

Description

This invention relates to a handrail drive mechanism for an escalator or other similar passenger conveyor, and more particularly to a handrail drive mechanism which automatically increases the driving force in response to resistance of movement of the handrail.

Passenger conveyors such as escalators or horizontal moving walkways will typically include handrails which move along hand rail guides in synchronism with the tread portion of the passenger conveyor. The drive for the handrail can include driving rollers which engage the handrail, moving racks which engage the underside of the handrail, or rotating sprockets which engage the underside of the handrail. When driving rollers are used, they may be directly opposed to form a mangle-type nip through which the handrail moves, or they may be rectilinearly offset along the path of movement of the handrail. Driving rollers can include combinations of driven rollers and idler rollers which cooperate to move the handrail. Devices have been described in the prior art which will vary the driving force imposed upon the handrail by the driving rollers. This provision is especially desirable when the driving rollers are smooth and rely on friction to provide the driving force necessary to move the handrail. U. S. Patents Nos. 3,414,109 Clark, granted December 3, 1968; 3,666,075 Iwata, granted May 30, 1972; 4,134,883 Mendelsohn et al, granted January 16, 1979; 4,151,905 Takahashi et al, granted May 1, 1979; and 4,200,177 Sato et al, granted April 29, 1980 are typical prior art disclosures of passenger conveyor handrail devices.

Subject matter of the invention is a handrail drive assembly as indicated in claim 1.

A handrail drive assembly comprising the pre-characterizing features of claim 1 is known from U.S. Patent No. 3, 666, 075.

Further elucidations and preferred features of the invention are stated hereinbelow:

The handrail drive mechanism of this invention is a mangle-type mechanism wherein the handrail passes through the nip of one or more opposed pairs of driving rollers. The driving force imparted to the handrail depends on the forces generated by the squeezing of the handrail by the rollers, and on frictional forces between the rollers and the handrail. The driving rollers are keyed to rotatable shafts to which chain sprockets are also keyed. An endless chain is mounted on the chain sprockets and can be driven in either direction by a powered sprocket. The power source is a reversible electric motor, typically the same motor that drives the treads on the passenger mover. The drive mechanism is mounted in a housing in opposed walls of which are journaled pairs of mount bearings. The

ends of each driving roller and sprocket shaft are rotatably carried by a cooperating pair of the mount bearings. The mount bearings and the roller and sprocket shaft are eccentric, with the rotational axis of the shaft being further away from the roller nip, and thus the handrail, than the rotational axis of the mount bearings. When the drive mechanism is idle, i.e., is not being driven, the drive chain is slightly slack, and the roller and sprocket shaft axes will remain further away from the nip, and, in each pair of cooperating driving rollers, further away from each other. Thus in the idle condition, very little or no squeezing or compression of the handrail will occur. This is a desirable condition since it enhances the useful life of the handrail.

When the drive mechanism is energized, the chain tightens as it is driven around the driving sprockets by the powered sprocket or sprockets. Rotation of the driving sprockets by the chain causes concurrent rotation of the driving rollers. Rotation of the driving roller and sprocket shafts in the eccentric mount bearings causes the eccentric mount bearings to rotate in the housing walls. This bearing rotation is slight but it brings the axes of each pair of opposed driving rollers closer to each other, and closer to the handrail. Consequently, the driving rollers are moved closer to each other whereby nip pressure on the handrail increases. So long as the handrail moves easily over its guiderail, the nip pressure generated by the opposed driving rollers will remain relatively constant. There will be just enough nip pressure to keep the handrail moving along over the handrail guide. If friction between the handrail and handrail guide increases, then the eccentric mount bearings will rotate further causing an increase in the nip pressure until a new state of equilibrium is reached. The reverse is true if the handrail-handrail guide friction decreases, such as when the passenger load in the mover decreases. Thus the nip pressure on the handrail constantly adjusts itself so that it remains at an equilibrium point which provides only enough driving force to overcome the frictional resistance to movement of the handrail over the handrail guide.

It is therefore an object of this invention to provide an improved passenger conveyer handrail drive which drives the handrails in synchronism with the passenger treads.

It is a further object of this invention to provide a handrail drive of the character described which drives the handrail through the nips of pairs of opposed driving rollers.

It is an additional object of this invention to provide a handrail drive of the character described wherein the nip pressure created by the opposed driving rollers on the handrail constantly adjusts itself responsive to changes in motion retarding frictional forces generated between the handrail

and the handrail guide.

It is another object of this invention to provide a handrail drive of the character described wherein there is substantially no nip pressure generated on the handrail when the handrail drive is in an idle condition, such as when the passenger conveyor is not moving.

These and other objects and advantages of the invention will become more readily apparent from the following detailed description of a preferred embodiment thereof when taken in conjunction with the accompanying drawings in which:

FIGURE 1 is a sectional view of the mechanism showing the eccentricity of the roller and sprocket shafts, and the shaft mount bearings; and

FIGURE 2 is a somewhat schematic elevational view of the mechanism showing how the nip pressure is adjusted when the mechanism is driving the handrail.

Referring now to FIGURE 1, the housing for the drive mechanism is denoted by the numeral 2, and includes opposed side walls 4 and 6. Driving rollers 8 and 10 are mounted on shafts 12 and 14, respectively, and are keyed to the shafts by keys 16 (only one of which is shown). The rollers 8 and 10 combine to form a nip through which the handrail 18 passes. Chain sprockets 20 and 22 are secured by keys 24 (only one of which is shown) to the shafts 12 and 14, respectively. The rollers 8, 10, respective shafts 12 and 14, and respective sprockets 20 and 22 thus rotate in concert. Mount bearings 26 and 28 are mounted in the housing walls 4 and 6, as are bearings 30 and 32. Shaft bearings 34, 36, 38 and 40 are mounted on the shafts 12 and 14, respectively. Bushing 42 interconnects bearings 26 and 34, and similarly bushings 44, 46 and 48 interconnect bearings 28 and 36; 30 and 38; and 32 and 40, respectively. As a result, the shafts 12 and 14 rotate in the bushings 42, 44, 46 and 48, respectively. Additionally, bushings 42, 44, 46 and 48 can rotate within the housing walls 4 and 6 by virtue of the bearings 26, 28, 30 and 32, respectively.

In FIGURE 1, the mechanism is shown as it appears at rest, i.e., when the sprockets 20 and 22 are not moving and when the handrail 18 is not moving. The axis of the shaft 12 designated by the numeral 13, and the axis of the shaft 14 is designated by the numeral 15. The axes of the mount bearings 26, 28 and the bushings 42, 44 are designated by the numeral 27 while the axes of the mount bearings 30, 32 and the bushings 46, 48 are designated by the numeral 31. It will be noted that the axes 13 and 27 are offset, as are the axes 15 and 31, and that the axes 27 and 31 are closer together, and closer to the handrail 18 and nip than are the axes 13 and 15. The device is designed to

provide only a very light compression of the handrail 18 by the rollers 8 and 10 when at rest as is shown in FIGURE 1. It will be appreciated that the axes 13 and 15 are as far apart as they can be as shown in FIGURE 1.

Referring to FIGURE 2, it will be noted that the drive chain 50 is threaded about the sprockets 20 and 22, and also about power sprockets 21. The latter are driven by a power source, such as an electric motor (not shown). It will be noted that the chain 50 has some slack when the mechanism is at rest thus allowing the axes 13, 15, 27 and 31 to assume the positions shown in FIGURE 1. When the mechanism is started up to drive the handrail 18 in the direction of the arrow A_2 , the chain 50 will be driven in the direction A_1 , by the power sprockets 21 thereby rotating the rollers 8 in the clockwise direction, and rotating the rollers 10 in the counterclockwise direction. The position of the rollers 8, 10, sprockets 20, 22 and chain 50 during driving of the handrail 18 are shown in phantom in FIGURE 2. When the shafts 12 and 14 are rotated in this fashion, the bushings 42, 44, 46 and 48 will rotate in the mount bearings 26, 28, 30, and 32, respectively. This rotation causes the axes 13 and 15 to shift to the positions 13' and 15', shown in FIGURE 2. In this manner, the centers of the rollers 8 and 10 are shifted, and thus the circumferences thereof are also shifted to the positions 8' and 10'. In the latter positions, the nip is tightened whereby nip pressure on the handrail 18 is increased. The drive rollers can be arranged in sets of pairs driven by a common chain, as shown in FIGURE 2, or the roller pairs can be spaced further apart along the path of travel of the handrail. It will be readily apparent that the drive rollers will tighten onto the handrail no matter which direction the handrail is being moved.

Since many changes and variations of the disclosed embodiment of the invention may be made it is not intended to limit the invention otherwise than as required by the appended claims.

Claims

1. A handrail drive assembly for moving the handrail of a passenger conveyor, said assembly comprising:

- (a) a pair of drive rollers (8,10) mounted on rotatable drive roller shafts (12,14), said drive rollers (8,10) forming a nip through which said handrail (18) passes;
- (b) two shaft bearings (34,36;38,40) provided for each of said drive roller shafts (12,14), said shaft bearings (34,36;38,40) supporting said drive roller shafts (12,14) for rotation about its axes (13,15);



and the handrail guide.

It is another object of this invention to provide a handrail drive of the character described wherein there is substantially no nip pressure generated on the handrail when the handrail drive is in an idle condition, such as when the passenger conveyor is not moving.

These and other objects and advantages of the invention will become more readily apparent from the following detailed description of a preferred embodiment thereof when taken in conjunction with the accompanying drawings in which:

FIGURE 1 is a sectional view of the mechanism showing the eccentricity of the roller and sprocket shafts, and the shaft mount bearings; and

FIGURE 2 is a somewhat schematic elevational view of the mechanism showing how the nip pressure is adjusted when the mechanism is driving the handrail.

Referring now to FIGURE 1, the housing for the drive mechanism is denoted by the numeral 2, and includes opposed side walls 4 and 6. Driving rollers 8 and 10 are mounted on shafts 12 and 14, respectively, and are keyed to the shafts by keys 16 (only one of which is shown). The rollers 8 and 10 combine to form a nip through which the handrail 18 passes. Chain sprockets 20 and 22 are secured by keys 24 (only one of which is shown) to the shafts 12 and 14, respectively. The rollers 8, 10, respective shafts 12 and 14, and respective sprockets 20 and 22 thus rotate in concert. Mount bearings 26 and 28 are mounted in the housing walls 4 and 6, as are bearings 30 and 32. Shaft bearings 34, 36, 38 and 40 are mounted on the shafts 12 and 14, respectively. Bushing 42 interconnects bearings 26 and 34, and similarly bushings 44, 46 and 48 interconnect bearings 28 and 36; 30 and 38; and 32 and 40, respectively. As a result, the shafts 12 and 14 rotate in the bushings 42, 44, 46 and 48, respectively. Additionally, bushings 42, 44, 46 and 48 can rotate within the housing walls 4 and 6 by virtue of the bearings 26, 28, 30 and 32, respectively.

In FIGURE 1, the mechanism is shown as it appears at rest, i.e., when the sprockets 20 and 22 are not moving and when the handrail 18 is not moving. The axis of the shaft 12 designated by the numeral 13, and the axis of the shaft 14 is designated by the numeral 15. The axes of the mount bearings 26, 28 and the bushings 42, 44 are designated by the numeral 27 while the axes of the mount bearings 30, 32 and the bushings 46, 48 are designated by the numeral 31. It will be noted that the axes 13 and 27 are offset, as are the axes 15 and 31, and that the axes 27 and 31 are closer together, and closer to the handrail 18 and nip than are the axes 13 and 15. The device is designed to

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Since many changes and variations of the disclosed embodiment of the invention may be made it is not intended to limit the invention otherwise than as required by the appended claims.

Claims

1. A handrail drive assembly for moving the handrail of a passenger conveyor, said assembly comprising:
 - (a) a pair of drive rollers (8,10) mounted on rotatable drive roller shafts (12,14), said drive rollers (8,10) forming a nip through which said handrail (18) passes;
 - (b) two shaft bearings (34,36;38,40) provided for each of said drive roller shafts (12,14), said shaft bearings (34,36;38,40) supporting said drive roller shafts (12,14) for rotation about its axes (13,15);



(c) drive means (21,50,20,22) for rotating said drive roller shafts (12,14) and drive rollers (8,10);

(d) said axes (13,15) of said drive roller shafts (12,14) being movable toward each other to increase nip pressure on said handrail (18) in response to the resistance of movement of said handrail (18),

characterized in that

(e) said shaft bearings (34,36,38,40) are each mounted in a bushing (42,44,46,48) which comprises an eccentric portion having a circumference which is eccentric in relation to the respective drive roller shaft (12,14);

(f) said eccentric portions of said bushings (42,44,46,48) are each mounted in a mount bearing (26,28,30,32), thereby allowing said drive means (21,50,20,22) to cause an alteration of the rotational positions of said bushings (42,44,46,48) in said mount bearings (26,28,30,32) and a movement of said axes (13,15) of said drive roller shafts (12,14) toward each other.

2. The handrail drive assembly of claim 1, wherein said drive means comprises roller sprockets (20,22) mounted on each of said drive roller shafts (12,14) and a chain (50) entrained about said roller sprockets (20,22), and a powered sprocket (21) for driving said chain (50) and said roller sprockets (20,22).

3. The handrail drive assembly of claim 2, wherein said chain (50) has sufficient slack when at rest to allow said drive roller shafts (12,14) to assume a rotational position in said mount bearings (26,28,30,32) which causes said drive rollers (8,10) to lightly contact the handrail (18).

4. The handrail drive assembly of claim 2 or 3, further comprising a housing (2) having opposed side walls (4,6), said drive rollers (8,10) being interposed between said side walls (4,6) whereby the handrail (18) passes through said housing (2), and said mount bearings (26,28,30,32) being mounted in said side walls (4,6); and wherein said roller sprockets (20,22) are disposed outside of said housing (2).

Patentansprüche

1. Handlaufantriebsanordnung zum Bewegen des Handlaufs eines Fahrgastbeförderers, die aufweist:

(a) ein Paar von Antriebsrollen (8,10), die an drehbaren Antriebsrollenwellen (12,14) an-

gebracht sind und einen Spalt bilden, durch den der Handlauf (18) läuft;

(b) zwei Wellenlager (34,36;38,40), die für jede der Antriebsrollenwellen (12,14) vorgesehen sind und die Antriebsrollenwellen (12,14) um ihre Achsen (13,15) drehbar abstützen;

(c) eine Antriebseinrichtung (21,50,20,22) zum Drehen der Antriebsrollenwellen (12,14) und der Antriebsrollen (8,10);

(d) wobei die Achsen (13,15) der Antriebsrollenwellen (12,14) aufeinander zu bewegbar sind, um den Druck im Spalt auf den Handlauf (18) in Reaktion auf den Bewegungswiderstand des Handlaufs (18) zu erhöhen,

dadurch gekennzeichnet, daß

(e) die Wellenlager (34,36,38,40) je in einer Buchse (42,44,46,48) angebracht sind, die einen exzentrischen Bereich aufweist mit einem Umfang, der bezüglich der entsprechenden Antriebsrollenwelle (12,14) exzentrisch ist;

(f) wobei die exzentrischen Bereiche der Buchsen (42,44,46,48) je in einem Befestigungslager (26,28,30,32) angebracht sind und dadurch zulassen, daß die Antriebseinrichtung (21,50,20,22) eine Veränderung der Drehstellungen der Buchsen (42,44,46,48) in den Befestigungslagerungen (26,28,30,32) und eine Bewegung der Achsen (13,15) der Antriebsrollenwellen (12,14) aufeinander zu bewirkt.

2. Handlaufantriebsanordnung nach Anspruch 1, bei der die Antriebseinrichtung an jeder der Antriebsrollenwellen (12,14) angebrachte Rollen-Kettenräder (20,22) und eine über die Rollen-Kettenräder (20,22) gezogene Kette (50) sowie ein angetriebenes Kettenrad (21) zum Antreiben der Kette (50) und der Rollen-Kettenräder (20,22) aufweist.

3. Handlaufantriebsanordnung nach Anspruch 2, bei der die Kette (50) im Ruhezustand genügend lose ist, damit die Antriebsrollenwellen (12,14) in den Befestigungslagern (26,28,30,32) eine Drehstellung einnehmen können, in der die Antriebsrollen (8,10) den Handlauf (18) leicht berühren.

4. Handlaufantriebsanordnung nach Anspruch 2 oder 3, die außerdem ein Gehäuse (2) mit gegenüberliegenden Seitenwänden (4,6) aufweist, zwischen denen die Antriebsrollen (8,10) angeordnet sind, wodurch der Handlauf (18) durch das Gehäuse (2) hindurchläuft, und in denen die Befestigungslager (26,28,30,32) an-



gebracht sind, und bei der die Rollen-Kettenräder (20,22) außerhalb des Gehäuses (2) angeordnet sind.

Revendications

1. Ensemble d'entraînement de main-courante servant à entraîner la main-courante d'un transporteur de passagers, ledit ensemble comprenant :

(a) une paire de rouleaux d'entraînement (8, 10) montée sur des arbres rotatifs de rouleaux d'entraînement (12,14), lesdits rouleaux d'entraînement (8, 10) formant entre eux un intervalle de pincement à travers lequel passe ladite main-courante (18) ;

(b) deux paliers d'arbres (34, 36 ; 38, 40) prévus pour chacun desdits arbres de rouleaux d'entraînement (12, 14), lesdits paliers d'arbres (34, 36 ; 38, 40) supportant lesdits arbres de rouleaux d'entraînement (12, 14) pour leur permettre de tourner autour de leurs axes (13, 15) ;

(c) des moyens d'entraînement (21, 50, 20, 22) servant à faire tourner lesdits arbres (12, 14) et les rouleaux d'entraînement (8, 10) ;

(d) les axes (13, 15) desdits arbres de rouleaux d'entraînement (12, 14) pouvant se rapprocher l'un de l'autre pour augmenter la pression de pincement sur la main-courante (18) en réponse à la résistance au mouvement de ladite main-courante (18),

caractérisé en ce que

(e) lesdits paliers d'arbres (34, 36, 38, 40) sont montés chacun dans un coussinet (42, 44, 46, 48) qui comprend une partie excentrique ayant une circonférence qui est excentrique par rapport à l'arbre de rouleau d'entraînement (12, 14) respectif ;

(f) lesdites parties excentriques desdits coussinets (42, 44, 46, 48) sont montées chacune dans un palier de montage (26, 28, 30, 32) en permettant ainsi audit moyen d'entraînement (21, 50, 20, 22) de provoquer une modification des positions de rotation desdits coussinets (42, 44, 46, 48) dans lesdits paliers de montage (26, 28, 30, 32) et un mouvement de rapprochement mutuel desdits axes (13, 15) desdits arbres de rouleaux d'entraînement (12, 14).

2. Ensemble d'entraînement de main-courante selon la revendication 1, dans lequel lesdits moyens d'entraînement comprennent des pignons de rouleaux (20, 22) montés sur lesdits arbres de rouleaux d'entraînement (12, 14), et une chaîne (50) entraînée autour desdits pi-

gnons de rouleaux (20, 22) et un pignon (21) entraîné par un moteur, servant à entraîner ladite chaîne (50) et lesdits pignons de rouleaux (20, 22).

3. Ensemble d'entraînement de main-courante selon la revendication 2, dans lequel ladite chaîne (50) présente, lorsqu'elle est au repos, un mou suffisant pour permettre auxdits arbres de rouleaux d'entraînement (12, 14) de prendre une position de rotation dans lesdits paliers de montage (26, 28, 30, 32) qui amène lesdits rouleaux d'entraînement (8, 10) à entrer légèrement en contact avec la main-courante (18).

4. Ensemble d'entraînement de main-courante selon la revendication 2 ou 3, comprenant en outre un carter (2) ayant des parois latérales opposées (4, 6), lesdits rouleaux d'entraînement (8, 10) étant interposés entre lesdites parois latérales (4, 6), de sorte que la main-courante (18) passe à travers ledit carter (2), lesdits papiers de montage (26, 28, 30, 32) étant montés dans lesdites parois latérales (4, 6), et lesdits pignons de rouleaux (20, 22) étant disposés à l'extérieur dudit carter (2).