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AUTOMATIC MOTOR-DRIVEN LEVELER FOR LOADING RAMP

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FIG. 1.

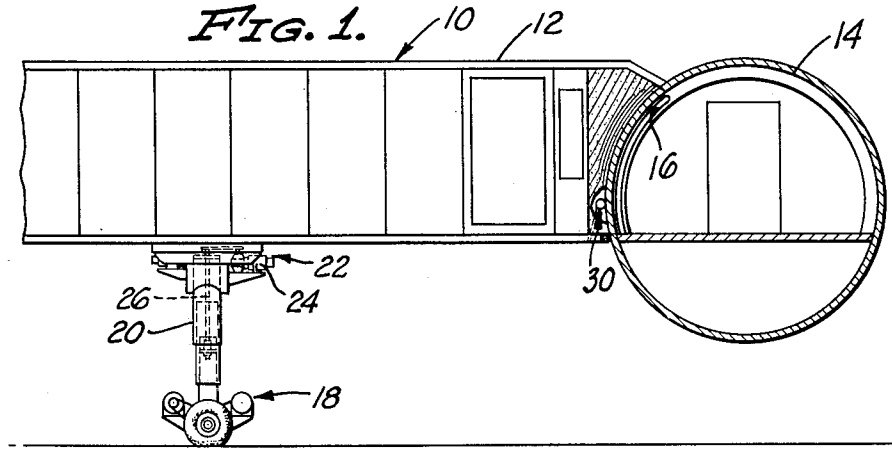


FIG. 2.

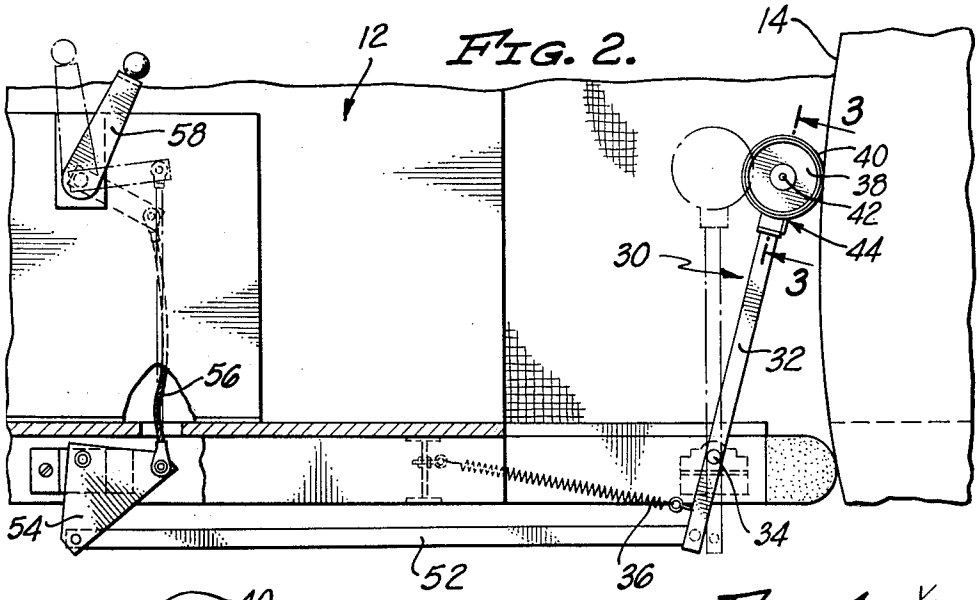


FIG. 3.

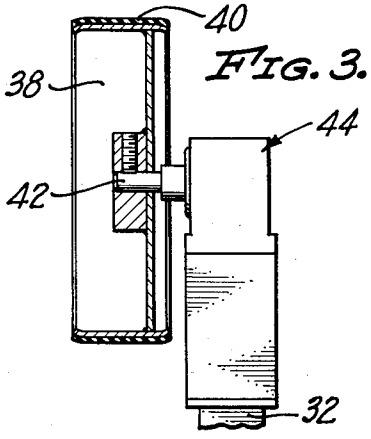
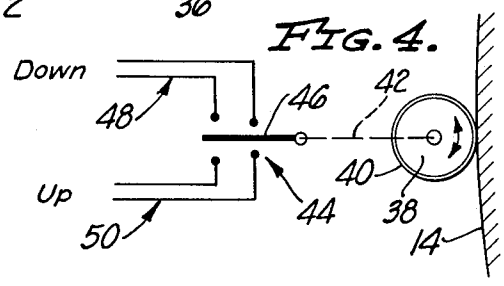


FIG. 4.



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AUTOMATIC MOTOR-DRIVEN LEVELER FOR LOADING RAMP

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The present invention relates in general to an apparatus responsive to relative movement of two relatively movable structures for maintaining such structures in the same relative positions. Expressed differently, the present invention relates to an apparatus which causes one of a pair of relatively movable structures to follow the other in response to movement of the latter so as to maintain the two structures in the same relative positions.

In general, the invention contemplates an apparatus which includes reversible motor means for moving one of the structures bidirectionally and a control means responsive to relative movement of the two structures for operating the reversible motor means in directions to maintain the two structures in the same relative positions. In the preferred embodiment of the invention, the control means is carried by the following structure, i.e., the structure to which the reversible motor means is connected, and is engageable with the other structure.

A primary object of the invention is to provide a control means on the following structure which includes a pivoted sensing member adapted to frictionally and rollably engage the adjacent structure to sense movement of the adjacent structure relative to the following structure. Such frictional, rolling engagement between the sensing member and the adjacent structure reduces to an absolute minimum the possibility of damage to the adjacent structure by the sensing member, which is particularly important where the adjacent structure is an airplane and the following structure is a loading ramp.

More particularly, an object of the invention is to provide a control means which includes a supporting member mounted on the following structure for pivotal movement from a retracted position toward the adjacent structure into an extended position, the sensing member being pivotally mounted on the supporting member about an axis perpendicular to the plane of pivotal movement of the supporting member and having an arcuate surface which is frictionally and rollably engageable with the adjacent structure when the supporting member is in its extended position. A related object is to provide a sensing member which has the form of a sensing roller the cylindrical surface of which is frictionally and rollably engageable with the adjacent structure.

Other objects of the invention are to provide means for biasing the supporting member toward its extended position so as to urge the sensing roller into frictional engagement with the adjacent structure, and to provide means for inactivating the control means by displacing the supporting member into its retracted position.

The foregoing objects, advantages, features and results of the present invention, together with various other objects, advantages, features and results thereof which will be evident to those skilled in the art to which the invention relates, may be attained with the exemplary embodiment of the invention described in detail hereinafter and illustrated in the accompanying drawing, in which:

FIG. 1 is a view, partially in side elevation and partially in section, showing two interengageable and relatively movable structures one of which incorporates the apparatus of the invention;

FIG. 2 is an enlarged view, partially in section and partially in elevation, illustrating a control means of the invention;

FIG. 3 is an enlarged, fragmentary sectional view taken along the arrowed line 3—3 of FIG. 2; and

FIG. 4 is a diagrammatic view of the control means of the invention.

Referring initially to FIG. 1 of the drawing illustrated therein is a portion of a telescoping loading and unloading ramp 10 comprising an outer tunnel 12 the outer end of which is engageable with an airplane fuselage 14 around a doorway 16 therein. The tunnel 12 is supported by a self-propelled, steerable, vertically extensible and contractible truck 18 by means of which the outer end of such tunnel may be maneuvered into register with the doorway 16. The truck 18 includes a telescoping column 20 which may be extended and contracted to raise and lower the tunnel 12 by a reversible motor means 22 shown as comprising a reversible electric motor 24 carried by the tunnel and driving a screw 26 within the telescoping column. For a more detailed description of the foregoing structure, attention is directed to the copending patent application of Robert D. Lichti, one of the inventors hereof, Serial No. 38,843, filed June 27, 1960, now abandoned the disclosure of which is incorporated herein by reference. However, it will be understood that various reversible motor means may be utilized for raising and lowering the tunnel 12, the reversible electric motor 24 and the screw 26 shown being illustrative only.

In order to maintain the tunnel 12 in register with the doorway 16, and in order to prevent damage to the fuselage 14 and/or the ramp 10, it is essential that the outer end of the tunnel and the portion of the fuselage engaged thereby be maintained at the same relative levels at all times, despite the presence of factors tending to produce relative vertical movement of the tunnel and the fuselage. The elevation of the doorway 16 may vary throughout a considerable range as passengers enter or leave, as baggage is loaded or unloaded, as the fuel tanks of the airplane are filled, and the like, and the tunnel 12 must follow the resulting vertical movement of the portion of the fuselage 14 around the doorway very closely. To a lesser degree, the tunnel 12 itself may tend to move vertically relative to the fuselage 14, e.g., as passengers enter and leave the tunnel, and any such tendency of the tunnel to move vertically relative to the fuselage must be prevented.

The present invention provides a control means, designated generally by the numeral 30, which operates the reversible motor means 22 in directions to maintain the tunnel 12 and the fuselage 14 in the same relative vertical positions in response to very slight relative vertical movements thereof. In the construction illustrated, the control means 30 is carried by the tunnel 12 and is engageable with the fuselage 14.

Referring particularly to FIG. 2 of the drawing, the control means 30 includes a supporting member or control arm 32 which is pivotally mounted intermediate its ends, at 34, on the tunnel 12 for movement toward and away from the fuselage 14 between extended and retracted positions. The extended position of the control arm 32 is shown in solid lines in FIG. 2 of the drawing and the retracted position thereof is shown in broken lines. A tension spring 36 connected at one end to the control arm 32 and at its other end to the tunnel 12 biases the control arm toward its extended position.

Pivotally mounted on one end of the control arm 32 is a relative-vertical-movement-sensing roller 38 having thereon a tire-like collar 40, preferably of an elastomeric material, which is engageable with the fuselage 14 adjacent the doorway 16 therein when the control arm is in

its extended position. The pivot axis of the sensing roller 38 is perpendicular to the plane of pivotal movement of the control arm 32 so that the circumferential collar 40 on the sensing roller is frictionally and rollably engageable with the fuselage 14. In other words, if any slight relative vertical movement of the tunnel 12 and the fuselage 14 occurs, the sensing roller 38 rolls upwardly or downwardly along the fuselage. With this construction, any possibility of damage to or marring of the external surface of the fuselage 14 is prevented since the sensing roller 38 merely rolls vertically over the external surface of the fuselage, and does not slide relative thereto. Also, since the control arm 32 is free to pivot in opposition to the action of the biasing spring 36, the possibility of damage to the fuselage 14 is further minimized.

As shown in FIG. 3 of the drawing, the sensing roller 38 is fixed on a shaft 42 oriented perpendicular to the plane of pivotal movement of the control arm 32. The shaft 42 is rotatable relative to the conrtol arm 32 and is connected at its inner end to a control switch designated generally by the numeral 44.

The control switch 44 may be of any suitable construction, but is basically a double throw switch capable of energizing the reversible electric motor 24 in opposite directions. As shown diagrammatically in FIG. 4 of the drawing, the control switch 44 basically includes a switch element 46 adapted to close either a "Down" circuit 48, or an "Up" circuit 50. It will be understood that the reversible electric motor 24 is connected in the circuits 48 and 50 in such a manner that it lowers the tunnel 12 when the "Down" circuit 48 is closed and raises the tunnel when the "Up" circuit 50 is closed.

In operation, if the fuselage 14 starts to move downwardly relative to the tunnel 12, of if the tunnel starts to move upwardly relative to the fuselage, the sensing roller 38 is rotated in the clockwise direction, as viewed in the drawing, to close the "Down" circuit 48. Consequently, the motor means 22 lowers the tunnel 12 to follow the fuselage 14 downwardly, or to prevent the tunnel from rising relative to the fuselage, as the case may be. The operation of the control means 30 is similar, but reversed in direction, whenever the fuselage 14 starts to move upwardly relative to the tunnel 12, or whenever the tunnel 12 starts to move downwardly relative to the fuselage 14.

Only a few degrees of rotation of the sensing roller 38 from its neutral position are necessary to effect closure of one or the other of the circuits 48 and 50. Consequently, only a very slight relative vertical movement of the tunnel 12 and the fuselage 14 is necessary to actuate the reversible motor means 22, thereby reducing the possibility of damage to the airplane, or to the ramp 10, to an absolute minimum.

In order to prevent the control means 30 from interfering with maneuvering of the outer end of the tunnel 12 into the proper position relative to the doorway 16, and in order to prevent damage to the control means itself and damage to the airplane by the control means during such maneuvering, the control arm 32 is preferably locked in its retracted position. This may be accomplished in various ways. In the particular construction illustrated in FIG. 2 of the drawing, the control arm 32 is pivotally connected to one end of a link 52 the other end of which is pivotally connected to a crank 54. The latter is connected, as by a cable 56, to a retracting crank 58 which is preferably mounted at a control station within the tunnel 12. As will be apparent, by pivoting the crank 58 from its solid-line position to its broken-line position, the control arm 32 may be pivoted from its extended position into its retracted position. The retracting crank 58 may be provided with any suitable latch means, not shown, for locking the control arm 32 in its retracted position.

Although an exemplary embodiment of the invention has been disclosed herein for purposes of illustration, it will be understood that various changes, modifications and substitutions may be incorporated in such embodiment without departing from the spirit of the invention as defined by the following claims.

We claim:

1. In combination: two relatively movable structures; means including reversible motor means for relatively moving said structures; and control means responsive to relative movement of said structures for operating said reversible motor means in directions to maintain said structures in the same relative positions, including a supporting member mounted on one of said structures for movement toward and away from the other of said structures, means interconnecting said supporting member and said one structure for biasing said supporting member toward said other structure, a sensing member pivotally mounted on said supporting member and having an arcuate surface frictionally and rollably engageable with said other structure, and a control member directly connected to said sensing member, so as to pivot therewith, and operatively connected to said reversible motor means.

2. In combination: a structure movable in opposite directions in a predetermined plane; means including reversible motor means connected to said structure for moving same in said opposite directions in said plane; a supporting member mounted on said structure for movement in said plane between retracted and extended positions; means interconnecting said structure and said supporting member for biasing said supporting member toward said extended position; a sensing member pivotally mounted on said supporting member for pivotal movement relative thereto about a pivot axis perpendicular to said plane, said sensing member having an arcuate surface the center of which is defined by said pivot axis and which is frictionally and rollably engageable with an adjacent structure when said supporting member is in said extended position; and a control member directly connected to said sensing member, so as to pivot therewith, and operatively connected to said reversible motor means.

3. In combination: a structure movable in opposite directions in a predetermined plane; means including reversible motor means connected to said structure for moving same in said opposite directions in said plane; a supporting member mounted on said structure for pivotal movement in said plane between retracted and extended positions; means interconnecting said structure and said supporting member for biasing said supporting member toward said extended position; a sensing member pivotally mounted on said supporting member for pivotal movement relative thereto about a pivot axis perpendicular to said plane, said sensing member having an arcuate surface the center of which is defined by said pivot axis and which is frictionally and rollably engageable with an adjacent structure when said supporting member is in said extended position; and a control member directly connected to said sensing member, so as to pivot therewith, and operatively connected to said reversible motor means.

4. In combination: a structure movable in opposite directions in a predetermined plane; means including reversible motor means connected to said structure for moving same in said opposite directions in said plane; a supporting member mounted on said structure for pivotal movement in said plane between retracted and extended positions; means interconnecting said structure and said supporting member for biasing said supporting member toward said extended position; a sensing roller pivotally mounted on said supporting member for pivotal movement relative thereto about a pivot axis perpendicular to said plane, said sensing roller having an arcuate surface the center of which is defined by said pivot axis and which is frictionally and rollably engageable with an adjacent structure when said supporting member is in said extended position; and a control member directly connected to said sensing roller, so as to pivot therewith, and operatively connected to said reversible motor means.

5. The combination set forth in claim 4 wherein said reversible motor means is a reversible electric motor and wherein said control member is a double throw switch.

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