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SLIDING DOOR HANGER

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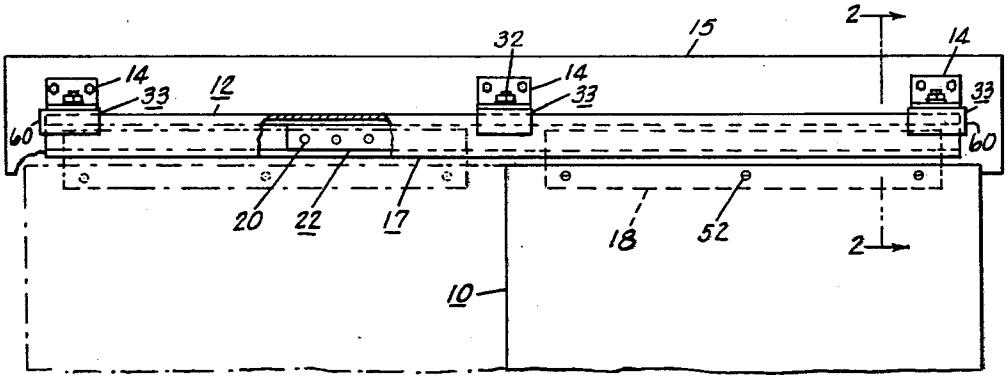


FIG. 1

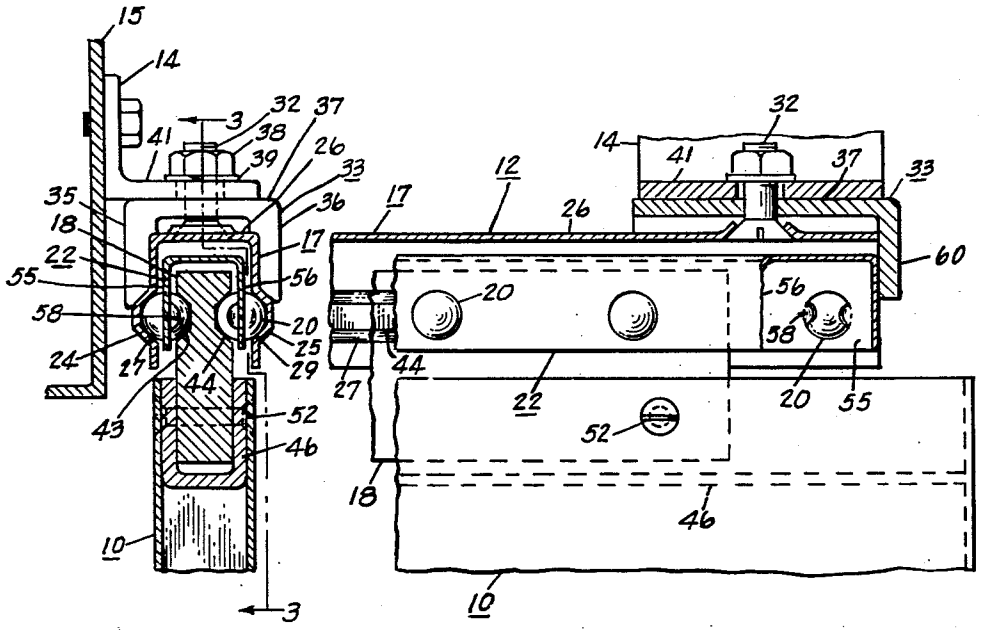


FIG. 2

FIG. 3

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SLIDING DOOR HANGER

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1 Claim. (Cl. 16—88)

This invention relates to linear type door hangers, and particularly to such hangers arranged for supporting doors for sidewise movement to control access to the entranceways of railway cars, elevator cars and like apparatus.

Generally speaking, such cars are used in locations that are subject to considerable dust of various types. This is particularly true of railways cars used in metropolitan subway systems where they operate within confining tunnels.

One popular linear type of hanger used in subway cars employs an inner track and an outer track which are joined together by two sets of anti-friction means, such as ball bearings, which operate in "runs" in the contiguous surfaces of the tracks. The outer track, which has roughly an inverted U-shaped cross-section is affixed to the structure above the entranceway. The inner or center track, which is movably supported within the outer track by the bearing means, is affixed to the top edge of the door and is movable within the outer track to permit the door to be moved sidewise to open and close the entranceway.

Since in such a hanger the ball bearings support the full weight of the door and center track, the ball bearings have in the past been made of metal which are undesirably noisy in operation. In order to minimize such noisy operation and also to reduce further the frictional engagement between relatively moving parts, it has been the practice periodically to lubricate the bearings in their "runs" in their tracks. This lubrication has in turn acted to collect or trap an undesirable amount of the surrounding dust, some of which is from the metal brake shoes which engage the wheels of the car. As the entrapped dust, adhering to the lubricant, accumulates, a thick abrasive compound is formed which acts to impede operation and to damage the tracks and the movable bearings, eventually resulting in noisy door operation.

To prevent the accumulation of this abrasive dust and to impede its abrasive action, it is customary routinely to remove the cars from service for inspection and for removal of the abrasive material. In addition to decreasing the number of cars that are available for service at any given time this routine inspection and maintenance involves considerable labor efforts, since it is necessary to remove the door and dismantle the hanger to gain access to gain access to the moving parts.

It is therefore an object of this invention to provide a linear type hanger for a sliding door which is quiet in operation and which is of such character that little or no periodic maintenance is required to maintain its cleanliness.

It is also an object of this invention to provide in such a hanger anti-friction means in the form of ball bearings, which are of such character that no lubrication is required, but which are of themselves durable enough to withstand the customary service requirements of substantially the life of the car.

In carrying out the invention, the hanger is provided with ball bearings made of a material which is self-lubricating, yet non-soiling as it has for all practical purposes no affinity to dust and like particles and which is resilient enough to be quiet in operation and yet can support moderate loads.

Features and advantages of the invention will be seen from the above and from the following description when

considered in conjunction with the drawings and appended claim.

In the drawings:

FIGURE 1 is a front elevational view of a hanger that is supporting a sliding door (only the top portion of the door being shown) in its closed position and with the open position indicated by dot-dash lines;

FIGURE 2 is an enlarged cross-sectional view taken along line 2—2 of FIGURE 1; and

FIGURE 3 is an enlarged fragmentary view of the right end of FIGURE 1 taken along line 3—3 of FIGURE 2.

Referring to the drawings, sliding door **10** is suspended from an overhead horizontally disposed hanger, generally designated **12**. Overhead hanger **12** is in turn suspended at its ends and midsection from L-shaped mounting brackets **14** bolted to the structure **15**, forming the entranceway. The hanger is approximately twice the width of door **10** and extends from one side to approximately the door's width beyond the other side of the entranceway. Essentially, hanger **12** comprises a stationary tube track **17** approximately twice the width of the door; a movable center track **18** within tube track **17** and held in rolling suspension therein by means of ball bearings **20**, and a ball retainer **22** adapted to fit within tube track **17** and maintain ball bearings **20** in spaced relationship with each other. Center track **18** to which sliding door **10** is attached extends longitudinally, preferably, slightly less than the door width, while retainer **22** extends longitudinally approximately one and a half times the width of door **10**.

Tube track **17** is of substantially inverted U cross-sectional shape having a horizontally disposed web portion **26** connecting two downwardly extending flange portions **24, 25** each of which is expanded outwardly to form on the inside surfaces two horizontally parallel and oppositely disposed ball races **27, 29** that extend the full length of the track. Tube track **17** is reinforced at suspension points by channel members **33**, the depending flanges **35, 36** of which engage the outer surfaces of flanges **24, 25**, respectively, of the tube track. At each suspension point a suspension bolt **32** passes through aligned apertures formed in web **26** of tube track **17**, web **37** of reinforcing channel member **33** and the horizontally extending flange portion **41** of mounting bracket **14**, and in co-operation with nut **38** and lock washer **39**, secures the tube track to the mounting bracket.

Center track **18** has a substantially rectangular cross-sectional shape with the widest sides of the rectangle disposed vertically. Horizontal ball races **43, 44**, are formed in the upper portion of each vertical side and extend along its entire length. These races are of the same size as races **27, 29** formed on the inside surfaces of flanges **24, 25** of tube track **17** and co-operate with them to form ball raceways on either side of center track **18**.

The lower portion of center track **18** is positioned in reinforcing channel **46** which forms the top edge of door **10**. Barrel bolts **52**, passing through apertures formed in the door and center track **18**, attach the door to the center track.

Ball elements **20** fit co-operating races **27, 43** and **29, 44** and are positioned therein on either side of center track **18** to hold the center track firmly in rolling suspension within tube track **17**. The balls **20** are formed of a self-lubricating plastic compound, such as polytetrafluoroethylene, commercially known as "Teflon" whose monomer formula is C_2F_4, and which hereinafter is referred to as Teflon. Teflon is non-soiling and resilient. The Teflon balls are maintained in linear and spaced relationship from each other in their raceways by means of retainer **22**, which retainer allows each ball to turn freely in place.

Retainer **22** is a channel member substantially inverted U cross-sectional shape, having downwardly ex-

tending parallel flange portions **55**, **56**. Flanges **55**, **56**, respectively, have spaced ball receiving apertures formed therein. Two lip portions **58**, projecting inwardly, are formed in each aperture in position and curved to fit the front and back of each Teflon ball **20**. These lip portions hold each ball from falling through its respective aperture when the ball is inserted into the retainer. When the hanger is assembled and center track **18** is inserted between the parallel downwardly extending flanges **55**, **56** of retainer **22**, center track ball races **43**, **44** engage balls **20** and press them clear of the retainer into engagement with ball races **27**, **29** of tube track **17**. As center track **18** is moved sidewise, each ball contacts retainer **22** only at the lip portion **58** in the direction of travel of the center track. Thus, Teflon balls **20** are retained in spaced relationship with each other but are free to turn in retainer **22** in the direction of travel by pressing against the curved lips **58** rather than the sharp edges of the aperture which might soon deform the balls. Retainer **22** is prevented from rolling out of the ends of tube track **17** by a downwardly extending projection **60** formed on the outside end of each of the reinforcing channel members **33** which are positioned at the ends of tube track **17**, the projections **60** acting as stops.

It is to be understood from the foregoing that with the hanger parts assembled as described, the tube track and center track are in rolling engagement with the Teflon balls in the retainer, which retainer is also free to move with respect to both tracks. As the door moves sidewise, the center track from which it is suspended moves twice the distance at twice the speed that the retainer moves but with only the rolling friction of the balls in the raceways to overcome.

As has been previously stated, overhead hangers using metal balls are noisy and therefore require periodic lubrication. When lubricated, dust and dirt collect in the lubricant, necessitating periodic dismantling and cleaning of the hanger to insure proper operation thereof. Unlike such hangers, the subject hanger, due to the self-lubricating, non-soiling characteristics of the Teflon balls, requires no lubrication and therefore remains relatively free of dirt, and yet, due to the resiliency of Teflon, is quiet in operation. This obviates the necessity for periodic lubrication and cleaning of the hanger and the resulting loss of service of the equipment upon which it is arranged.

This is an unexpected result, since it has been generally known that, though Teflon is a thermoplastic with a very low coefficient of friction (static against polished steel .09–.12, inclined plane test method), is self-lubricating and non-soiling and therefore desirable as a bearing material, it is easily dented, scratched, is relatively soft and is ordinarily susceptible to cold flow (creep). These latter characteristics of Teflon, it was thought, made it unacceptable, unless mechanically reinforced, for use as a bearing material. This is especially true for stressed applications, such as the subject hanger wherein the Teflon ball bearings support the weight of the door and center track (approximately 80 pounds) and the operating forces applied to open and close the door may also stress the ball bearings. For example, see the patent to Tait, #2,691,814 wherein at column 1, lines 34–35, Tait recognizes the low mechanical strength of Teflon and therefore limits the use of Teflon to "plane bearings" for sliding contact applications only, such as bearing sleeves, bearing liners, thrust washers, etc. (see Tait, column 1, lines 1–4), which applications are relatively low stressed ones compared with ball bearings to which point contact loads are applied. Even so, Tait does not form his plane bearings from Teflon alone but, rather, impregnates a spongy metal with Teflon and places this impregnated metal on a rigid metal backing in order to obtain a plane bearing of sufficient mechanical strength. In other words, Tait, rather than use Teflon as a bearing material, merely uses it as a "lubricant" by impregnating the spongy material to form a relatively low friction surface for use as a bearing surface.

The subject hanger has been installed on subway cars and tested for substantial periods under service conditions. Under such conditions it has been found to operate quietly and has remained free of abrasive dust. In actual use the hanger requires no cleaning and is much quieter in operation than hangers equipped with ball bearings made of metal. Accelerated life tests were also performed which indicated that the subject hanger, using Teflon balls, showed no deterioration in utility or efficiency for the expected life of a subway car (25 years).

As changes can be made in the above described construction and many apparently different embodiments of this invention can be made without departing from the scope thereof, it is intended that all matter contained in the above description or shown on the accompanying drawings be interpreted as illustrative only and not in a limiting sense.

What is claimed is:

A linear type ball supported sliding door hanger for movably suspending a vertically disposed horizontally sliding door, said hanger comprising a pair of straight track members one of which is centrally located and movable longitudinally with respect to the other and when so located is adapted for suspending said sliding door forming a load, the other track member being stationary and having substantially an inverted U cross sectional shape with its downwardly depending legs substantially parallel to the opposed vertically disposed sides of said centrally located movable track member, the adjacent surfaces of said fixed and movable track members having formed in their oppositely disposed areas ball receiving troughs or races substantially throughout their lengths and constituting ball raceways between said track members when one is encompassed within the other, a plurality of ball elements positioned in longitudinal alignment in said raceways for facilitating longitudinal travel of said movable track relative to said stationary track and when so arranged constituting supporting means between said track surfaces for the suspension of said door, a ball retaining member having ball carrying portions extending into said raceways between said tracks and being adapted to maintain adjacent ones of said ball elements separated from each other, each and all of said load supporting ball elements being composed of polytetrafluoroethylene.

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