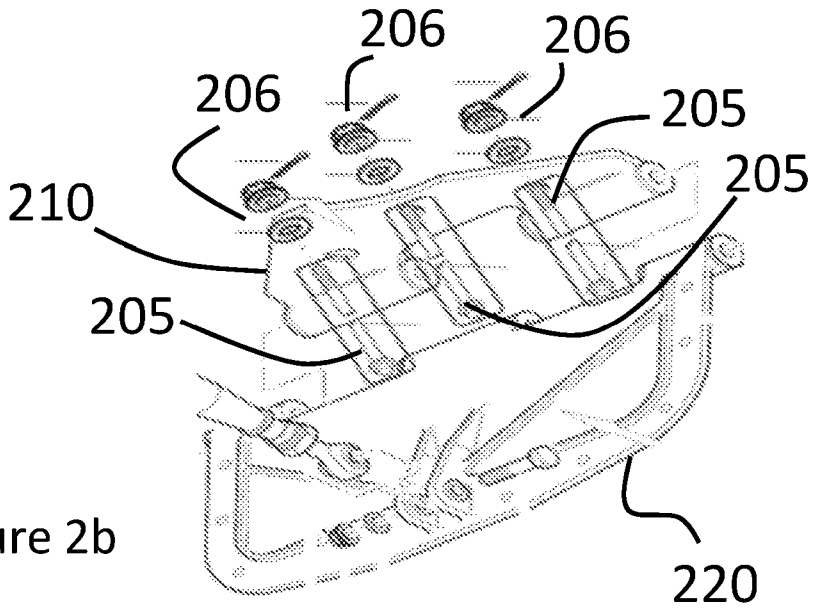

Figure 2b

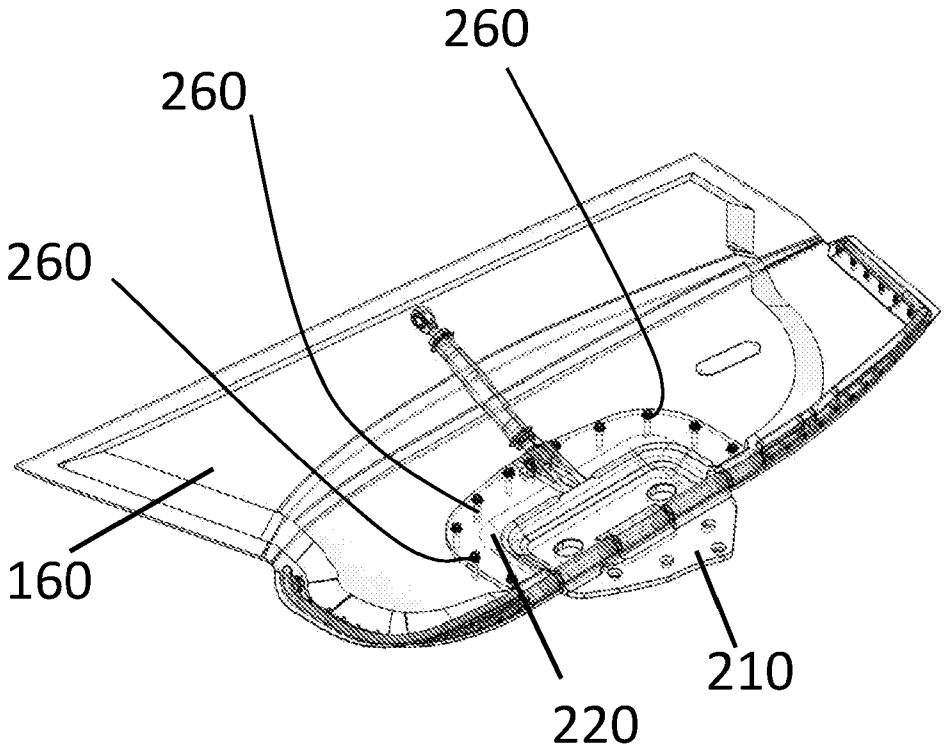

Figure 2c

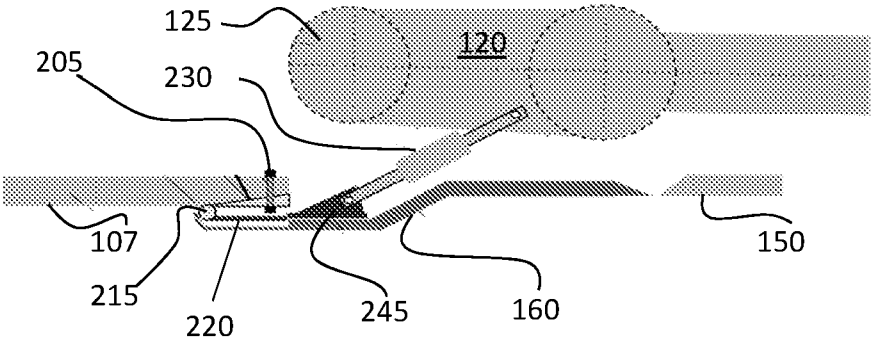

Figure 2d

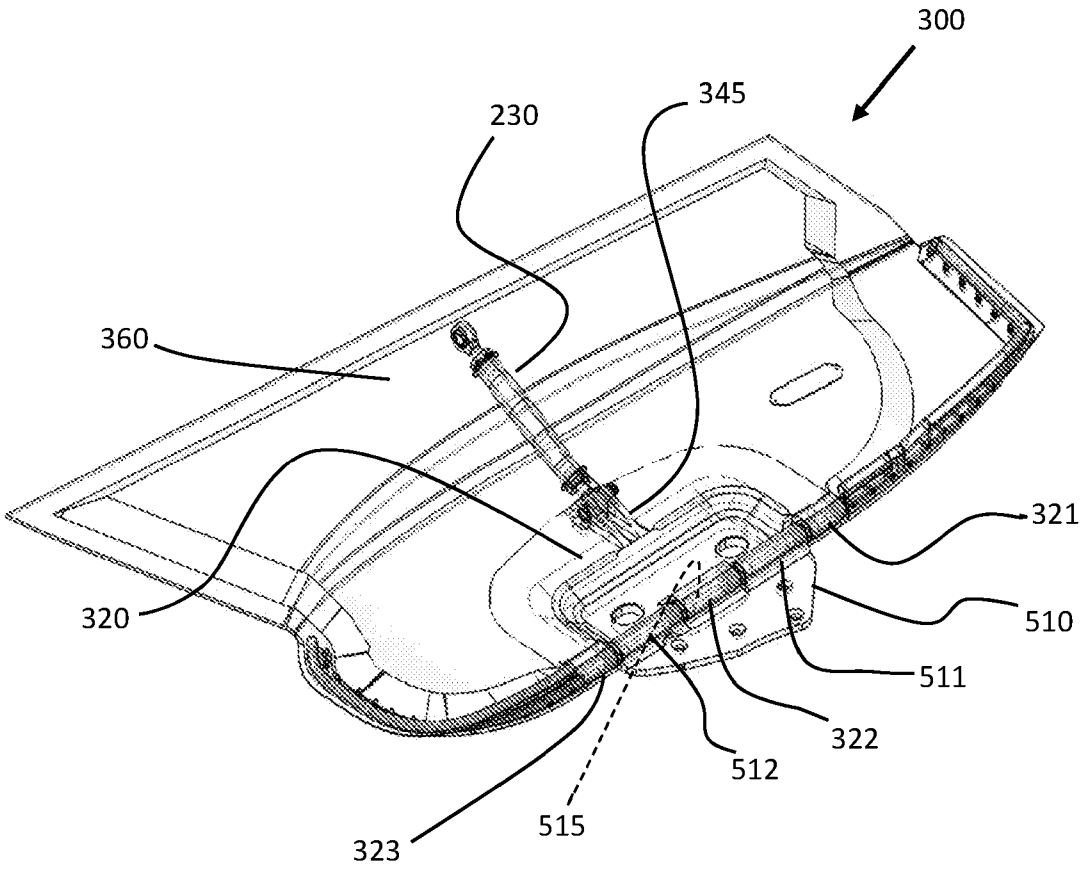

Figure 3

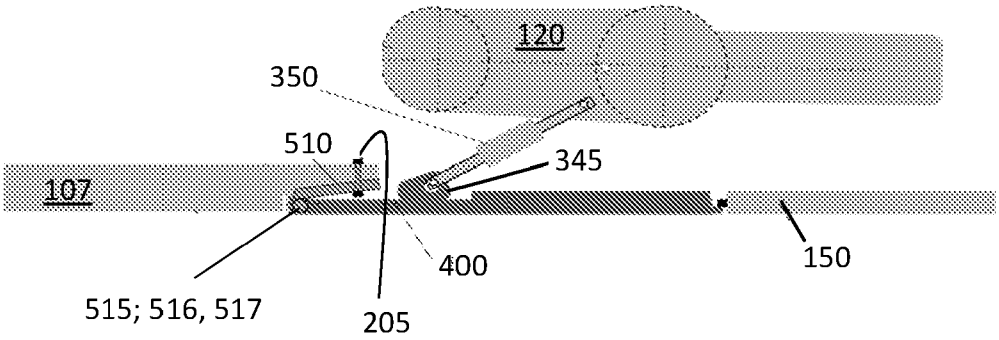

Figure 4

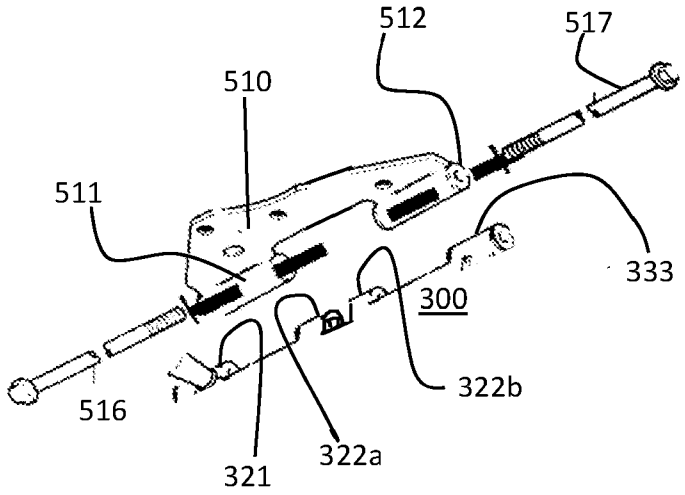

Figure 5

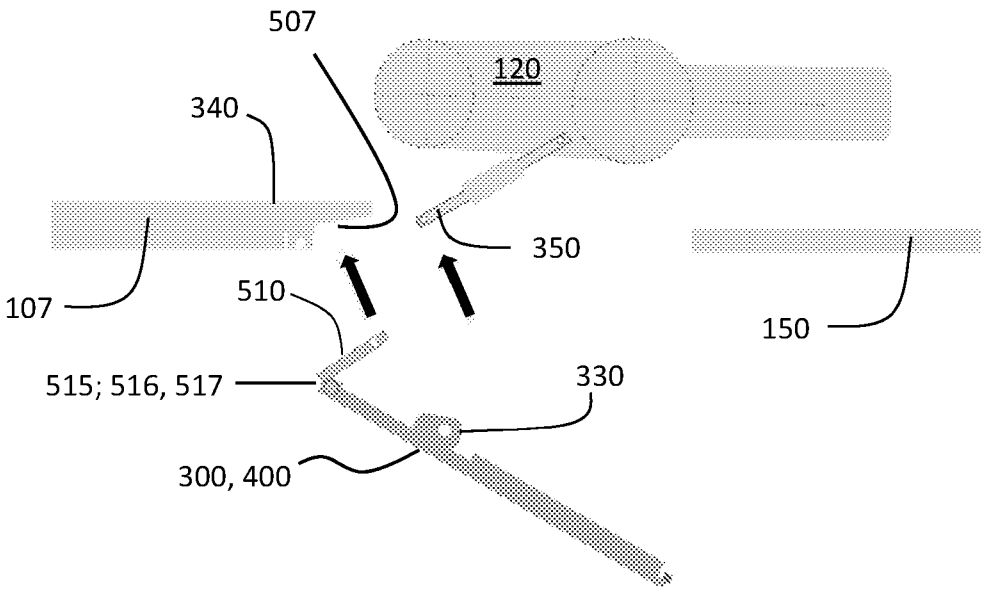

Figure 6

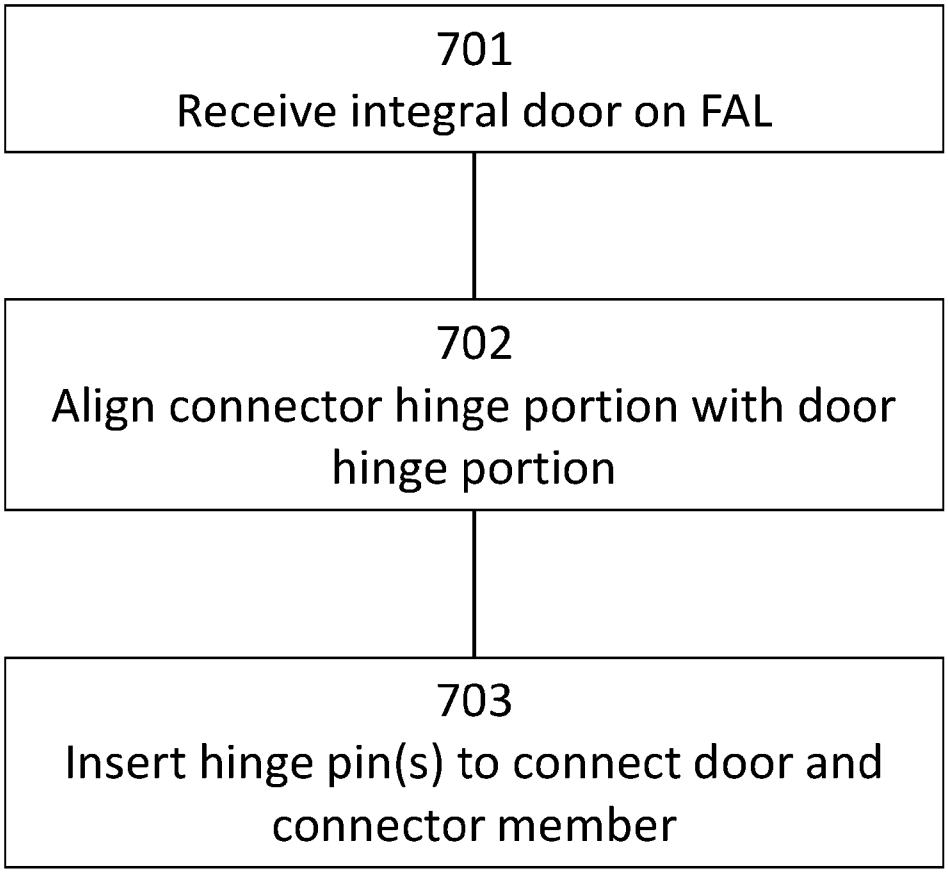
701
Receive integral door on FAL
702
Align connector hinge portion with door hinge portion
703
Insert hinge pin(s) to connect door and connector member

Figure 7

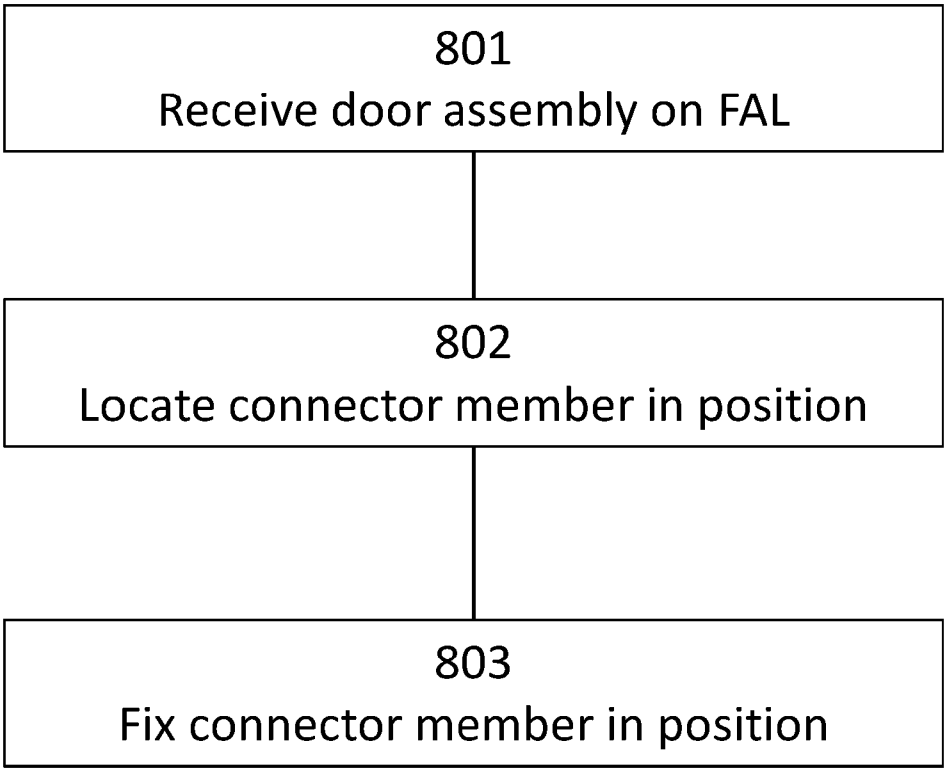
801
Receive door assembly on FAL
802
Locate connector member in position
803
Fix connector member in position

Figure 8

LANDING GEAR DOORS AND INSTALLATION PROCESSES THEREFOR

BACKGROUND OF THE INVENTION

[0001] The present invention concerns aircraft doors. More particularly, but not exclusively, the invention concerns landing gear doors which at least partially cover aircraft landing gear bay apertures, for example when the landing gear is retracted.

[0002] Landing gear doors, in conjunction with other components, are used to provide a clean and unbroken surface on the underside of the aircraft when the landing gear is retracted. By way of example, Fig. 1a shows an aircraft 101 having landing gear door components 110 including landing gear doors and door fairings in a closed configuration, with the associated landing gear assemblies (not shown) retracted in their respective landing gear bays.

[0003] Fig. 1b shows a portion of the known aircraft 101 with a landing gear bay 130 and a landing gear assembly 120 together with associated components (landing gear door 140, hinged fairing 160, and leg fairing 150 fixed for movement with the leg) in an extended configuration.

[0004] To prevent or impede the ingress of water, dirt and other foreign bodies into the landing gear bay 130, these components should all fit together closely when the landing gear assembly 120 is retracted. Furthermore for aerodynamic efficiency (minimum profile drag) the overall surface of the underside of the fuselage 105 and wings 106 should be as 'clean' as possible when the landing gear is retracted, so it is also important that the edges of these components mutually align and follow the contours (or loft lines) of the underside of the aircraft as closely as possible without protrusions or recesses.

[0005] It is also important that none of the above components interfere with each other, since any fouling of one component with respect to another during extension or retraction of the landing gear could lead to damage and potentially a landing gear extension/retraction failure. Therefore each of the components must be carefully aligned when being installed on the aircraft 101.

[0006] Fig. 2a, 2b, 2c and 2d are referenced to describe a known process for installing a hinged fairing, such as the fairing 160. A base plate 210 is fixed into the wing 106 of the aircraft 101 during wing assembly. During final assembly, on a final assembly line, a hinged plate 220 is connected to the base plate 210 via a hinge pin 215, which passes through hinge portions 221, 222, 223 of the hinged plate 220 and hinge portions 211, 212 of the base plate 210 and is fastened with a nut (not shown). The hinge portions 211, 212 of the base plate 210 protrude from the aircraft surface to facilitate access for insertion of the hinge pin 215. Then an actuator 230 of the landing gear assembly 120 is connected to coupling portion 245 of the hinged plate 220 (via coupling 240 and threaded member e.g. bolt or pin 250). Finally the fairing 160 is attached to the hinged plate 220 via fixings in the form of screws or bolts 260.

[0007] It will be appreciated that each of these steps requires adjustment and careful fitting, and therefore the entire process takes time, and involves a relatively high number of assembly operations on the final assembly line. Furthermore, there are some risks of misalignment associated with the mating and fixing together of the hinged plate and the fairing 160. Also, the aerodynamics of the wing 106 are adversely affected in that the hinge portions 211, 212 of the base plate, and thus the installed fairing 160, are not completely flush with the lower covers of the aircraft.

The present invention seeks to mitigate one or more of the above-mentioned problems. Alternatively or additionally, the present invention seeks to provide an improved landing gear door assembly.

SUMMARY OF THE INVENTION

[0008] The present invention provides an aircraft landing gear fairing door for a landing gear bay aperture in a body of an aircraft (the door, in use, being moveable to and from a position in which it covers at least part of the aperture - in other words the door releasably covering at least part of the aperture). The door comprises:

a base portion having a door hinge portion adapted to receive at least one hinge pin along a hinge axis;

a body portion to cover at least part of the aperture; and

a coupling portion adapted to couple the door with a coupling device coupled to the landing gear such that movement of a leg of the landing gear causes movement of the door about an axis of the hinge pin;

at least the base portion and the body portion being formed as one integral component.

[0009] This facilitates a reduction in the number of assembly operations performed on the final assembly line, thereby facilitating a reduction in time and/or cost to complete assembly of the components, and/or reducing risk of damage to components during such assembly operations. Furthermore, a reduction in risk of misalignment can be facilitated because the base portion and the body portion of the fairing door may in some examples be more accurately aligned, facilitating improved flushness of the external surface of the fairing door both with the portions of the lower covers that define part of the landing gear bay aperture, and also with the fixed leg fairing with the landing gear in the retracted condition.

[0010] Preferably, the base portion, the body portion and the coupling portion of the door are formed as one integral component.

[0011] The door hinge portion preferably comprises first and second door hinge regions, the first door hinge region being adapted to receive a first hinge pin, and the second door hinge region adapted to receive a second hinge pin. This facilitates easier and quicker assembly of the door with a hinge portion of the lower covers of a wing, as the arrangement more easily accommodates clashes or misalignments introduced by the integrated presence of the fairing, or body portion, with the base portion, during insertion of the hinge pins.

[0012] In some embodiments, the door is adapted to hingedly connect with a connector member for relative rotation therebetween, the connector member comprising a connector hinge portion to align with the door hinge portion to also receive the or each hinge pin, and wherein the connector member is adapted to be fixedly connected to the body of the aircraft, in a region adjacent the aperture, to support the door for movement relative to the aircraft body about the axis.

[0013] According to a second aspect of the invention there is provided a door assembly comprising:

the door of any preceding claim; and

a connector member comprising a connector hinge portion aligned with the door hinge portion;

the connector hinge portion and the door hinge portion receiving the or each hinge pin, so as to connect the door and the connector member for relative rotation therebetween;

the door assembly being pre-assembled for subsequent fixing to the aircraft body by fixedly connecting the connector member to lower covers of the aircraft in a region adjacent the aperture, to support the door for movement relative to the aircraft body about the axis.

[0014] This facilitates a reduction in risk of misalignment because the base portion and the body portion of the fairing door may be more accurately aligned with each other, and with the connector member, facilitating improved flushness of the external surface of the fairing door both with the portions of the lower covers that define part of the landing gear bay aperture, and also with the fixed leg fairing with the landing gear in the retracted condition. This arrangement facilitates a reduction in the number of assembly operations performed on the final assembly line, thereby facilitating a reduction in time and/or cost to complete assembly of the components, and/or reducing risk of damage to components during such assembly operations.

[0015] Preferably, the connector member is a plate-like support member adapted to be received and located in a predetermined position by a correspondingly adapted recess in the aircraft body. This further facilitates a reduction in risk of misalignment and improved flushness of the external surface of the fairing door with the lower covers and with the fixed leg fairing. In some preferred examples, the connector member is a plate-like support member

[0016] The connector member may be connected to the lower covers in any convenient manner, for example by fixings in the form of threaded members such as bolts that pass through respective holes in the connector member and threadedly engage with internally threaded holes or nuts in a region of the lower covers.

[0017] According to a third aspect of the invention there is provided a door assembly to releasably cover an external aperture in a body of an aircraft, the assembly comprising:

a door having i) a base portion and ii) a body portion; and

a connector member connected with the base portion for relative rotation therebetween about a common axis of rotation;

the connector member adapted to be fixedly connected to the body of the aircraft, in a region adjacent the aperture, to support the door for movement relative to the aircraft body about the axis;

the door assembly being pre-assembled for subsequent fixing to the aircraft body.

[0018] This arrangement facilitates a reduction in the number of assembly operations performed on the final assembly line, thereby facilitating a reduction in time and/or cost to complete assembly of the components, and/or reducing risk of damage to components during such assembly operations.

[0019] Preferably, the base portion and the body portion of the door are formed as one integral component. This facilitates a reduction in risk of misalignment because the base portion and the body portion of the fairing door may be more accurately aligned with each other, and with the connector member, facilitating improved flushness of the external surface of the fairing door both with the portions of the lower covers that define part of the landing gear bay aperture, and also with the fixed leg fairing with the landing gear in the retracted condition.

[0020] The connector member, including the hinge portion thereof, is preferably wholly contained in a recess in the lower covers, and the outer surface of the door in the retracted position is a continuation of the surface of the lower covers. This facilitates an improvement in the aerodynamic performance of the wing.

[0021] According to a fourth aspect of the invention there is provided a process of installing the door described in any of paragraphs [0008] to [0012] on an aircraft, the aircraft comprising a connector member fixedly connected to the body of the aircraft, in a region adjacent the aperture, the connector member comprising a connector hinge portion, the process comprising:

receiving the door on an aircraft assembly line;

aligning the connector hinge portion with the door hinge portion;

inserting at least one hinge pin through the connector hinge portion and the door hinge portion, so as to connect the door and the connector member for relative rotation therebetween.

[0022] Preferably, the door hinge portion comprises respective first and second door hinge regions, and the connector hinge portion comprises respective first and second connector hinge regions, the process further comprising:

aligning the door hinge portion and the connector hinge portion;

inserting a first hinge pin through the first door hinge region and the first connector hinge region; and

inserting a second hinge pin through the second door hinge region and the second connector hinge region.

[0023] This arrangement facilitates a reduction in the number of assembly operations performed on the final assembly line, thereby facilitating a reduction in time and/or cost to complete assembly of the components, and/or reducing risk of damage to components during such assembly operations.

[0024] According to a fifth aspect of the invention there is provided a process of installing the door assembly described in any of paragraphs [0013] to [0020] on an aircraft, the aircraft comprising a positioner to guide and support the connector member of the door assembly in a predetermined position relative to a landing gear bay aperture in the body of the aircraft, the process comprising:

receiving the door assembly on an aircraft assembly line;

locating the connector member in position;

fixing the connector member in position.

[0025] In some examples, the process further comprises adjusting the position of the connector member to accurately align the door with the aperture, with the aperture closed by the door, prior to fixing the connector member in position.

[0026] The positioner preferably comprises a recess in lower covers of a wing assembly of the aircraft in a region adjacent the landing gear bay aperture, the recess being configured and located to receive and guide the connector member into the predetermined position.

[0027] The process may further comprise coupling the coupling portion of the door with a coupling device coupled to the landing gear such that movement of a leg of the landing gear causes movement of the door about an axis of the hinge pin.

[0028] Preferably, the assembly line is a final assembly line.

[0029] According to a sixth aspect of the invention there is provided an aircraft comprising the door, or the door assembly, or made using the process as described in any of paragraphs [0008] to [0028].

[0030] The aircraft is preferably a passenger aircraft. The passenger aircraft preferably comprises a passenger cabin comprising a plurality of rows and columns of seat units for accommodating a multiplicity of passengers. The aircraft may have a capacity of at least 20, more preferably at least 50 passengers, and more preferably more than 50 passengers. The aircraft may be a commercial aircraft, for example a commercial passenger aircraft, for example a single aisle or twin aisle aircraft.

[0031] It will of course be appreciated that features described in relation to one aspect of the present invention may be incorporated into other aspects of the present invention. For example, the processes of the invention may incorporate any of the features described with reference to the apparatus of the invention and *vice versa*. Steps provided in the processes herein need not necessarily be performed in the order described, unless specifically indicated to the contrary.

DESCRIPTION OF THE DRAWINGS

[0032] In the description below, the prior art is described in more detail to better understand the context in which the invention may be used, and to facilitate better understanding of improvements flowing from the invention, with reference to:

Figures 1a and 1b, showing a prior art arrangement of a known aircraft with retractable landing gear; and

Figures 2a, 2b, 2c and 2d showing portions of a hinged door fairing assembly, and a connection arrangement therefor, used in the prior art assembly process.

[0033] Embodiments of the present invention will then be described by way of example only with reference to the accompanying schematic drawings of which:

Figure 3 shows an integrated aircraft landing gear door according to an embodiment of the invention, assembled to form an aircraft landing gear door assembly;

Figure 4 shows a portion of an aircraft having an aircraft landing gear door assembly according to an embodiment of the invention;

Figure 5 illustrates a hinge joint of an aircraft landing gear door assembly according to an embodiment of the invention;

Figure 6 shows an aircraft landing gear door assembly according to an embodiment of the invention, prior to connection to a portion of an aircraft;

Figure 7 is a diagram illustrating a process in accordance with an embodiment of the invention; and

Figure 8 is a diagram illustrating a process in accordance with a further embodiment of the invention.

DETAILED DESCRIPTION

[0034] Fig. 1a shows an aircraft 101 comprising a fuselage 105 and a pair of wings 106. The aircraft 101 also includes sets of landing gear door components 110, which provide a contiguous covering at the underside of the fuselage 105 and the pair of wings 106 for main landing gear assemblies (not shown) when in a retracted configuration.

[0035] Referring now also to Fig. 1b, a portion of the aircraft 101 is depicted with the left (port) side of the landing gear door components 110 of Fig. 1a shown in greater detail, now in an extended (deployed) position. These comprise a wheel bay door 140, a landing gear leg fairing 150, fixed for movement with the landing gear main leg (not visible in Fig.1b), and hinged leg fairing 160. A main landing gear assembly 120 of the aircraft 101 is pivotally coupled to the wing 106 via pintles 125, such that the main landing gear assembly 120 can be moved through an aperture 131 defined by the lower fuselage 105 and lower covers 107 and into a landing gear bay 130 within which the gear assembly 120 is housed when in the retracted condition.

[0036] As mentioned above the landing gear door 140, landing gear door fairing 150, and hinged leg fairing 160 fit together when the main landing gear assembly 120 is retracted to form a contiguous covering of the landing gear bay aperture 131. The landing gear door 140 is pivotally coupled via hinged mounts 135 to the fuselage 105, such that when the main landing gear assembly 120 is retracted, the wheel bay door 140 partially closes the landing gear bay aperture 131.

[0037] The landing gear leg fairing 150 is attached to the main leg of the main landing gear assembly 120, such that when the main landing gear assembly 120 is retracted, the landing gear leg fairing 150 also partially closes the landing gear bay aperture 131. Furthermore, when the main landing gear assembly 120 is retracted, a lower edge 155 of the landing gear leg fairing 150 is arranged to abut an edge 145 of the wheel bay door 140.

[0038] Similarly a hinged leg fairing 160 is hingedly attached to the wing 106 via a hinged joint (not shown in Fig. 1b) such that when the main landing gear assembly 120 is retracted, the hinged fairing 160 rotates about the hinged joint to close the fairing 160. When closed, the fairing 160 abuts an edge of the landing gear leg fairing 150 (opposite the lower edge 155). In this way the arrangement of the wheel bay door 140, landing gear leg fairing 150, and the hinged fairing 160 together close the landing gear bay aperture 131 to the exterior when the main landing gear assembly 120 is retracted, as shown in Fig. 2c.

[0039] Referring now also to Figures 2a, 2b, 2c and 2d, the hinged joint is shown in more detail. A base plate 210 of the hinged joint is fixedly connected to the lower covers on the underside of the wing 106 of the aircraft 101, typically during assembly of the wing 106 on a wing assembly line, using fixings such as bolts 205 passing through holes in the plate and retained by nuts 206, as shown in Figure 2b. The prior art connector hinge portion 211, 212 stands proud of the surface of the lower covers 107 to facilitate the insertion of hinge pin 215 therethrough. When assembling the major component assemblies of the aircraft on a final assembly line, hinged plate 220 of the hinged joint is rotatably connected to the base plate 210 by insertion of the hinge pin 215 through the connector hinge portion 211, 212 and the hinge portion 221, 222, 223 of the hinged plate 220. An actuation strut 230 of the landing gear assembly 120 is then connected to the hinged plate 220 by coupling a rotary joint 240 to a coupling portion 245 of the hinged plate 220 by inserting an elongate member

such as a threaded pin or bolt 250. The fairing 160 is then attached to the hinged plate 220 by fixing several screws or bolts 260 in multiple locations around the hinged plate, as best seen in Fig.2b. Figs. 2b and 2d show the hinged fairing assembly 160, 220 assembled with the base plate 210 in accordance with the known sequence of assembly described above, and thereby rotatably connected to the lower covers. As best shown in Fig. 2d, with the base plate 210, hinged plate 220 and fairing 160 assembled on the aircraft 101, with the landing gear assembly 120 in the retracted position, the hinged fairing 160 closes a region of the aperture 131 between the leg fairing 150 and the edge of the lower covers 107 that define the aperture 131 in that region.

Embodiments according to the invention

[0040] Referring to Figure 3, an aircraft landing gear integrated fairing door, or hinged fairing, 300 is shown, comprising a base portion 320 and a body portion 360, which are integrally formed together as a single unitary component. This arrangement facilitates accurate alignment and positioning of the base portion 320 relative to the body portion and therefore a smooth outer surface and accurate mating with portions of other components during use, and/or facilitates an increase in strength and/or durability of the component. The integrated door component can be formed, for example, from moulded carbon fibre reinforced plastics (CFRP), or by any suitable alternative material, such as metallic alloys for example, and/or process, such as casting or pressing for example.

[0041] The door 300 further comprises a coupling portion 345 which, in the present embodiment, is integrally formed together with the base portion 320 and the body portion 360 as part of the single unitary component, although in alternative embodiments the coupling portion 345 may be affixed to the door 300 as a separately provided component. The coupling portion 345 can take any suitable form, such as the bracket shown, or any other connector for providing a rotational connection.

[0042] The base portion 320 of the integral door 300 takes a generally plate-like form, and may be shaped similarly to the hinged plate 220 of Figures 2a and 2c, but without the need for holes or other arrangement for fastening to a separate fairing. The base portion 320 has

a hinge portion 321, 322, 323 adapted to receive at least one hinge pin 515 along a hinge axis, as shown in the arrangement of Figure 3, to hingedly connect the base portion 320 with a connector member 510 for relative rotation therebetween. The connector member 510 comprises a hinge portion 511, 512 to align with the door hinge portion 321, 322, 323 to also receive the hinge pin 515, as shown in Figure 3.

[0043] The connector member 510 may take the form of a base plate, for example, and is adapted to be fixedly connected to the lower covers of an aircraft in a region adjacent a landing gear bay aperture 131, to support the door 300 for movement about the hinge axis relative to the lower covers 107 of an aircraft body. The connector member 510 be connected to the lower covers using bolts, for example, as for a known fixing arrangement such as that shown in Figure 2b, or by any other appropriate means.

[0044] Figure 5 shows an alternative hinge joint arrangement in which the hinge portion of the door 300 comprises a first door hinge region 321, 322a adapted to receive a first hinge pin 516, and a second door hinge region 322b and 333 adapted to receive a second hinge pin 517. This facilitates easier connection with the respective first and second regions 511, 512 of the hinge portion of the connector member 510, in that the arrangement can more easily accommodate variations in alignment of the various elements of the door hinge portions 321, 322a, 322b, 333 that may be introduced by integral formation of the fairing body portion 360 with the base portion 320.

[0045] Figure 4 shows an alternative integral door, or hinged fairing, 400 that is similar to the door 300 described above with reference to Figures 3 and 5, except that the door 500 has a flatter cross-sectional profile as seen in Figure 4. Thus, with the respective hinge portions 321, 322, 323; 321, 322a, 322b, 333: 511, 512 of the door 400 and the connector member 510 substantially wholly received in the recess in the lower covers, the outer surface of the door 400 in the retracted position is a continuation of the surface of the lower covers.

[0046] As shown in Figure 6, a pre-assembled door assembly can be provided for subsequent fixing to the lower covers. The pre-assembled door assembly comprises: a door having at least a base portion and a fairing body portion, for example the integral door 300 or alternative door 400 described above; the connector member 510; and the hinge pin 515

or hinge pins 516, 517. Portions of the lower covers 107 defining the recess 507 may accurately receive and guide the connector member 510 into position within the recess 507, and/or allow for some minor orientational and/or positional adjustment prior to final fixing.

[0047] In Figures 4 and 6, the connector member 510, including the hinge portion thereof, is substantially wholly received in the recess 507 in the lower covers, and the outer surface of the door 400 in the retracted position is a continuation of the surface of the lower covers 107. However, in some alternative embodiments, for example using the integral door 300 of Figure 3, the hinge joint, and part of the fairing portion 360, may stand proud of the surface of the lower covers 107, providing an outward surface profile similar to that of the fairing 160 of Figure 2d.

[0048] Embodiments according to the invention also include the process, shown in Figure 7, of installing the door 300, 400 to an aircraft, wherein the connector member 510 is already fixedly connected to the aircraft. The process comprises: receiving 701 the door 300, 400 on an aircraft assembly line, such as a final assembly line (FAL) for the aircraft; aligning 702 the connector hinge portion 511, 512 with the door hinge portion 321, 322, 323 or 321, 322a, 322b, 333; and inserting 703 at least one hinge pin 515 or 516, 517 through the connector hinge portion and the door hinge portion, so as to connect the door 300, 400 and the connector member 510 for relative rotation therebetween. The process preferably further comprises: aligning the door hinge portion and the connector hinge portion; inserting a first hinge pin 516 through the first door hinge region 321, 322a and the first connector hinge region 511; and inserting a second hinge pin through the second door hinge region 322b, 333 and the second connector hinge region 512.

[0049] Embodiments according to the invention also include the process, shown in Figure 8, of installing a door assembly including a door 300, 400 and connector member 510 on an aircraft, the aircraft comprising a positioner to guide the connector member 510 into, and support the connector member 510 in, a predetermined position relative to a landing gear bay aperture 131 in the body of the aircraft, the process comprising: receiving 801 the door assembly 300, 400, 510, 515, 516, 517 on an aircraft assembly line, such as the final assembly line (FAL); locating 802 the connector member 510 in position; and fixing 803 the connector member 510 in position.

[0050] In some embodiments, the process further comprises adjusting the position of the connector member 510 to accurately align the door 300, 400 with the aperture131, with the aperture 131 closed by the door, prior to fixing the connector member 510 in position. The landing gear assembly 120 may be extended and retracted at least once in order to verify and adjust the position and kinematics of the fairing 300.

[0051] The recess 507 is configured and located to receive and guide the connector member 510 into the predetermined position during assembly. The process further comprises coupling the coupling portion 345 of the door 300, 400 with a coupling device 350, for example an actuator strut, the coupling device 350 being coupled to the landing gear 120 such that movement of a leg of the landing gear 120 causes movement of the door 300, 400 about the hinge axis.

[0052] Whilst the present invention has been described and illustrated with reference to particular embodiments, it will be appreciated by those of ordinary skill in the art that the invention lends itself to many different variations not specifically illustrated herein. By way of example only, certain possible variations will now be described.

[0053] Where in the foregoing description, integers or elements are mentioned which have known, obvious or foreseeable equivalents, then such equivalents are herein incorporated as if individually set forth. Reference should be made to the claims for determining the true scope of the present invention, which should be construed so as to encompass any such equivalents. It will also be appreciated by the reader that integers or features of the invention that are described as preferable, advantageous, convenient or the like are optional and do not limit the scope of the independent claims. Moreover, it is to be understood that such optional integers or features, whilst of possible benefit in some embodiments of the invention, may not be desirable, and may therefore be absent, in other embodiments. It will be appreciated that in performing the various methods described herein, activities or steps of the methods may be executed in any appropriate order.

CLAIMS

1. An aircraft landing gear leg fairing door to releasably cover at least part of a landing gear bay aperture in a body of an aircraft, the door comprising:

    a base portion having a hinge portion adapted to receive at least one hinge pin along a hinge axis;

    a body portion to cover at least part of the aperture; and

    a coupling portion adapted to couple the door with a coupling device coupled to the landing gear such that movement of a leg of the landing gear causes movement of the door about an axis of the hinge pin;

    at least the base portion and the body portion being formed as one integral component.

2. The door of claim 1, wherein the base portion, the body portion and the coupling portion of the door are formed as one integral component.

3. The door of claim 1 or 2, wherein the hinge portion comprises first and second hinge regions, the first hinge region being adapted to receive a first hinge pin, and the second hinge region adapted to receive a second hinge pin.

4. The door of any preceding claim, wherein the door is adapted to hingedly connect with a connector member for relative rotation therebetween, the connector member comprising a connector hinge portion to align with the door hinge portion to also receive the or each hinge pin, and wherein the connector member is adapted to be fixedly connected to the body of the aircraft, in a region adjacent the aperture, to support the door for movement relative to the aircraft body about the axis.

5. A door assembly comprising:

    the door of any preceding claim;

a connector member comprising a connector hinge portion aligned with the door hinge portion;

the connector hinge portion and the door hinge portion receiving the or each hinge pin, so as to connect the door and the connector member for relative rotation therebetween; and wherein

the door assembly is pre-assembled for subsequent fixing to the aircraft body by fixedly connecting the connector member to lower covers of the aircraft in a region adjacent the aperture, to support the door for movement relative to the aircraft body about the axis.

6. A door assembly to releasably cover an external aperture in a body of an aircraft, the assembly comprising:

a door having i) a base portion and ii) a body portion; and

a connector member connected with the base portion for relative rotation therebetween about a common axis of rotation;

the connector member adapted to be fixedly connected to the body of the aircraft, in a region adjacent the aperture, to support the door for movement relative to the aircraft body about the axis;

the door assembly being pre-assembled for subsequent fixing to the aircraft body.

7. The door assembly of claim 6, wherein the base portion and the body portion of the door are formed as one integral component.

8. The door assembly of any of claims 5 to 7, wherein the connector member, including the hinge portion thereof, is substantially wholly received in a recess in the lower covers, and the outer surface of the door in the retracted position is a continuation of the surface of the lower covers.

9. The door assembly of any of claims 5 to 8, wherein the connector member is adapted to be received and located in a predetermined position by a correspondingly adapted recess in the aircraft body.

10. A process of installing the door of any of claims 1 to 4 on an aircraft, the aircraft comprising a connector member fixedly connected to the body of the aircraft, in a region adjacent the aperture, the connector member comprising a connector hinge portion, the process comprising:

receiving the door on an aircraft assembly line;

aligning the connector hinge portion with the door hinge portion; and

inserting at least one hinge pin through the connector hinge portion and the door hinge portion, so as to connect the door and the connector member for relative rotation therebetween.

11. The process of claim 10, wherein the door hinge portion comprises respective first and second door hinge regions, and the connector hinge portion comprises respective first and second connector hinge regions, the process comprising:

aligning the door hinge portion and the connector hinge portion;

inserting a first hinge pin through the first door hinge region and the first connector hinge region; and

inserting a second hinge pin through the second door hinge region and the second connector hinge region.

12. A process of installing the door assembly of any of claims 5 to 9 on an aircraft, the aircraft comprising a positioner to guide and support the connector member of the door assembly in a predetermined position relative to a landing gear bay aperture in the body of the aircraft, the process comprising:

receiving the door assembly on an aircraft assembly line;

locating the connector member in position; and

fixing the connector member in position.

13. The process of claim 12, further comprising adjusting the position of the connector member to accurately align the door with the aperture, with the aperture closed by the door, prior to fixing the connector member in position.

14. The process of claim 12 or 13, wherein the positioner comprises a recess in lower covers of a wing assembly of the aircraft in a region adjacent the landing gear bay aperture, the recess being configured and located to receive and guide the connector member into the predetermined position.

15. The process of any of claims 10 to 14, further comprising coupling the coupling portion of the door with a coupling device coupled to the landing gear such that movement of a leg of the landing gear causes movement of the door about the hinge axis.

16. The process of any of claims 10 to 15, wherein the assembly line is a final assembly line.

17. An aircraft comprising the door of any of claims 1 to 4, or the door assembly of any of claims 5 to 10, or made using the process of any of claims 10 to 16.

Intellectual Property Office

Application No:	GB2304839.0	**Examiner:**	Alex Swaffer
Claims searched:	1-5, 10, 11	**Date of search:**	13 September 2023

Patents Act 1977: Search Report under Section 17

Documents considered to be relevant:

Category	Relevant to claims	Identity of document and passage or figure of particular relevance
X	1-5, 8-11, 16, 17	CN 112960111 A (Commercial Aircraft Corp) See paragraphs 0003 & 0068 and figures 1-3.
A	-	US 2015/251750 A1 (Gulfstream Aerospace Corp): See figures 2-5.

Categories:

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.

Field of Search:

Search of GB, EP, WO & US patent documents classified in the following areas of the UKC^{X} :

Worldwide search of patent documents classified in the following areas of the IPC

B64C

The following online and other databases have been used in the preparation of this search report

SEARCH-PATENT

International Classification:

Subclass	Subgroup	Valid From
B64C	0025/16	01/01/2006

Intellectual Property Office

Application No:	GB2304839.0	**Examiner:**	Alex Swaffer
Claims searched:	6 & 7	**Date of search:**	14 February 2024

Patents Act 1977
Further Search Report under Section 17

Documents considered to be relevant:

Category	Relevant to claims	Identity of document and passage or figure of particular relevance
X	6, 17	US 2019/218840 A1 (The Boeing Co): See figures 3, 4 and 8.
X	6, 17	US 2019/300142 A1 (Hartwell Corp): See figures 7-12.
X	6, 17	US 2011/138574 A1 (United Technologies Corp): See figure 3.
X	6, 17	GB 624831 A (Britt): See figure 1.

Categories:

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.

Field of Search:

Search of GB, EP, WO & US patent documents classified in the following areas of the UKC^{X} :

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B64C

The following online and other databases have been used in the preparation of this search report

SEARCH-PATENT

International Classification:

Subclass	Subgroup	Valid From
B64C	0025/16	01/01/2006