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TITLE OF INVENTION

DUAL RAMP CAM ACTUATOR

FIELD OF THE INVENTION

The present invention concerns a device for linking together an elevator car door and a landing door in view to enable their synchronous opening and closing.

BACKGROUND OF THE INVENTION

In the past, a large number of devices have been used to provide a link between an elevator car door and a landing door.

These known devices generally use cams, rollers, rocker bars and similar elements. However, one of the problems encountered with these devices is the difficulty of obtaining perfect alignment between the free edges of the car door and the landing door during the opening and closing phases. This difficulty particularly concerns door panels driven linearly which are unable to use the rotational movement of the motor system so as to firstly unlock the lock of the landing door without causing a movement of the car door and then to activate the linking device. misalignment results from an over-travel of the car door with respect to the landing door, said over-travel being used to drive the linking device so as to take the place existing between said device and the locking system of the landing door. This misalignment can result in a malfunctioning of the door detectors and moreover is inaeesthetic.

SUMMARY OF THE INVENTION

An object of the present invention is to obviate these drawbacks and accordingly it concerns a device for linking together an elevator car door and a landing door during the opening and closing phases of said doors.

Another object of the invention is to provide a device of this type which allows for a synchronized movement of the doors with an alignment of their free edges.

Still another object of the invention is to provide a device allowing for the free passage of the car at the landing levels.

Another object of the invention is to provide a device of this type which is easy to mount and to set, and which is reliable and strong.

The present invention concerns a device for linking together an elevator car door and a landing door and for driving said doors in a synchronous movement during the opening and closing phases, said device being of the type in which the landing doors are locked in a closed position by a pivoting lock, said device comprising :

- two vertical rods joined to the extremities of two rocker bars joined at an intermediate point of their length onto a supporting plate integral with the car door so that said rods can pivot from a close position to a spaced apart position,

- a first ramp secured to a fixed portion of the elevator car and which comprises a horizontal bearing surface,

- a cam roller rotatably mounted at the upper end of a first of said rods and which, in the closed position of the car door, overlaps said horizontal bearing surface, the two rods then being in their close position, whereby during the vertical movement of the elevator car, they are able to pass freely through the level of the landing doors without being impeded by the locks of the latter, and whereby during the opening of the car door, the two rods move together until the second rod causes the unlocking of the lock, the free edge of the car door thus being offset by a predetermined distance with respect to the free edge of the landing door,

- and a second ramp secured to the elevator car following the first ramp in the direction of opening of the car door and which acts on the cam roller to force the two rods to be spaced from each other, so that said second rod causes an additional movement of the landing door with respect to the car door in the direction of opening equal to said distance.

BRIEF DESCRIPTION OF THE DRAWINGS

A particular embodiment of the invention will be now

described with reference to the accompanying drawings on which :

- . figure 1 is a perspective view from the front of the linking device of the invention, said device being separated from the elevator car door and the rods being spaced as far as possible from each other ;

- . figure 2 is a front view from the front of the linking device mounted on a car door, the latter being in a closed position, the cam roller being borne by the first ramp and the rods being in their close position ;

- . figure 3 is an enlarged detailed front view of figure 2 showing the alignment device after the car door has moved towards its open position on the horizontal bearing surface of the first ramp ;

- . figure 4 is a front view seen from the rear of the linking device corresponding to figure 2 at the moment when the car is ready to arrive at the level of a landing door, the latter being locked in its closed position by a lock ;

- . figure 5 is a diagrammatic view at the moment when the car is at the level of a landing door prior the unlocking of the latter ;

- . figure 6 is a simplified cutaway view along the line VI-VI of figure 5 ;

- . figure 7 is a front view seen from the front of the linking device, the cam roller bearing against the second ramp and the rods being spaced from each other ;

- . figure 8 is a simplified front view seen from the rear corresponding to figure 7 and showing the lock in an open position ;

- . figure 9 is a simplified cutaway view along the line IX-IX of figure 8, and

- . figure 10 is a perspective view of the two ramps.

The linking and alignment device 10 shown on figures 1 and 2 includes two vertical rods 12, 14 with an L-shaped section each having two wings 16, 18 and 20, 22 perpendicular to one another. The rod 12 is joined via its wing 16, by means of two spindles 28, 30 to the ends of two

parallel rocker bars 24, 26 pivotably mounted around hinge pins 32, 34 borne by a support plate 36. The support plate is secured by means of sets of bolts and nuts 38 to a carriage 40 from which an elevator car door 42 is suspended. Similarly, the rod 14 is joined via its wing 20 by means of spindles 44, 46 to the other ends of the rocker bars 24, 26.

The rods and rocker bars thus form an articulated parallelogram able to pivot from the position shown on figure 1 where the rods are spaced from each other to the position of figure 2 where they are almost joined side by side.

A suitable elastic device, such as a helical spring 48, is hooked onto the rods and exerts on the latter a torque which tends to bring the articulated parallelogram-shaped unit into its spaced apart position of figure 1. The maximum opening of said unit is limited by the stopping of the rocker bar 24 against a stop 50 secured to the support plate 36.

Mounted rotating at the upper end of the rod 14 is a cam roller 52 which, when the car door 42 is closed, overlaps a horizontal cam surface 54 formed on a ramp 56 secured to a fixed portion of the elevator car, for example, the door lintel 58. In this position shown on figure 1, the rods 12, 14 are joined side by side and the spring 48 is stretched.

As clearly shown on figure 3, the ramp 56 is U-shaped and comprises a horizontal upper arm 60 via which said ramp is fixed to a horizontal wing 62 of the lintel by means of sets of bolts and nuts 63, a vertical arm 64 being used as a stop for the cam roller 52 in the closed position of the car door and a horizontal lower arm 66 on which the horizontal cam surface 56 is formed. The latter is followed, in the opening direction of the door, (indicated by the arrow f) by a cam surface slanted towards the arm 68.

Reference is now made to figure 4 which is a view of the device of the invention seen from the opposing face with respect to the face which is visible on figure 2. On figure 4, the elevator car, which is not shown, is assumed to move

downwards. This figure corresponds to a moment when the car approaches a landing served by the elevator.

The landing door 70 is mounted sliding on a rail 72 and is locked in its closed position by a known type of lock 74. The lock is mounted pivoting around a spindle 76 fixed to the rail 72. The lock comprises a latch in which a sliding bolt 78 is engaged, a fixed locking roller 80 and a mobile unlocking roller 82.

It can be seen on figure 4 that in the retracted position of the rods 12, 14, the parallel wings 18, 22 of the latter are disposed in such a way as to be able to pass freely between the rollers 80, 82. When the car stops at a landing door, the rods 12, 14 are located in the position shown on figures 5 and 6. The car door 42 and the landing door 70 are then closed and their free edges 42', 70' are in coincidence.

Reference is now made to figure 3 which shows the position of the cam roller 52 after it has moved in the direction of opening f by a distance D , at the end of which the rods 12, 14 have moved to take-up the play D_1 (see figure 5) which exists between the rod 12 and the unlocking roller 82, after which the rod 12 has forced the unlocking roller to pivot around the axis 76 and thus unlocks the latch 74. During this travel D , only the car door has moved, the landing door remaining in a closed position. As a result, an offset D of the free edge 42' of the car door 42 is created with respect to the free edge 70' of the landing door 70.

The aim of the invention is to allow to the landing door to take-up this offset.

To this effect, according to the invention, a second ramp 84 is used which is also secured to the horizontal wing 62 of the lintel 58 in a position offset with respect to the first ramp 56 in the direction of opening. The second ramp 84 includes a cam surface 86 slanted downwards and towards the direction of opening and positioned in such a way that, as soon as the cam roller 52 has left the horizontal cam

surface 54, it comes into contact with the slanted cam surface 86.

As a result, when the car door continues its opening movement, which movement is henceforth accompanied by the landing door, the cam roller 52 encounters the cam surface 86. The action of this surface combined with that of the spring 48 causes a relative spacing of the rods 12 and 14 with respect to each other. Owing to the fact that the rod 12 bears already against the unlocking roller 82, this will result during this spacing movement, in an additional displacement of the landing door by said distance D in the direction of opening with respect to the car door so that the offset is retrieved. The free edges 42' and 70' of the car door and landing door then come into coincidence and remain so over the entire travel of the doors until their fully open position.

It will be noted that although the spring 48 alone would be sufficient to bring back the spaced apart rods, it is nevertheless necessary, in practice, to add to it a second ramp 84 so as to ensure that this spacing would be certainly effected.

The taking up of the play D is substantially instantaneous, because the distance run by the car door solely is very short compared with the total travel of the door.

When the rods are separated from each other, the rod 14 abuts by its wing 22 against the roller 80 which ensures a solid coupling of the landing door and the car door.

Upon the closing movement, the rod 14 abuts against the roller 80, which actuates the landing door. When the cam roller 52 arrives near at the ramp 56, it climbs the slanted cam surface 68 and then arrives on the horizontal cam surface 54, so that the rods 12 and 14 are brought close together.

In view to allow for easy adjustment of the ramps when they are installed, it is essential that the distance d existing between the rod 12 and the roller 82 (figure 6) be

identical to the distance existing between the rod 14 and the roller 80.

Since the roller 82 is mobile and the roller 80 is fixed, the rod 12 needs to move by a greater distance with respect to the distance run by the rod 14 to take-up the initial play existing between the rod 12 and the roller 82. For this reason, the hinge pins 32, 34 of the rocker bars 24, 26 on the support plate 36 are closer to the rod 14 than to the rod 12, as shown on figure 2.

As shown on figure 10, the first ramp 56 and second ramp 84 have in common the same nut and bolt fixing 63 and moreover the second ramp is provided with a dowel 88 intended to prevent it from rotating when the cam roller 52 comes into contact with the slanted surface 86. The dowel 88 and the nut 63 traverse oblong holes 90, 92 formed on the horizontal wing 62 of the lintel so as to allow for an adjustment of the position of the second ramp. By giving the ramps 56 and 84 symmetrical shapes, it is possible to use them for doors which open toward the left or toward the right, as well as for doors with central or lateral opening.



WHAT IS CLAIMED IS :

1. Device for linking together an elevator car door and a landing door and for driving said doors in a synchronous movement during the opening and closing phases, said device being of the type in which the landing doors are locked in a closed position by a pivoting lock, said device comprising :

- two vertical rods joined to the extremities of two rocker bars joined at an intermediate point of their length onto a support plate integral with the car door so that said rods can pivot from a close position to a spaced apart position,

- a first ramp secured to a fixed portion of the elevator car and which comprises a horizontal bearing surface,

- a cam roller rotatably mounted at the upper end of a first of said rods and which, in the closed position of the car door, overlaps said horizontal bearing surface, the two rods then being in their close position, whereby during the vertical movement of the elevator car, they are able to pass freely through the level of the landing doors without being impeded by the locks of the latter, and whereby during the opening of the car door, the two rods move together until the second rod causes the unlocking of the lock, the free edge of the car door thus being offset by a predetermined distance with respect to the free edge of the landing door,

- and a second ramp secured to the elevator car following the first ramp in the direction of opening of the car door and which acts on the cam roller to force the two rods to become separated from each other so that said second rod causes an additional movement of the landing door with respect to the car door in the direction of opening equal to said distance.

2. Linking device according to claim 1, wherein a prestressed spring is hooked onto the rods and exerts on the latter a torque tending to bring them into a position where said rods are spaced from each other.

3. Linking device according to claim 2, wherein said



spaced apart position is limited when one of the rocker bars abuts against a stop secured to the support plate.

4. Linking device according to claim 1, wherein the articulation points of the rocker bars on the support plate are closer to the rod bearing the cam roller than the other rod.

5. Linking device according to claim 1, wherein the rods are constituted by parallel L-shaped profiles having wings by which they are connected to the rocker bars respectively, and second wings perpendicular to the first wings, said second wings biasing the lock of the landing door towards its unlocked position when the rods start to move towards their spaced apart position.