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ROLLER TYPE HINGE

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2 Sheets-Sheet 1

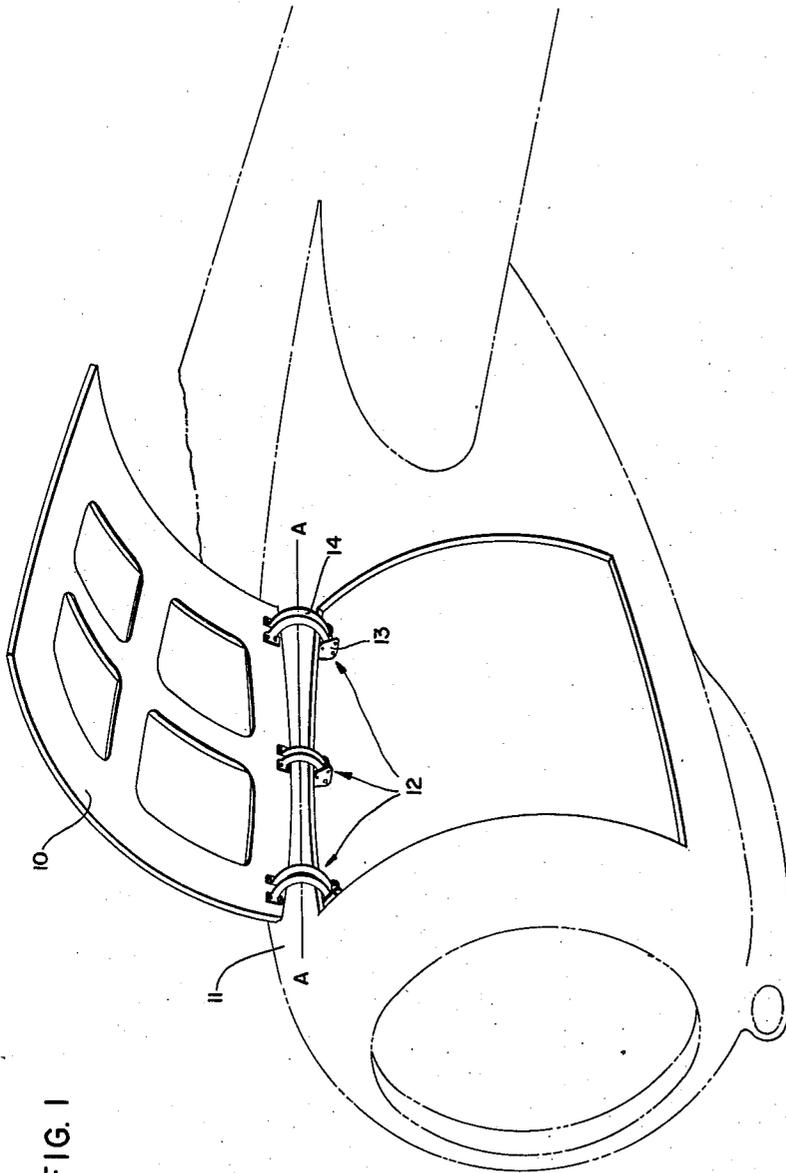


FIG. 1

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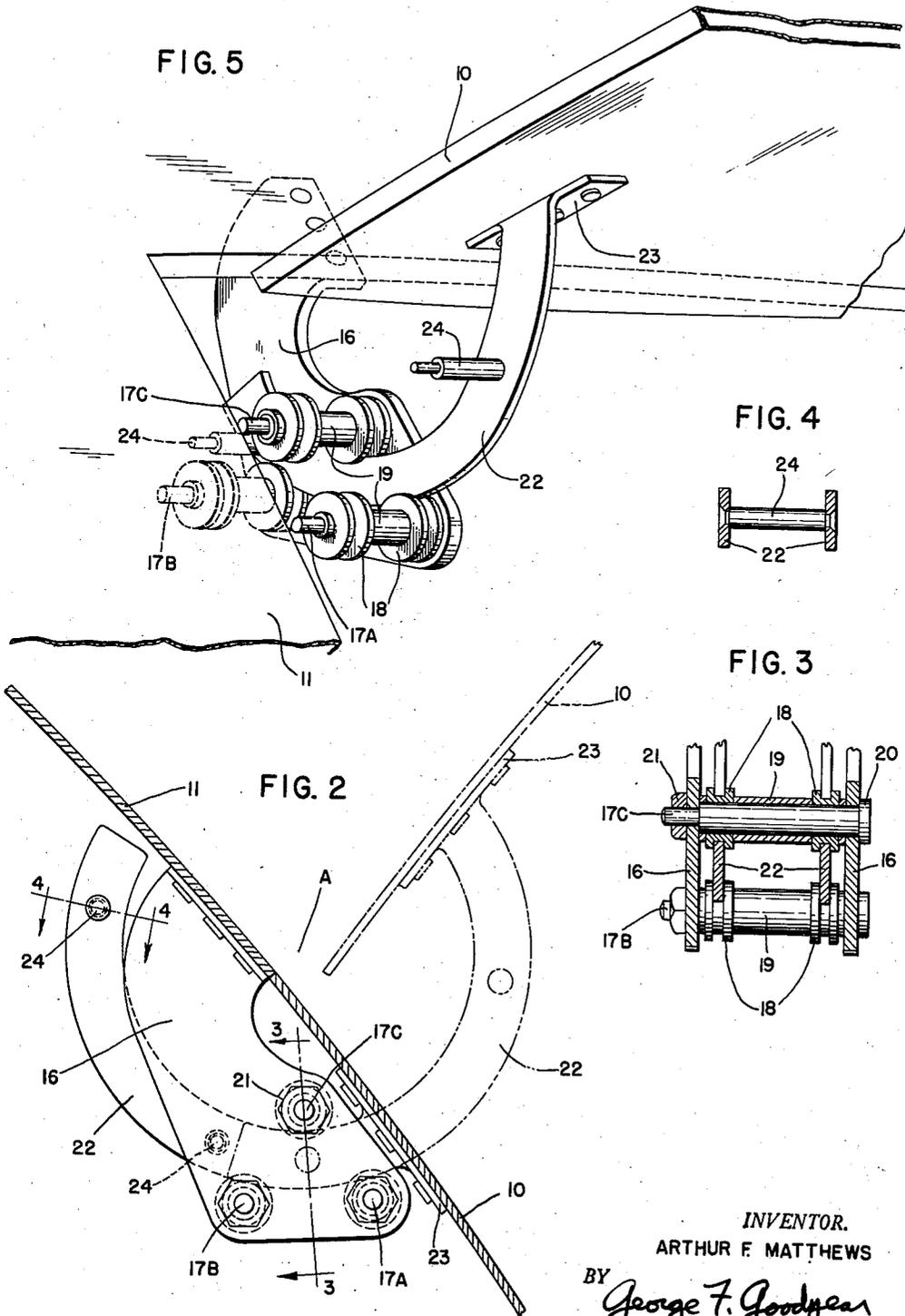
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ROLLER TYPE HINGE

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3 Claims. (Cl. 16—171)

1

This invention relates generally to hinges, and is particularly directed to improvements in roller hinges which will render them of greater utility.

In airplane fuselages, engine nacelles and other curved surfaces, it is often desired to provide hinged closures or doors for various purposes. In the design of hinges for such purposes, it is desired to prevent interference of adjacent edges along the hinged joint, and at the same time provide a smooth uninterrupted surface offering little aerodynamic resistance. The common type of individual hinge or continuous piano hinge is limited in its application to a condition in which the hinge line is rectilinear and also lies within or on the surface of the panel or skin. A curved surface obviously does not lend itself readily to the installation of such a hinge.

It is therefore an object of this invention to provide a hinge embodying novel features which will permit the use thereof in a wide variety of applications where the standard type of leaf hinge will not serve in a satisfactory manner. Another object is to provide a hinge in which the hinge axis may be located at some advantageous point outside the physical limits of the hinge structure, so that the utility thereof may be greatly enhanced. Still another object is to provide a hinge which is remarkably well adapted for general use where a door or movable panel is desired to be provided in a body having a curved contour. A further object is to provide a hinge capable of use in an installation in which the parting line is required to be other than rectilinear and in which edge interference must be eliminated for free hinging movement. A still further object is to provide a hinge which is useful as a structural member for resisting tension and bending loads which may be imposed thereon. Another object is to provide a hinge which will permit the ready detachment of the door or other hinged part without first necessitating the disassembly or removal of any securing elements, such as bolts, screws or the like. An additional object is to provide a hinge structure which is particularly well adapted for use in aircraft, wherein flush joints and otherwise aerodynamically clean, smooth contours are greatly to be desired. Other objects will appear hereinafter.

These objects are accomplished by means of a hinge construction in which one of the cooperating hinge elements comprises a set of guide rollers and the other cooperating hinge element is a curved track element cooperating with and guided by the guide rollers, in a manner to be described more particularly hereinafter.

2

The invention may be more readily understood by reference to the accompanying drawings, in which: Figure 1 is a perspective view of an aircraft engine nacelle with an access door hinged thereto employing the novel type of hinge structure according to the present invention; Figure 2 is a cross section on a greatly enlarged scale of a portion of Figure 1; Figures 3 and 4 are views taken along the lines 3—3 and 4—4, respectively, of Figure 2; Figure 5 is a perspective view, on the same scale as Figure 2, with parts removed for clarity in illustration.

Referring now to Figure 1, the hinge construction according to the present invention is shown as installed on a door 10 providing access to the interior of an aircraft engine nacelle 11. In the present instance three hinge assemblies 12 are shown, although a greater number could be provided. Each assembly includes a guide portion 13 and a track portion 14. Each track portion is curved as shown, preferably in a plane and preferably having a constant radius of curvature (i. e. each operative edge of the track defining the arc of a circle, as shown in greater detail hereafter). The three assemblies 12 need not have the same radii of curvature, but the center of curvature for all the track elements should lie on a single straight line, which is the hinge axis and is an imaginary line in space indicated at A—A, exterior to the door 10 and the nacelle 11.

The details of the hinge assembly are indicated more clearly in Figures 2, 3 and 4. The guide portion 13 includes two spaced bracket members 16 disposed parallel to each other and affixed to the nacelle 11 such as by riveting, welding or the like. The brackets 16 are suitably apertured for the reception of thru-shafts. In the form shown, three such shafts 17A, 17B and 17C are indicated as being arranged in a triangular pattern, the purpose of which will appear presently. A pair of roller elements 18 separated by a spacer element or collar 19 are operatively carried on each shaft, and the assembly thereof is maintained by the provision of a head 20 at one end and a nut or collar 21 at the opposite end thereof. The roller elements are circumferentially grooved, so that they may serve as guides in addition to their function as friction reducing elements.

In conjunction with the bracket members 16, there is arranged a spaced pair of hinge track members 22, and as illustrated these members 22 are formed as arcuate elements having substantially parallel bounding faces. These tracks 22 are attached to the movable panel or door 10 by means of suitable flanges 23. Spacing of the

3

tracks is maintained by one or more shouldered elements 24 spaced along the arcuate portion thereof such that parallelism therebetween is assured. The spacer elements 24 have projecting end portions as indicated in Figures 4 and 5, which are up-set into a countersunk depression so as to lie flush with the outer surface of the tracks. As shown, the tracks 22 are arranged to lie between and be embraced by the hinge bracket members 16. Furthermore, the spacing of each pair of roller elements 18 is exactly equal to the track spacing such that, at the time the tracks and brackets are placed in operative assembly, the tracks will ride down in the grooved portions of the roller elements 18 and be guided and supported thereby.

It may now be seen that the throw or hinging travel of the present device is determined by the amount of curvature given the track elements 22 while the smooth, substantially frictionless and interference free movement will be governed by the location of the grooved roller elements 18 with respect thereto. Further, on examination of Figure 2, it can be seen how the present hinge functions such that a smooth exterior surface is preserved between nacelle 11 and door 10 when the same is in closed position (full line), and such that the adjacent edges of the latter parts, when opened (dot-dash line), are separated to obviate interference or binding. It is also clearly shown that the true hinge axis, indicated at A in Figure 2 and at A—A in Figure 1, may be located in space. This latter feature is particularly advantageous in the case of hinge mounting a door or panel having a pronounced curvature in two directions. Figures 1 and 2 illustrate to advantage the latter named condition and shows how the present type of roller hinge will obviate door edge clearance difficulties and yet maintain a clean outer contour when the same is closed. The true hinge axis A is exteriorly located with respect to the nacelle body shown.

A further examination of Figures 2 and 5 will reveal an important advantage found only in a hinge of the present type. It will be noted that the track members 22 roll along on the grooved rollers 18 and that no means for limiting or stopping such travel is made. Thus, if the door 10 is opened sufficiently far, the tracks 22 will become disengaged from the rollers 18 and complete removal thereof is obviously possible. Quick detachability is therefore a feature giving this present hinge a marked superiority over the pin type leaf or plate hinges.

An additional advantage to be gained from this hinge resides in the structural characteristics of the arrangement. Obviously a considerable tension load may be imposed on the hinge since such loading will be distributed substantially equally between the two roller shafts 17A and 17B. The major portions of any compressive loads will be absorbed along the abutting edges of the structure 11 and door 10. Proper selection of proportions and sizes of the several parts and elements of this present hinge is facilitated by its inherent structural arrangement.

While a hinge track having its edge portions corresponding to the arc of a circle has been indicated in the drawings, it is contemplated that the edge portions of the tracks or moving hinge elements 22 may correspond to some other curve, so that the effective hinge axis A may move in space as the door is opened or closed. Thus, the curvilinear trend thereof may be that of an

4

ellipse, a spiral or a sine curve. The possible combinations are many so that the hinged door or panel may be given a bodily movement which will permit it to clear most adjacent obstacles. When other than substantially circular track elements 22 are employed, there must be an alteration made in the geometrical relationship of the roller elements 18, and in some cases additional or movable rollers may be required. Consequently, the circularly curved track elements are preferred.

While the hinge member which forms the subject matter of the present description is illustrated as applicable to the installation condition in which the hinge axis is generally horizontal in extent, it should be understood that the structural revisions required to permit the use of this type hinge with its hinge axis set in a vertical position are not such as will depart in any great materiality from the broad principle involved.

The foregoing description of the invention is intended merely to point out a simple preferred arrangement of parts and elements in a hinge of roller type, but it is to be understood that additions and alterations may be made or become obvious after a study of the same without departing from the spirit and full intended scope of the invention as will be defined by the claims hereinafter appended.

I claim:

1. A device to provide for relative hinging movement of two elements, comprising roller means for one element and curved track means for the other element, said roller means comprising spaced sets of three rollers each, with each roller having a groove in the circumferential face thereof, said track means comprising a circularly curved rail for each set of rollers with one curved edge of each rail engaging in the grooves of two rollers of one set and with the opposite curved edge of said rail engaging in the groove of the third roller of said set, said rails being spaced at one end from said other element to provide for their disengagement from said rollers upon continuation of hinging movement in one direction, and said track means further comprising a part connecting said rails intermediate the ends thereof and adapted to pass between said two rollers and said third roller of each set during hinging movement.

2. A device to provide for relative hinging movement of two elements, comprising roller means for one element and curved track means for the other element, said roller means comprising spaced sets of three rollers each, with the corresponding rollers of the several sets in coaxial relation, said track means comprising a circularly curved rail for each set of rollers with one curved edge of each rail engaging circumferential portions of two rollers of one set and with the opposite curved edge of the rail engaging a circumferential portion of the third roller of said set, said curved rail edge and said circumferential portions of the rollers having cooperating groove and groove engaging surfaces, and said track means further comprising a part connecting said rails intermediate the ends thereof and adapted to pass between said two rollers and said third roller of each set during hinging movement.

3. A device to provide for relative hinging movement of two elements, comprising roller means for one element and curved track means for the other element, said roller means com-

5

prising spaced sets of three rollers each, with the corresponding rollers of the several sets in coaxial relation, said track means comprising a circularly curved rail for each set of rollers with one curved edge of each rail engaging circumferential portions of two rollers of one set and with the opposite curved edge of the rail engaging a circumferential portion of the third roller of said set, said curved rail edges and said circumferential portions of the rollers having cooperating groove and groove engaging surfaces, and said rails being spaced at one end from said other element to provide for their disengagement from said rollers upon continuation of hinging movement in one direction.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,648,781	Pepin -----	Nov. 8, 1927
2,233,882	Bobek -----	Mar. 4, 1941

FOREIGN PATENTS

Number	Country	Date
654,618	France -----	Nov. 29, 1928