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COMPLETE SPECIFICATION

Improvements in and relating to Sliding Door Mountings

I, ERWIN EDWARD SPORK, a British Subject, of 115 Bonney Avenue, Clayfield, Brisbane, in the State of Queensland, Commonwealth of Australia, do hereby declare the invention, for which I pray that a patent may be granted to me, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to sliding door mountings, and it has more particular reference to improvements in and relating to differential-type ball mountings for sliding doors.

It is well-known to provide differential-type ball mountings for sliding doors, such an assembly comprising basically a door carrier adapted to be connected along the top of a sliding door and having an upper ball-housing adapted to engage over and slide along a bottom rail of a door track, the ball-housing containing a pair of spaced balls which are freely rotatable and engage at their lowermost peripheries in a bottom groove of the door track bottom rail, while their upper portions engage with laterally spaced rail portions of the carrier disposed at a distance from the horizontal plane through the centres of the balls less than the radius of the balls, a differential-type action being obtained so that the distance travelled by the balls is a suitable fraction of the distance travelled by the carrier and door. This type of door mounting will hereinafter be referred to as "the type described".

The practice has always been to mount the balls in a cage device which has a longitudinal interconnecting bar or rod extending between a pair of ball carriers which hold the balls firmly but rotatably at fixed distances from one another. In order that the cage device will be maintained as part of the door carrier, it is the practice to provide a pair of transverse supporting pins through the top of the carrier beneath the interconnecting bar or rod but between the innermost travel positions of the respective balls. Similar pins may be located at the ends of the carrier to define the outermost travel positions of the respective balls.

While differential-type ball mountings of this kind have proved very efficient in operation, this method of mounting the balls involves quite some cost in the materials required for the ball cage device, while considerable time and skill are required for the manufacture of the cage which must be made with some accuracy.

My present invention has therefore been devised to reduce the cost of such mountings and it accordingly has for its principal object the provision of a carrier for a door mounting of the type described which will not require any form of cage device to support the balls, and yet will be as efficient or more efficient than the fittings previously employed.

With the foregoing and other objects in view, my invention resides broadly in a sliding door carrier of the type having an upper ball-housing adapted to engage over and slide along a bottom rail of a horizontal overhead door track, the ball-housing containing a pair of spaced balls which are freely rotatable and adapted to engage at their lowermost peripheries in a bottom groove of the door track bottom rail, while their upper portions are adapted to engage with laterally-spaced rail portions of the carrier disposed at a distance from the horizontal plane through the centres of the balls less than the radius of the balls, characterized in that the housing is provided on each side with a continuous longitudinal rib disposed beneath the horizontal plane through the centres of the balls, the two ribs having their inner margins spaced apart a distance less than the diameters of the balls so as to retain the balls within the housing of the carrier, and further characterized in that the housing is provided with stop members projecting into the movement area of the balls to define the outermost limit positions of travel

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stop members will serve a dual purpose insofar as they will prevent the balls from falling out of the ends of the housing retaining them at all times within their inner and outer travel positions, while they will also act to engage the freely and independently movable balls and bring them to correct functioning locations, upon movement of the door, in the event of the balls becoming incorrectly located. Other features of the invention will be hereinafter apparent.

In order that the invention may be more readily understood and put into practical effect, reference will now be made to the accompanying drawings, wherein:—

Fig. 1 is a perspective view of part of a door and door mounting as presently known;

Fig. 2 is a sectional end view of the door carrier and track of the known mounting shown in Fig. 1;

Fig. 3 is a broken-away, sectional side elevation along the line 3—3 of Fig. 2;

Fig. 4 is a perspective view of part of a door and door mounting in accordance with my invention;

Fig. 5 is a sectional end view, to enlarged scale, of the door carrier and track shown in Fig. 4, and

Fig. 6 is a broken-away, sectional side elevation along the line 6—6 of Fig. 5.

Referring firstly to the known, standard type of sliding door mounting shown in Figs. 1 to 3, this comprises a carrier 10 adapted to be secured along the top of a door 11 and engaged and supported by a door track 12. The door track 12 is suitably an extruded section having a horizontal top web 13, a vertical side web 14 and a grooved bottom rail 15, the top web 13 and bottom rail 15 extending from the same side of the side web 14 so that the side of the track opposite the side web 14 is open. This track 12 may be mounted above a door opening in any desired manner, such as by screws passing upwardly through the top web 13 into the lower surface of an overhead beam, or by screws passing through the side web 14 into a wall or other vertical surface. The length of the track 12 is approximately twice the width of the door opening.

The known type of carrier 10 is also an extruded section, and it has a lowermost horizontal door-attachment web 16, a vertical side web 17, and an uppermost ball-housing 18, the latter having an inverted-channel top portion 19 with inner and outer webs 20 and 21. The ball-housing 18 and lower web 16 are both on the same side of the vertical side web 17, and the arrangement is such that the ball-housing 18 is engaged over the bottom rail 15 of the track 12 on the open side of the track. The carrier 10 is of the same length as the width of the door or slightly less, and the pair of metal spherical balls 23 which are freely rotatable and can move along the carrier 10 and track 12, these balls 23 being held rotatably at a fixed distance apart by means of a cage device 24 having an interconnecting rod 25 provided at each end with a pair of retaining rings 26 between which the respective ball is rotatably held. The cage device 24 is retained in the housing 18 by a pair of transverse pins 27 passed through the webs 20 and 21 near to the middle of the carrier 10, these pins 27 being beneath the rod 25 for that purpose. At each end of the carrier 10, there is a further pin 28 defining the outermost limit of travel of the respective ball. Each ball 23 engages at its lowermost periphery in the groove of the track bottom rail 15, while the weight of the door and carrier causes the upper portion of each ball to engage laterally-spaced rails at the lower ends of the webs 20 and 21, the engagement positions being above the horizontal plane through the centre of the balls but at a distance therefrom which is less than the radius of the ball.

In consequence, a differential-type sliding action is obtained, the cage 24 and balls 23 moving a distance which is a certain fraction —usually between one-third and one-half—of the door travel. The balls remain a set distance apart, and each moves between the outermost pin 28 and an innermost position in which the other ball is engaged with the respective outermost pin.

In the door mounting according to my invention, and shown in Figs. 4 to 6, there are the same basic components of carrier 10*a*, door 11*a*, and door track 12*a*, and the mounting and operation thereof follow the same principles as previously applied. The track 12*a* as a top web 13*a*, side web 14*a*, and a grooved bottom rail 15*a*, but the groove of the latter is slightly higher than previously in relation to the lower end of the vertical side web 14*a*, as will be seen in the drawings. The carrier 10*a*, has a lower web 16*a*, a vertical side web 17*a* and a ball housing 18*a* with an inverted channel top portion 19*a*. The inner web 20*a* has an integral bottom web consisting of an inwardly inclined upper portion 29 and vertical lower portion 30, the junction of the web 20*a* and portion 29 constituting a rail 31 above the centre of the ball 23*a*, while the portion 30 extends down past the centre of the ball and has a return rib 32 tapered in to a fairly sharp inner margin close to the periphery of the ball beneath the horizontal plane through its centre.

The outer web 21*a* is joined to the vertical web 17*a* by an inclined portion 33, the junction of the web 21*a* and portion 33 constituting a rail 34 corresponding in height to the

ment, the balls 23*a* may engage at their lowermost peripheries in the groove of the rail 15*a*, the radius of curvature of the latter being slightly greater than that of the balls, while the upper parts of the balls engage against the rails 31 and 34 above the horizontal plane through the centres of the balls but at a lesser distance therefrom than the radius of the balls. The two ribs 32 and 35 are at the same height and located beneath the horizontal plane through the centres of the balls, and their tapered sharp inner margins are spaced apart a distance less than the diameter of the balls and just enough to allow free rotation under normal operating conditions yet without the balls falling from the housing 18*a* when the carrier 10*a* is not engaged with the door track 12*a*. The two ribs 32 and 35 thus provide supporting edges for the balls at similar locations on the opposite sides of the balls, preventing the balls from falling downwardly from the upper part of the housing 18*a*.

In addition, the carrier 10*a* is provided with four transverse pins passing through the webs 20*a* and 21*a* and thus extending into the movement area or area of travel of the balls. Two of the pins 28*a* are located at the opposite extremities of the carrier 10*a* to prevent the balls from falling from its ends, while the other two pins 27*a* are at equal distances from the respective ends and located at the innermost limits of travel of the balls, the actual positions depending of course on the differential ratio employed.

In operation, it will be apparent that the balls 23*a* are simply located without any interconnection whatsoever, and they cannot fall from the ends of the carrier 10*a* by virtue of the stop or limiting pins 28*a*, and they cannot fall downwards past the ribs 32 and 35. When the door is supported, the balls will operate with a differential action, one being at its innermost position when the other is at its outermost position. When the balls are in their normal locations in the carrier, they will function in exactly the same manner as in previous constructions, remaining a fixed distance apart during movement of the door, even though they are not interconnected by a cage device. However, should the balls be located a different distance apart at other than their correct functioning positions, as for example as a result of incorrect initial positioning upon installation, or as a result of knocking or dislodgment, they will automatically come back to their correct positions as the door is operated, the relevant pin 27*a* or 28*a* engaging the dislodged ball and moving it to its limit of travel in a sliding instead of rolling action ready for correct movement on the reverse sliding action of the door.

the major advantage that the ball cage is dispensed with, thus saving costs and time in construction and installation. However, it will of course be understood that the particular form of the invention described and illustrated may be subject to many modifications of constructional detail and design. For example, any types of stop members could be employed instead of the pins 27*a* and 28*a*, such tongues expressed from the carrier 10*a* to enter the movement path of the balls. The invention embraces all modifications and constructions as fall within its scope and ambit, as defined by the appended claims. In addition, there may be used the usual rubber stops at the ends of the track against which the carrier may engage in the fully open and fully closed positions of the door. Also, means of any suitable kind may be provided to prevent lifting of the door and carrier to prevent removal of the carrier by lifting and withdrawing same from the open side of the track.

WHAT I CLAIM IS:—

1. A sliding door carrier of the type having an upper ball-housing adapted to engage over and slide along a bottom rail of a horizontal overhead door track, the ball-housing containing a pair of spaced balls which are freely rotatable and adapted to engage at their lowermost peripheries in a bottom groove of the door track bottom rail, while their upper portions are adapted to engage with laterally-spaced rail portions of the carrier disposed at a distance from the horizontal plane through the centres of the balls less than the radius of the balls, characterized in that the housing is provided on each side with a continuous longitudinal rib disposed beneath the horizontal plane through the centres of the balls, the two ribs having their inner margins spaced apart a distance less than the diameter of the balls so as to retain the balls within the housing of the carrier, and further characterized in that the housing is provided with stop members projecting into the movement path of the balls to define the outermost limit positions of travel of the respective balls near to the ends of the carrier, and also at corresponding innermost limit positions of travel of the respective balls at inner positions along the housing.

2. A sliding door carrier, according to Claim 1, and further characterized in that the ~~con~~ the same height on the opposite sides of the ball-housing.

3. A sliding door carrier, according to either of the preceding claims, and further characterized in that the continuous longitudinal ribs are tapered in cross-section and have sharp inner margins.

4. A sliding door carrier, according to any one of the preceding claims, and further

aforementioned rail 31, while the web 17*a* is provided with an integral tapered return rib 35 corresponding in height to the aforementioned rib 32. By virtue of this arrangement, the balls 23*a* may engage at their lowermost peripheries in the groove of the rail 15*a*, the radius of curvature of the latter being slightly greater than that of the balls, while the upper parts of the balls engage against the rails 31 and 34 above the horizontal plane through the centres of the balls but at a lesser distance therefrom than the radius of the balls. The two ribs 32 and 35 are at the same height and located beneath the horizontal plane through the centres of the balls, and their tapered sharp inner margins are spaced apart a distance less than the diameter of the balls and just enough to allow free rotation under normal operating conditions yet without the balls falling from the housing 18*a* when the carrier 10*a* is not engaged with the door track 12*a*. The two ribs 32 and 35 thus provide supporting edges for the balls at similar locations on the opposite sides of the balls, preventing the balls from falling downwardly from the upper part of the housing 18*a*.

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It will be appreciated that, by means of the invention, the carriers may be made equivalent in all respects to known types but with the major advantage that the ball cage is dispensed with, thus saving costs and time in construction and installation. However, it will of course be understood that the particular form of the invention described and illustrated may be subject to many modifications of constructional detail and design. For example, any types of stop members could be employed instead of the pins 27*a* and 28*a*, such as tongues expressed from the carrier 10*a* to enter the movement path of the balls. The invention embraces all modifications and constructions as fall within its scope and ambit, as defined by the appended claims. In addition, there may be used the usual rubber stops at the ends of the track against which the carrier may engage in the fully open and fully closed positions of the door. Also, means of any suitable kind may be provided to prevent lifting of the door and carrier to prevent removal of the carrier by lifting and withdrawing same from the open side of the track.

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4. A sliding door carrier, according to any one of the preceding claims, and further

one of the preceding claims, and further characterized in that the stop members are pins extending transversely through the housing.

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