Feb. 27, 1973 R. C. GODWIN 3,718,171

DOORS

Filed Sept. 30, 1971 4 Sheets-Sheet 1

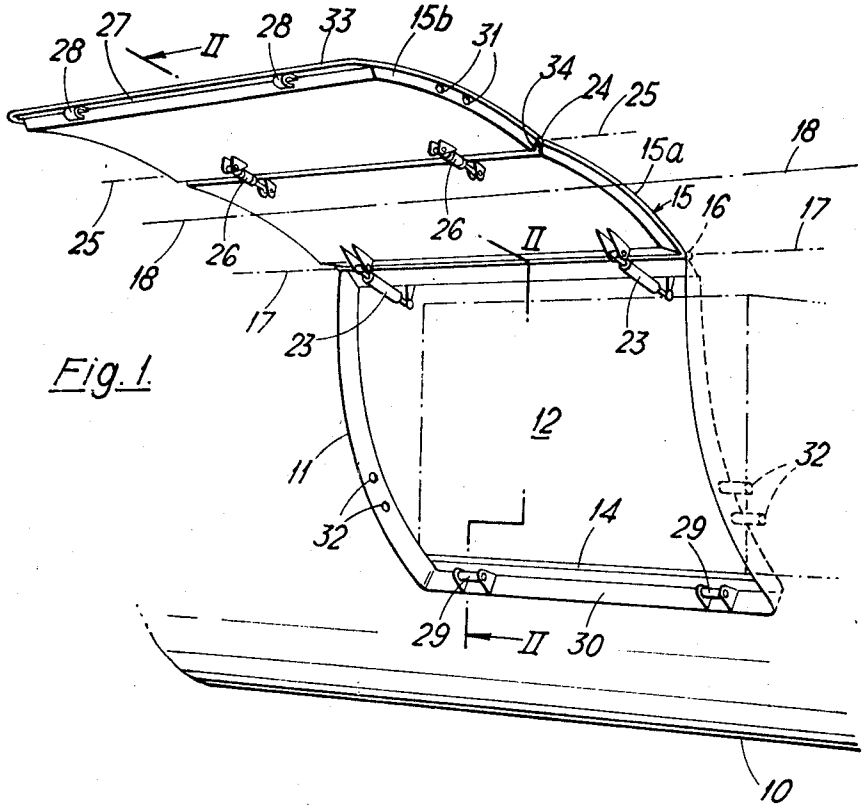

Fig. 1.

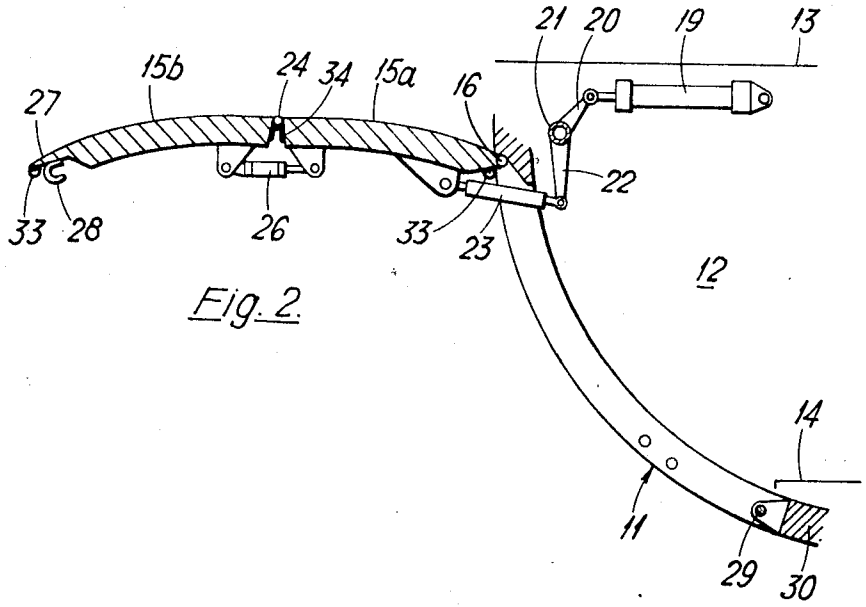

Fig. 2.

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Feb. 27, 1973 R. C. GODWIN 3,718,171

DOORS

Filed Sept. 30, 1971 4 Sheets-Sheet 2

Fig. 3.

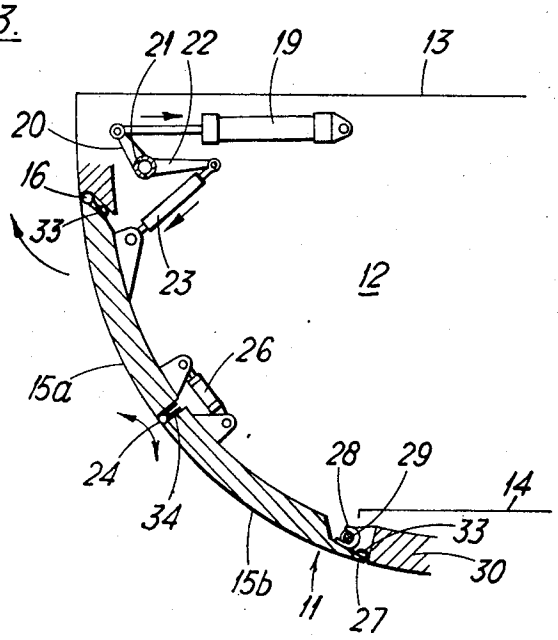

Fig. 4.

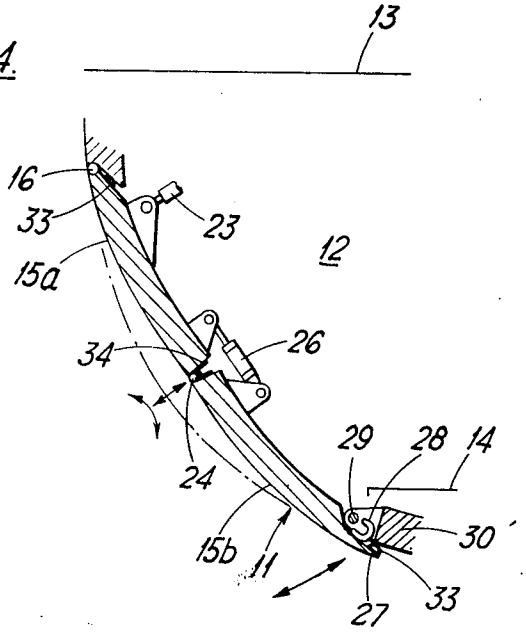

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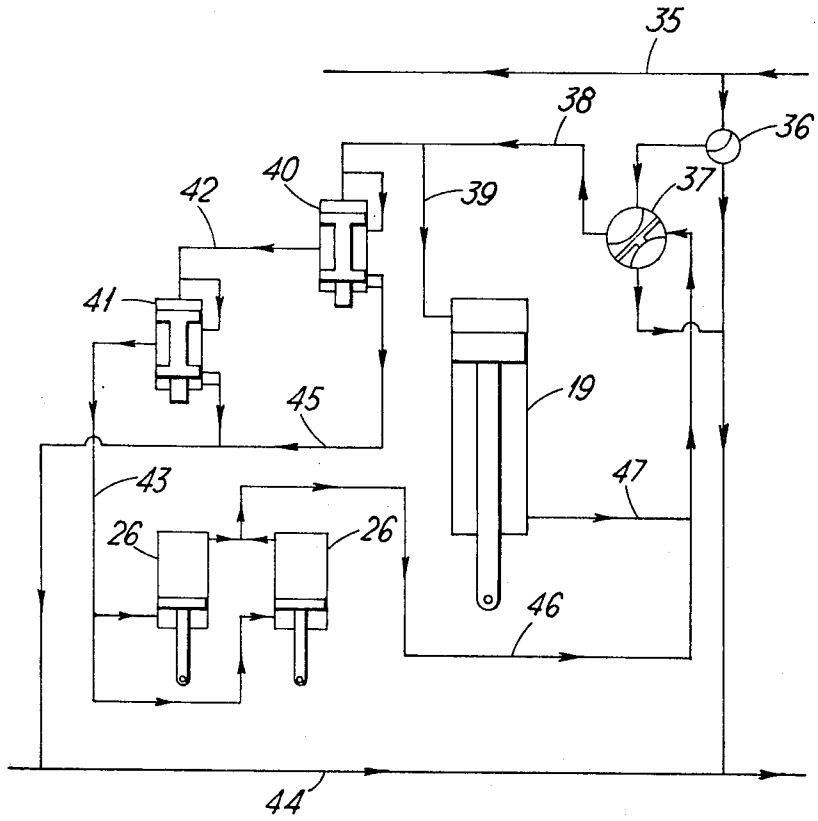
Fig. 5.



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Feb. 27, 1973 R. C. GODWIN 3,718,171

DOORS

Filed Sept. 30, 1971 4 Sheets-Sheet 4

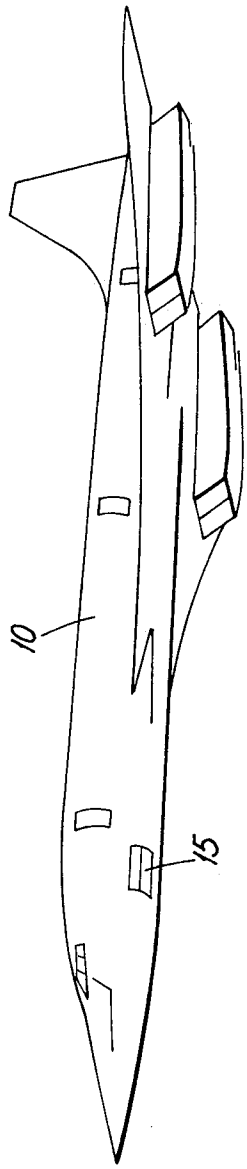

Fig. 6.

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DOORS

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U.S. Cl. 160—210 3 Claims

ABSTRACT OF THE DISCLOSURE

A door assembly having, a door frame and a door hinged to one edge of the frame. The door comprises two parts hinged together for limited relative rotation, and an actuator effective with the door in the closed position operatively connecting the two parts so as to vary the effective depth of the door. The edge of the door remote from the main hinge and the corresponding edge of the door frame being provided with engageable hook means. The relative positions of the hook means being such that when the two parts of the door are set for maximum depth the hook means are disengaged from each other, whilst when the two parts of the door are set to a lesser depth the hook means engage each other to positively lock the door in a closed position.

This invention relates in general to doors and, more particularly, to a door intended primarily for use in pressurised aircraft.

According to the present invention a door assembly including in combination, a door frame, a door to fit the frame, first hinge means pivotally connecting one edge of said door to one edge of said frame for pivotal movement relative thereto about a first hinge axis, said door being formed of two parts, and second hinge means pivotally connecting said two parts for pivotal movement relative thereto about a second hinge axis parallel to said first hinge axis, actuating means effective with said door in the closed position, for causing limited relative movement of said two parts about said second hinge axis in a sense to vary the effective depth of said door, engageable hook means including one member mounted adjacent the edge of said door remote from said first hinge axis and one member mounted adjacent the corresponding edge of said door frame, the relative positions of the said two members being such that with the two door parts set for maximum depth the two members are disengaged from each other whilst with the two door parts set to a lesser depth the two members engage each other to prevent opening movement of the door.

A preferred door assembly according to the present invention is illustrated in the accompanying drawings, in a fuselage of a pressurised aircraft.

In these drawings:

FIG. 1 is a perspective view of an aircraft fuselage with a door in an open position.

FIG. 2 is a sectional elevation taken on line II—II—II of FIG. 1, and FIGS. 3 and 4 are similar sectional elevation but with the door in other positions.

FIG. 5 is a diagrammatic layout of a hydraulic sequencing system shown in the door fully open position.

FIG. 6 is a perspective view of an aircraft in flight showing the general position of the door.

Referring to the figures generally, an aircraft fuselage **10** has a rectangular door frame **11** in its lower side giving access to a freight hold **12** located under the cabin floor **13**. The hold **12** itself has a floor **14**.

A rectangular door **15** is connected at its upper edge

to the upper edge of the frame by means of a hinge **16**, the axis **17** of the hinge, the first hinge axis, lying generally parallel to the longitudinal axis **18** of the fuselage (FIG. 1). The door **15** opens upwards and outwards, the opening (and closing) movements being effected by means of a jack **19** (see FIGS. 2 and 3), a crank **20** mounted on a rotatable tube **21** extending the full width of the door aperture, and spaced cranks **22** on each end of the tube each coupled to push-pull rods **23** which are in turn pivoted to the top edge of the door.

The door **15** is formed of two parts **15***a* and **15***b* both of about the same size, and pivoted to each other by means of a hinge **24** whose axis **25**, the second hinge axis (FIG. 1) moves as the door pivots about the hinge **16** but remains parallel to the axis **17**.

Jacks **26** mounted adjacent the hinge **24** on both parts **15***a* and **15***b* of the door control the relative pivotal movement between the parts **15***a* and **15***b*.

The periphery of the door **15** is provided with an inflatable seal **33** which deforms on contact with the door frame **11** to give an air tight seal. The centre hinge **24** is provided with a sealing strip **34** which distorts slightly during operation of the jacks **26**.

The free edge **27** of the door **15** is provided with hooks **28** which have their mouths directed along the plane of the door towards the hinges **16** and **24**. Rods **29** are provided on the bottom edge **30** of the frame and are positioned to lie parallel to the hinge axes in order to be engaged by the hooks **28** on closure of the door **15**.

The two parts **15***a* and **15***b* of the door are of curved shape in cross-section such that in one relative position they lie with their exterior surfaces in continuous convex relationship with one another, and when the door is fully closed, with the fuselage contour. This condition is shown in FIG. 3. The two parts **15***a* and **15***b* can be relatively pivoted one to the other about hinge **24** by means of jacks **26**, extension of which moves the parts **15***a* and **15***b* from the continuous convex relationship into a discontinuous at least partly concave relationship indicated in FIGS. 1, 2 and 4. In this latter condition, the effective depth of the door, that is, from the hinge **16** to the hooks **28** is increased from that when the parts **15***a* and **15***b* are in the continuous convex relationship. This is due to the curvature of the door **15** as a whole unit in this condition; the door **15** is, in effect, tending to be flattened.

Thus extension of the jacks **26** when the door is fully closed disengages the hooks from the rods **29**. This is shown in FIG. 4. Contraction of the jacks **26** when the door is closed sufficiently for the hooks **28** to initially engage the rods **29** causes the effective length of the door **15** to be shortened and thus causes the hooks **28** to fully engage the rods **29**.

The jacks **26** are provided with internal locks to hold the door parts in their continuous convex relationship and thereby to maintain the door securely closed. In this condition, pressurisation loads tend to cause the door parts **15***a* and **15***b* to pivot about hinge **24** and assume a more convex relationship. This is prevented by the close engagement of the hooks **28** with the rods **29**.

The jacks **26** are also provided with further internal locks to hook the door parts **15***a* and **15***b* in their discontinuous, partly flattened, relationship when open. This enables the door **15** to swing clear of the aperture **11**, as shown in FIG. 2, with less pivotal movement about hinge **16** than would be necessary if the door remained in its more curved configuration.

Further locking means is provided in case of failure of the internal locks of the jacks **26** or a reversal of the pressurisation loads. The locking means takes the form of shoot bolts **31** (FIG. 1) which are incorporated in the structure of the lower part of the door **15***b*. The shoot bolts **31** are arranged such that on closure of the door **15**

the bolts **31** extend from within the door to engage in sockets **32** in the door frame, thus locking the door firmly.

As an alternative the door **15** can be similarly mounted for inward opening. In this case the two parts **15***a* and **15***b* are required to hinge relatively to one another about the second hinge axis **25** to a greater degree than for outward opening so as to clear the door frame **11** and the rods **29** on opening.

A sequencing system (FIG. 5) is provided to ensure that the jacks **19** and **26** operate in the appropriate order during operation of the door **15.**

Assuming the door **15** to be in its fully open position as indicated in FIG. 2 the operational sequence to close the door **15** is as follows:

Fluid pressure from a main hydraulic system line **35** is directed through a cockpit isolating valve **36** to flow to a two position selector valve **37** which in this instance is turned to the close position. Fluid flows from the valve **37** into a supply line **38** which is connected by a supply line **39** to the top of the jack **19.** Fluid also flows through the supply line **38** to the first of a pair of sequencing valves **40** and **41** which are connected by a line **42** to each other in series. These valves **40** and **41** delay the flow of fluid to the jacks **26** while fluid entering the top of the jack **19** first unlocks then extends and finally re-locks the jack **19** in a position shown in FIG. 4. The door **15** has now been swung bodily downwards about the hinge **16.** Fluid is now allowed to flow from the second sequencing valve **41** via a supply line **43** to the jacks **26** which first unlock then retract and finally re-lock in a position shown in FIG. 3. The parts **15***a* and **15***b* of the door have now been pivoted about the hinge **24** to be in continuous convex relationship with each other and with the fuselage contour. The hooks **28** are in full engagement with the rods **29** to hold the door **15** firmly closed.

Fluid leaving the bottom of the jack **19,** the tops of the jacks **26,** and the bottoms of the sequencing valves **40** and **41** is returned to the hydraulic system return line **44** by return lines **45, 46** and **47.**

Opening of the door is achieved in an exactly opposite sequence except that the sequencing valves **40** and **41** are not used since the door **15** cannot move until the jacks **26** have been extended. The valve **37** is turned to open and the return lines **46** and **47** become supply lines **38, 39, 42** and **43** becoming return lines.

I claim:

1. A door assembly including in combination, a door frame, a door to fit said frame, first hinge means pivotally connecting one edge of said door to one edge of said frame for pivotal movement relative thereto about a first hinge axis, said door being formed of two parts, and second hinge means pivotally connecting said two parts for pivotal movement relative thereto about a second hinge axis parallel to said first hinge axis, actuating means effective with said door in the closed position, for causing limited relative movement of said two parts about said second hinge axis in a sense to vary the effective depth of said door, engageable hook means including one member mounted adjacent the edge of said door remote from said first hinge axis and one member mounted adjacent the corresponding edge of said door frame, the relative positions of the two members being such that with the two door parts set for maximum depth the two members are disengaged from each other whilst with the two door parts set to a lesser depth the two members engage each other to prevent opening movement of the door.

2. A door assembly according to claim **1** wherein said actuating means comprises at least one hydraulic jack operatively interconnecting said two door parts.

3. A door assembly according to claim **1** wherein a hydraulic sequencing system is provided which includes, two sequencing valves connected in series for delaying actuation of the hydraulic jack operatively interconnecting said two door parts whilst a main hydraulic door jack is operated to close said door.

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