

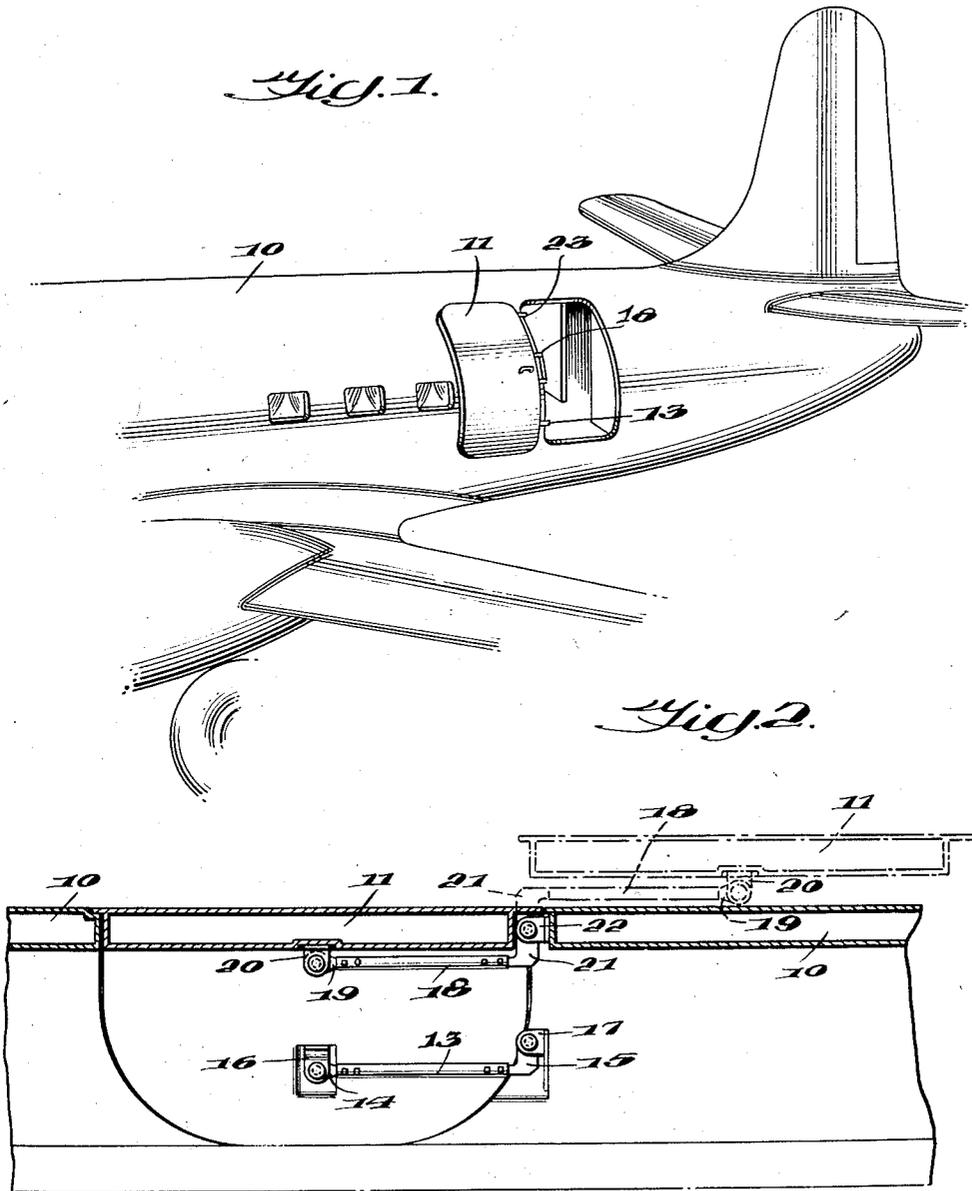
Aug. 21, 1951

F. A. MULLER
DOOR HINGE LINKAGE

2,564,988

Filed Oct. 10, 1946

4 Sheets-Sheet 1



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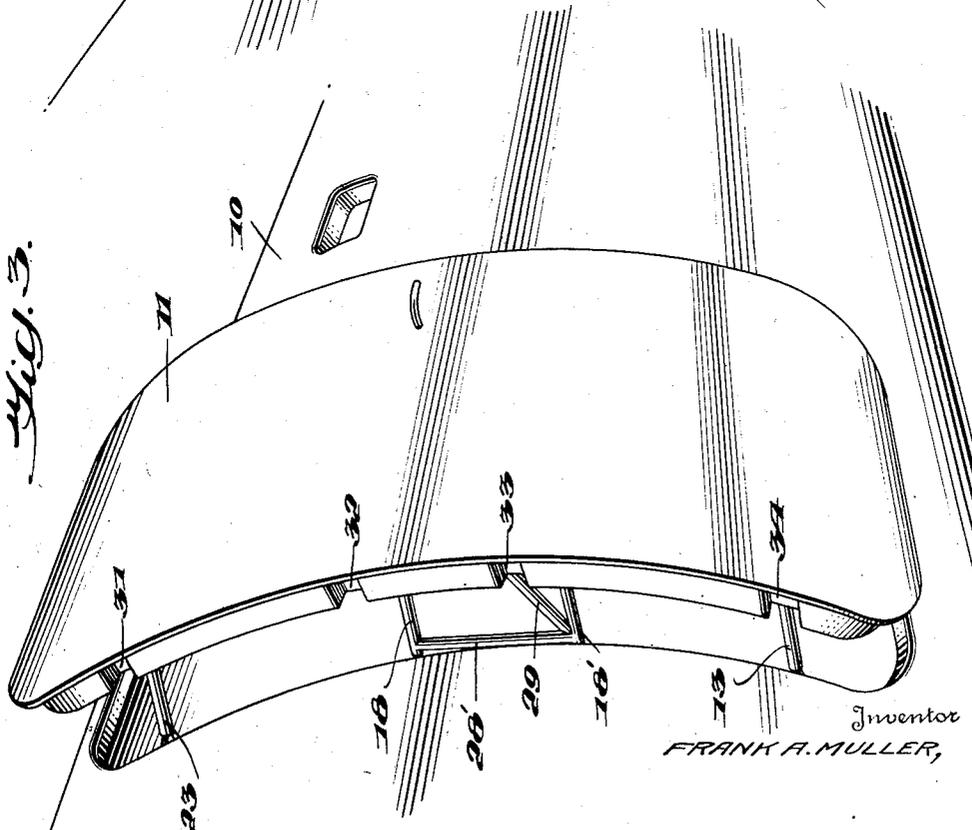
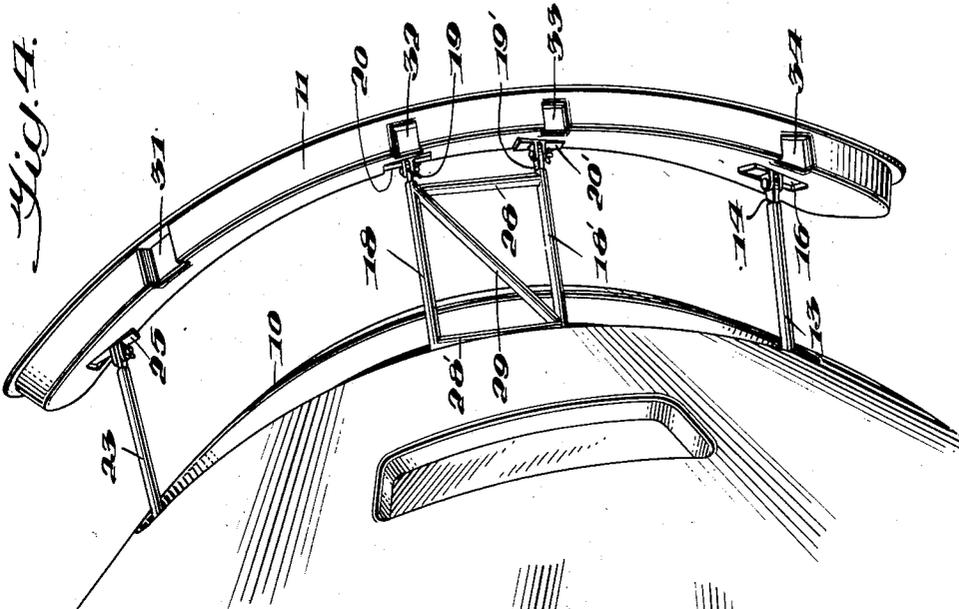
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4 Sheets-Sheet 3

Fig. 5.

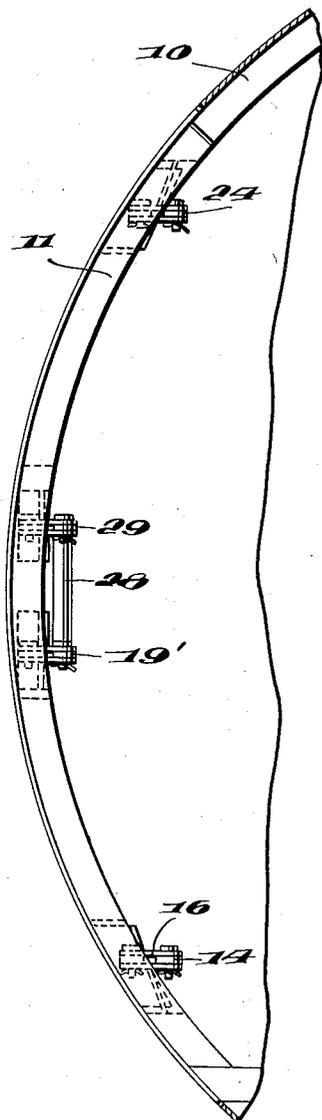
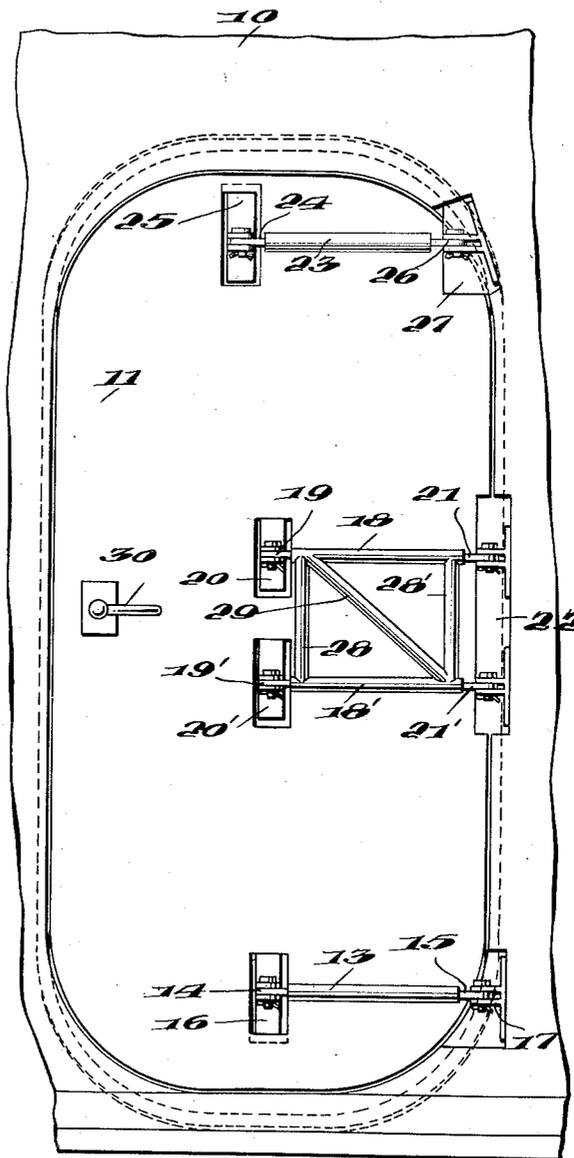


Fig. 6.



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4 Sheets-Sheet 4

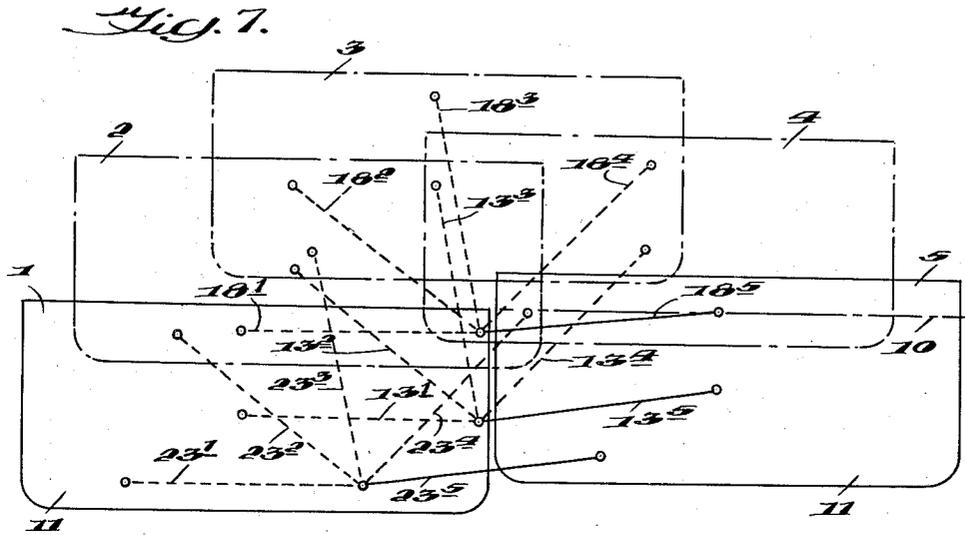
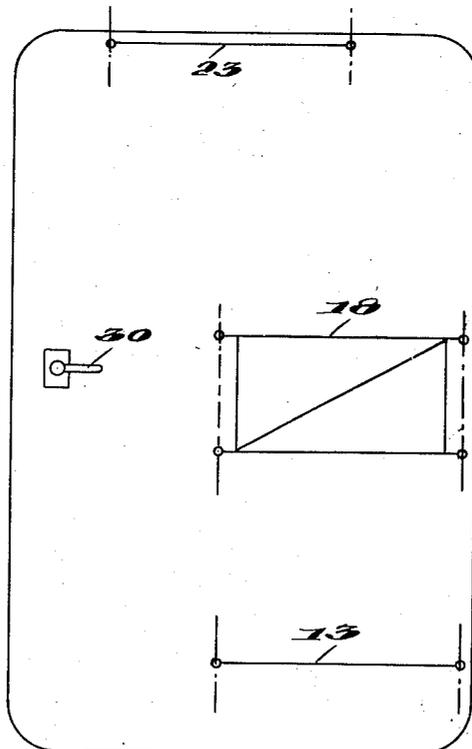


Fig. 8.



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UNITED STATES PATENT OFFICE

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DOOR HINGE LINKAGE

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6 Claims. (Cl. 20—16)

1

This invention relates to a novel door suspension and hinge structure particularly adapted for use where the doorway is in a structure having an externally curved contour.

The problem of hinging doors in automobiles, ships and airplanes, where the door curves to conform with the complex curvature of the structure of the doorway, is that it is necessary to resort to complicated hinge mechanisms. In nearly every case when the door is opened to its fullest extent, it presents an unpleasing appearance, as well as extending so far from the structure on which it is mounted that it presents an interference with loading and unloading, and an additional hazard because wind is very apt to blow the extending door shut. This is particularly true in aircraft where the fuselage at the entrance doorway has a convex curvature. In most large aircraft, the fuselage at this point is generally circular. If the door of such a fuselage is hinged in the conventional manner, the door in the open position rests with its convex or outside, tangent to the convex outside of the fuselage, and is quite subject to being blown shut, as well as being difficult to open, and unsightly in appearance.

By the novel doorway structure of this invention, it is possible to open the door with a minimum of effort because the door moves outwardly generally parallel to the wall structure on which it is mounted on a system of linkages that stabilize the door for all positions from the closed position to the open position, in which the concave side of the door comes to rest beside the doorway and conforms with the curvature of the wall structure.

It is an object of this invention to provide a door suspension and hinge structure for a curved contour wall which may be easily opened and held in an open position, and stabilized against inadvertent closing.

Another object of this invention is the provision of a linkage system to hinge a door in which one linkage is a truss member that supports the load of the door, and other cooperative linkages that stabilize the door structure from the closed to the open position.

A further object of this invention is the provision of linkage structure with hinge points located so that at least two of the linkages for all positions of the door, from opened to closed, form a stabilizing parallelogram structure between the door and the doorway structure.

It is a further object of this invention to provide a door and hinge structure which permits

2

the door to be opened, and maintain the outside of the door outwardly of the structure in the open position so that it presents a pleasing appearance upon approaching the doorway.

Further and other objects will become apparent from the description of the accompanying drawings which form a part of this disclosure and in which like numerals refer to like parts.

In the drawings:

Figure 1 is a fragmentary view of an airplane fuselage showing the door in the open position.

Figure 2 is a horizontal section through the side of the fuselage showing the door.

Figures 3 and 4 are perspective views of the door and its relation to the fuselage.

Figure 5 is a transverse section through the fuselage and door.

Figure 6 is a view of the inside of the door in the fuselage.

Figures 7 and 8 are schematic views showing the operation of the linkages.

The airplane fuselage 10, shown in Figure 1, is generally circular in cross section and, therefore, door 11, faired into the side of the fuselage, must conform with the curvature of the fuselage when closed. Door 11 is supported during the opening, and in its open position, by a suspension and hinge structure which consists of a truss linkage 18—18', which carries the greater part of the load of the door, and two stabilizing linkages 13 and 23. As shown in Figure 2, linkage 13 has fittings 14 and 15 secured to the ends thereof and pivoted in brackets 16 and 17. The brackets are secured to the door and door frame, respectively. Members 18 and 18' have fittings 19 and 19' pivoted to brackets 20 and 20' which are secured to the door, and fittings 21 and 21' pivoted to bracket 22 which is secured to the door frame. In a similar manner, member 23 has a fitting 24 secured thereto pivoted on bracket 25 mounted on door 11, and fitting 26 pivoted on bracket 27 which is secured to the door frame.

It will be noted in Figures 6 and 8 that linkages 23, 18—18' and 13 are of equal length. From Figures 2, 5 and 7, it will be noted that the axes of the hinges are out of alignment. Figure 7 clearly shows that they are out of alignment, one from another, in a vertical direction, and Figure 6 shows that the center line of the pivot in bracket 27 is displaced along the fuselage from the location of the pivot in bracket 22. The purpose of this can most easily be seen from a consideration of Figures 7 and 8. These figures show schematically the door having linkages 23, 18 and 13 securing the door to the door frame. Fig-

3

ure 3 shows schematically the inside view of the door and the vertical arrangement of linkages 23, 18 and 13. Truss member 13 is, in effect, a single linkage when considered in the plan view in Figure 7. Figure 7 shows schematically door 11 in five positions, as the door moves from the closed position 1, represented as the closed door in Figure 2, to the fifth position, representing the dotted line position in Figure 2 of the door open and lying flat against the fuselage. It will be noted that for all positions of the door from 1 to 5, at least two of the linkages form two sides of a parallelogram which are widely spaced. In position 1, the door is stable because it is supported by the door frame. As the door moves from position 1 to position 2, linkages 13 and 18 do not form too widely spaced sides of a parallelogram and a stable support for the door, but in this position the door is stabilized by the spacing of linkages 18 and 23. This is true through position 3, but it can be seen that, whereas linkages 13 and 18 were spaced in positions 1 and 2, they are almost aligned in position 3 and, therefore, cannot be depended upon to stabilize the door. In position 4, the door is stabilized by linkages 13 and 18—18' somewhat assisted by linkage 23, but in position 5 the linkages are all widely spaced, 23 and 18—18' affording the principal support. Stability presents the greatest problem when the door is in position 3, illustrated in Figure 4. In this position, the door is moving generally parallel to the side of the fuselage and is restrained by the linkages from outward motion, yet the force causing it to move in the arcuate path, or in a path generally parallel at this time to the fuselage, is a thrust on door handle 33 located eccentrically of the pivotal supports of the door. Therefore, in this position, where the door is subjected to a thrust tending to twist the door, it is restrained by two of the linkages, 23 and 18, providing well spaced sides of a parallelogram. Figure 3 shows the door at the initial position upon opening, generally corresponding to position 2 of Figure 7.

To support the door in place in the door frame and have the exterior of the door present a smooth, unbroken surface, pockets 31 to 34 are formed in the side of the door and the door frame to accommodate the hinge brackets. The skin of the door extends over these pockets and around the door in a flange to provide the tight fit of the door in the door frame.

It should be understood that the linkages can be arranged along the door at any one of a number of places so long as the hinge axes are maintained out of alignment to provide the parallelogram action of the linkages. Linkage 13 can be moved to a position projected vertically upward to a location on the top of the door to get it out of the way, if desired. Truss member 13—13' may be located anywhere that will provide effective support for the door. Stabilizing linkages 13 and 23 will cooperate with the truss member to stabilize the door throughout its opening.

It is to be understood that certain changes, alterations, modifications and substitutions can be made without departing from the spirit and scope of the appended claims.

I claim as my invention:

1. In a structure having a wall of generally circular vertical cross-section, and a doorway in the side thereof, a door for said doorway curved to conform with the side of said structure, at least three vertically spaced linkage members of substantially equal length, each having one end

4

pivoted on a bracket secured to the edge structure of the doorway and the other end pivoted on a bracket secured to the central portion of said door for swinging about generally vertical axes, the axes of certain of said pivots at the edge of said doorway being out of alignment due to the contour of said structure, at least one of said doorway pivot brackets being spaced relative to the other brackets longitudinally of said structure so that at least two of said linkage members form with said door and said wall an effective parallelogram to support the door and maintain the concave face of the door toward the side of said structure for all positions of the door from the closed to the open position.

2. In a structure having a wall of generally circular vertical cross-section, and a doorway in the side thereof, a door for said doorway curved to conform with the side of said structure, at least three vertically spaced linkage members of equal length, each having one end pivoted on a bracket secured to the edge of the doorway and the other end pivoted on a bracket secured to the central portion of said door for swinging about generally vertical axes, at least two adjacent linkage members having coaxial pivotal end supports and intermediate supporting members forming a truss structure of said two adjacent linkages to bear the load of the door, the axes of certain of said pivots at the edge of said doorway being out of alignment due to the contour of said wall, at least one of said doorway pivot brackets being spaced relative to the other brackets longitudinally of the structure so that at least two of said linkage members form with said door and said wall an effective parallelogram to support the door and maintain the concave face of the door toward the side of the structure for all positions of the door from the closed to the open position.

3. In a structure having a wall of generally circular vertical cross-section, and a doorway extending longitudinally in the side thereof, a door for said doorway curved to conform with the side of said structure, at least three vertically spaced parallel linkage members of equal length, each having one end pivoted on a bracket secured to the edge structure of the doorway and the other end pivoted on a bracket secured to the central portion of said door for swinging movement about generally vertical axes, the axes of said pivots at the edge of said doorway being out of vertical alignment due to the contour of said structure, at least one of said doorway pivot brackets being spaced relative to the other brackets longitudinally of said structure so that said linkage members form with said door and said wall plurality of effective parallelograms to support the door and maintain the concave face of the door toward the side of said structure for all positions of the door as the door is displaced outwardly and along the structure from the closed to the open position.

4. In a structure having a wall of generally circular vertical cross-section, and a doorway in the side wall thereof, a door for said doorway curved to conform with the side wall of said structure, at least three vertically spaced parallel linkage members of equal length to support said door, each having one end pivoted on a bracket secured to the edge structure of the doorway and the other end pivoted on a bracket secured to the central portion of said door, said end secured to the edge of said doorway being offset approximately equal to one half the thickness of said side wall, the pivot for the bracket of said off-

5

set end being located approximately on the centerline of said wall, the axes of said pivots at said doorway being generally vertically but out of alignment due to the generally circular contour of said structure, at least one of said doorway pivot brackets being spaced relative to the other brackets longitudinally of the fuselage so that at least two of said linkage members form with said door and said wall an effective parallelogram to support the door and maintain the concave face of the door toward the side of the fuselage for all positions of the door from the closed to the open position.

5. In a structure having a wall of generally circular vertical cross-section, and a doorway formed in the side thereof, a door for said doorway curved to conform with the side wall of said structure, a plurality of vertically spaced parallel linkage members of equal length, each having one end pivoted for swinging movement about a generally vertical axis on a bracket secured to the edge of the doorway and the other end pivoted on a bracket secured to the central portion of said door, at least two adjacent linkage members having coaxial pivotal supports on the ends and intermediate supporting members forming a truss structure of said two adjacent linkages to bear the load of the door, said end secured to the edge of said doorway being offset approximately equal to one half the thickness of said side wall, the pivot for the bracket of said offset end being located approximately on the centerline of said wall, the axes of said pivots at said doorway of the other linkage being out of alignment due to the contour of said structure, at least one of said doorway pivot brackets being spaced relative to the other brackets longitudinally of the structure so that at least two of said linkage members form with said door and said wall an effective parallelogram to support

6

the door and maintain the concave face of the door toward the outside of the structure for all positions of the door from the closed to the open position.

6. In a structure having a wall curved convexly outwardly in vertical cross-section and a doorway extending therethrough, a door for said doorway curved to conform with the curvature of said wall, at least three vertically spaced linkage members of substantially equal length, each having one end pivoted on a bracket secured to the edge structure of the doorway and the other end pivoted on a bracket secured to the central portion of said door for swinging about generally vertical axes, the axes of certain of said pivots at the edge of said doorway being out of alignment due to the contour of said structure, at least one of said doorway pivot brackets being spaced relative to the other brackets longitudinally of said structure so that at least two of said linkage members form with said door and said wall an effective parallelogram to support the door and maintain the concave face of the door toward the side of said structure for all positions of the door from the closed to the open position.

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