Dec. 3, 1968 R. H. JACKSON ET AL 3,414,108

INCLINED MOVING WALKWAY ARRANGEMENT

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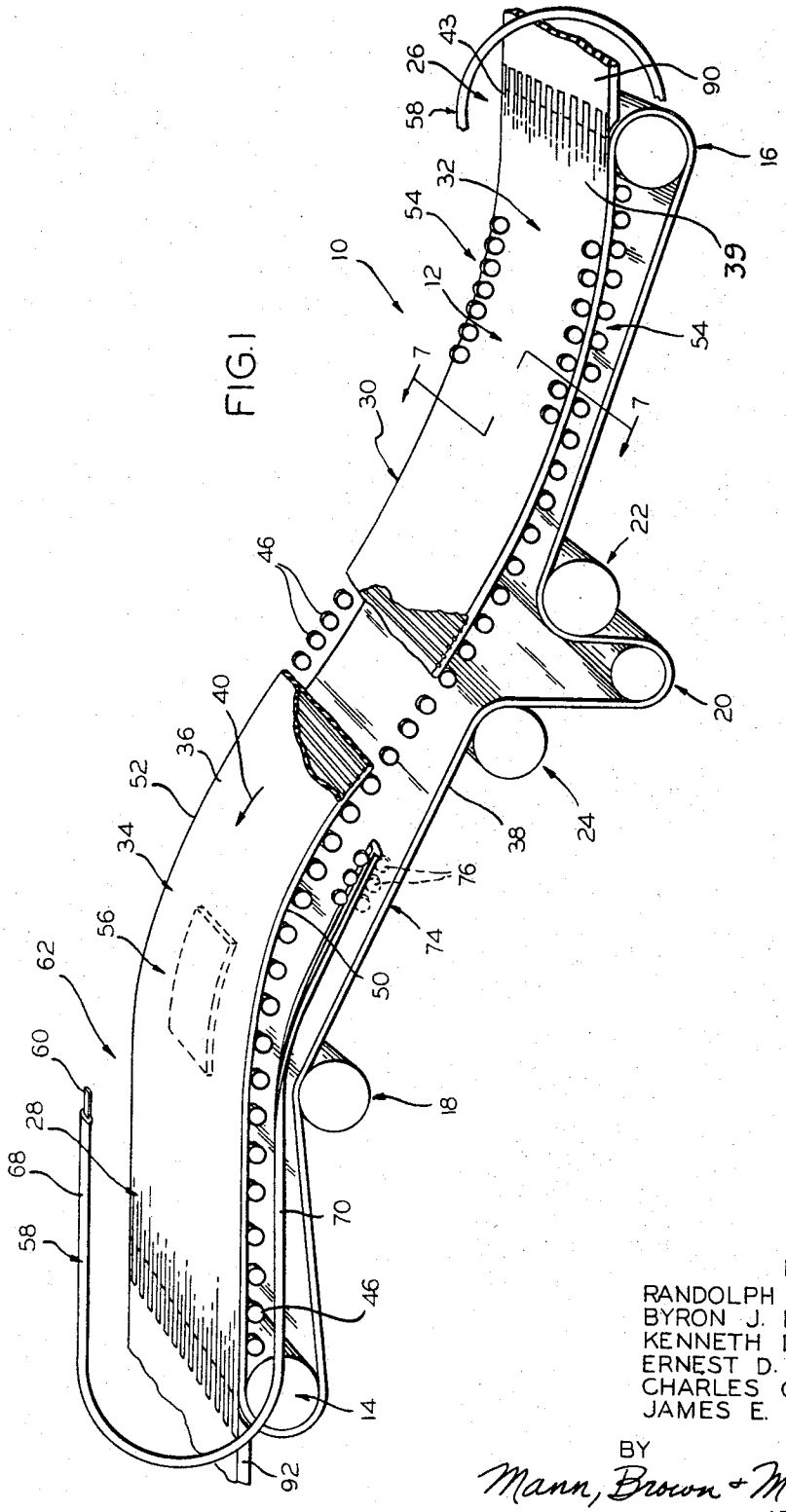


FIG. 1

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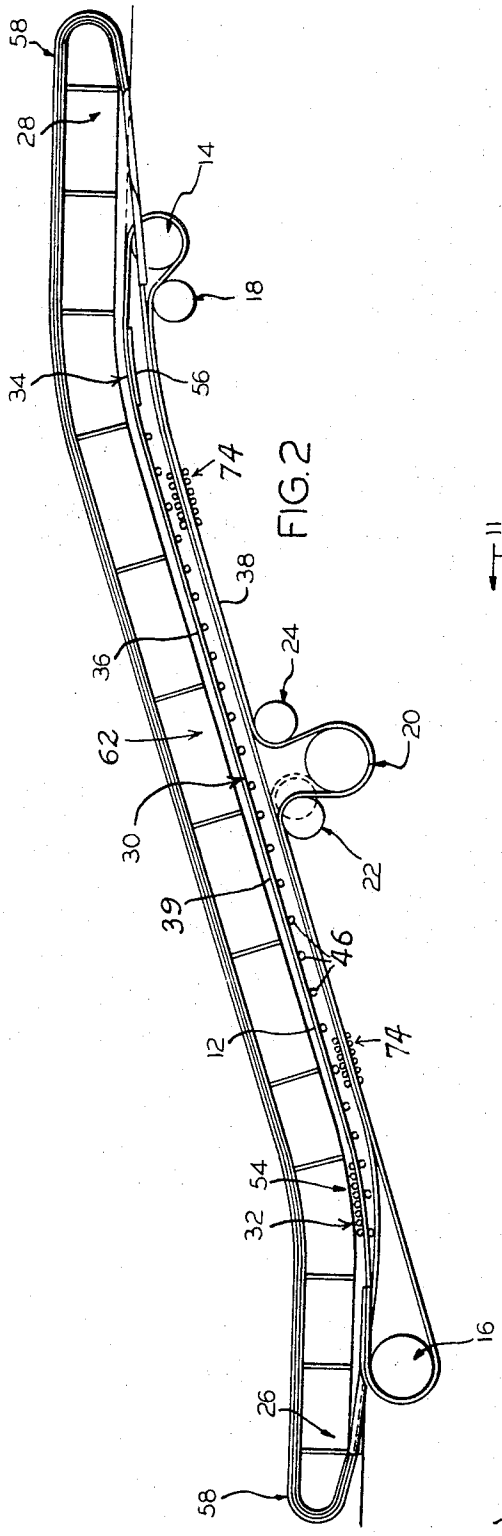


FIG. 2

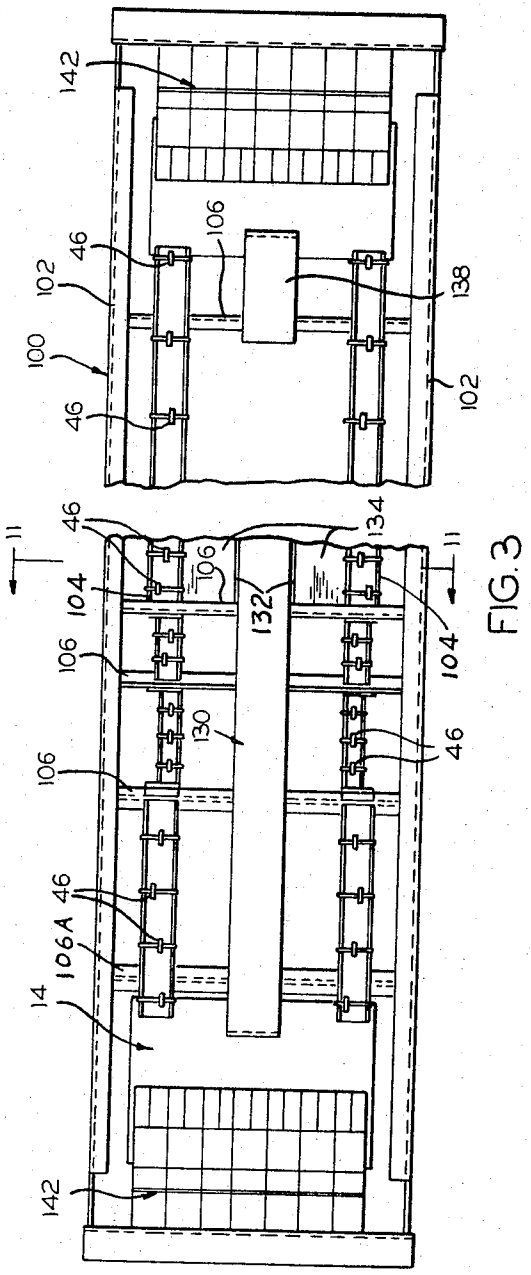


FIG. 3

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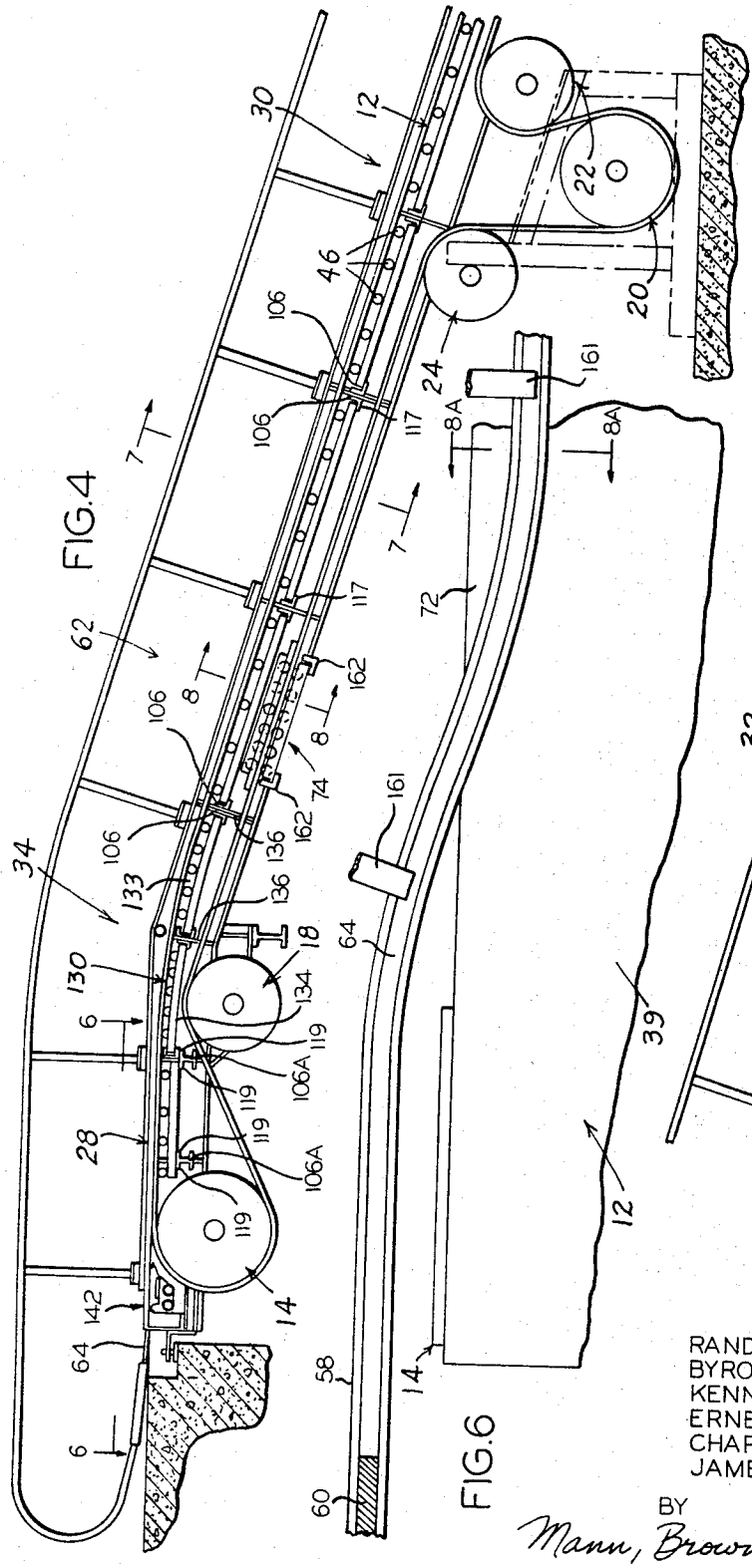


FIG. 4

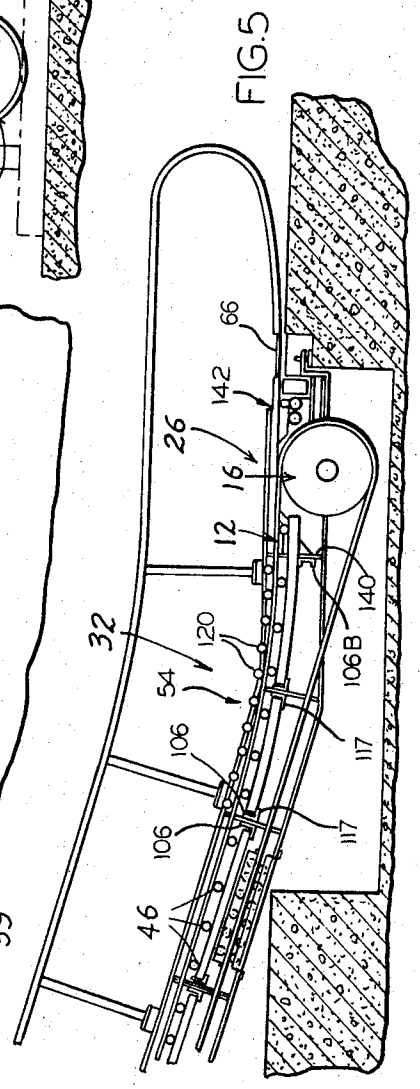


FIG. 5

FIG. 6

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INCLINED MOVING WALKWAY ARRANGEMENT

Filed March 27, 1967 5 Sheets-Sheet 4

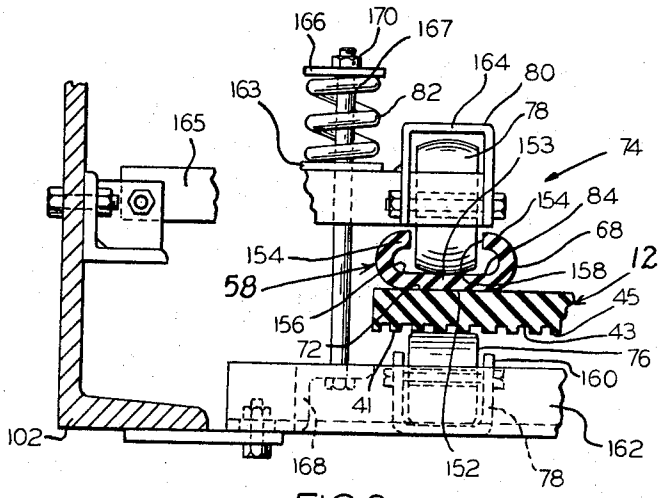


FIG.8

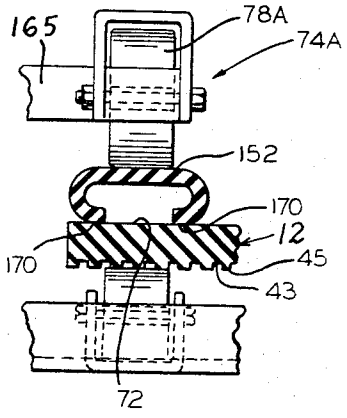


FIG.9

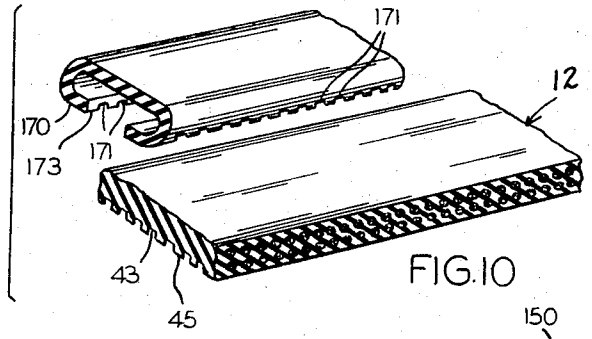


FIG.10

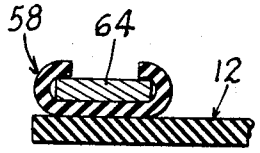


FIG.8A

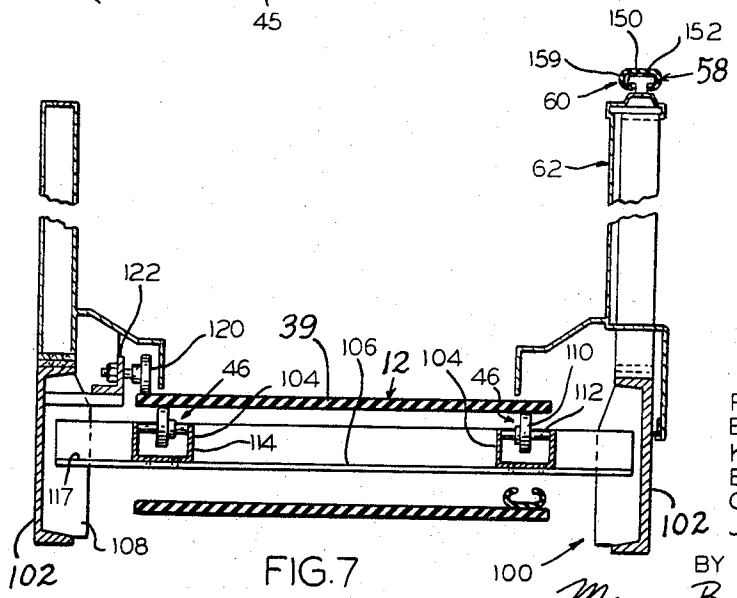


FIG.7

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INCLINED MOVING WALKWAY ARRANGEMENT

Filed March 27, 1967 5 Sheets-Sheet 5

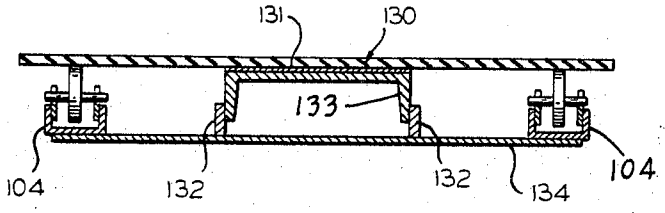


FIG. 11

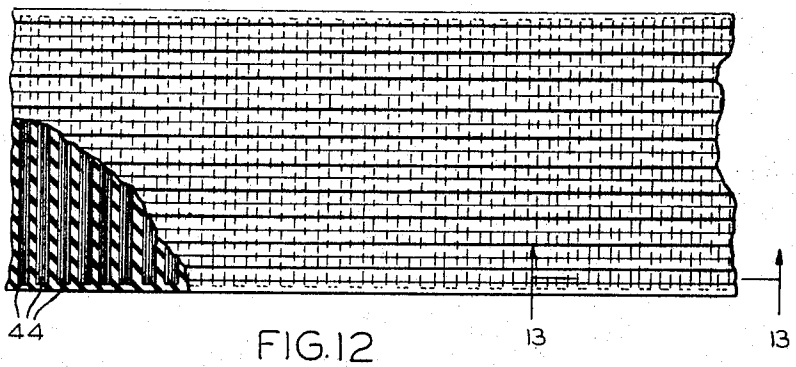


FIG. 12

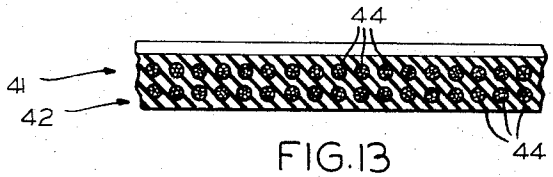


FIG. 13

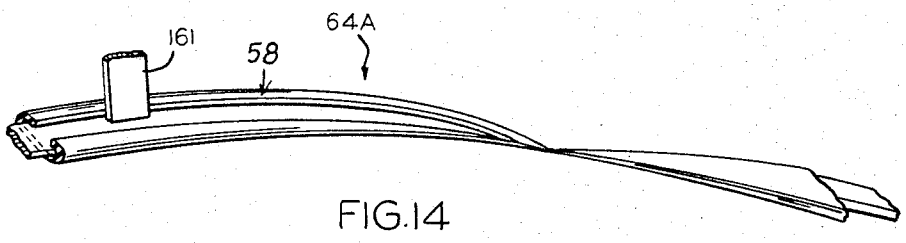


FIG. 14

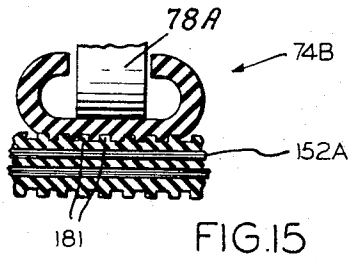


FIG. 15

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3,414,108

INCLINED MOVING WALKWAY ARRANGEMENT

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Filed Mar. 27, 1967, Ser. No. 626,003
15 Claims. (Cl. 198—16)

ABSTRACT OF THE DISCLOSURE

This invention relates to an inclined moving walkway arrangement of the moving sidewalk type in which the walkway is defined by an endless conveyor belt member that is built for lateral stiffness but adequate longitudinal flexibility for belt training purposes, with the belt being trained between end pulleys on wheel-like rollers that support the side edges of the belt, with no solid support through the center of the belt, such as a slider plate, being employed for most of the length of the conveyor. The moving walkway arrangement for the first time provides both a level entry and a level exit that is defined by the belt training arrangement, and a moving hand rail is provided which is driven by having its lower run releasably clamped to the lower run of the belt instead of having the hand rail driven through take off mechanisms from the conveyor driving end pulley.

Conventional moving sidewalk or moving walkway arrangements ordinarily involve an endless conveyor in the form of a ribbon belt of rubber or the like moving on either a slider plate type bed arrangement or a roller type bed arrangement made up of closely spaced rollers that extend the width of the belt.

While slider bed conveyor arrangements provide good support for the belt under the belt's passenger load, the drag of the belt on the slider bed greatly restricts practical conveyor lengths because of tension requirements on the belt.

Roller bed type arrangements greatly reduce the drag problem on the belt, but because of the bumpy conveyance given passengers as they are moved from one roller to another, this type of conveyor has not been considered practical for moving sidewalk or walkway passenger conveying purposes.

Moreover, neither the slider bed type arrangement nor the roller bed type arrangement have permitted the use of a level entry or a level exit at the lower end of an inclined moving walkway apparatus due to the fact that the high tension in the belt has made it impractical to have the belt define the concave curve at the base of the inclined portion that would be necessary to have the belt provide the level exit or entry. The tension involved is in the system not only to establish a driving traction with the belt but also because of the load on the belt created by passengers being pulled up or down the inclination.

Furthermore, the conventional hand rail arrangement for apparatus of this type has heretofore involved an endless hand rail member trained over a balustrade guide, and heretofore the hand rail driving and return arrangements involved have been disposed above the level of the conveyor, necessitating the use of a double panel arrangement to cover up from within and without the conveyor the chains and sprocketing or similar mechanical motion transmitting structures involved for aesthetic purposes, and have made it impractical to use a transparent balustrade.

A principal object of this invention is to provide an inclined moving walkway arrangement that not only

eliminates the drag problem of slider bed type arrangements and the bumpy ride problem of roller bed type arrangements, but also in the same conveying unit provides both a level entry and a level exit for the conveyor while avoiding the need for solid support at the center of the conveyor belt for most of the length of the conveyor.

Another principal object of the invention is to provide an inclined moving walkway arrangement in which balustrade consists of one fixed panel, and the use of a transparent balustrade is a practical option.

Still another principal object of the invention is to provide a hand rail drive for moving walkway arrangements that eliminates the need for separate driving mechanisms to move the hand rail, that provides a driving force to the hand rail that is inherently synchronized with the speed of the moving walkway, and takes advantage of the movement of the moving walkway itself to drive the hand rail.

Yet another object of the invention is to provide a hand rail arrangement and drive therefor that makes it feasible to lubricate the inner surface of the hand rail.

Further objects of the invention are to provide a moving walkway arrangement which has a passenger conveying surface that is as level for passenger comfort as can be achieved by a slider bed arrangement but which has a practical operating length that is equivalent to that achieved by roller bed supported arrangements, to provide an inclined moving walkway arrangement that operates on the consistently effective basis required for use as a public conveyance, and to provide an inclined moving walkway arrangement that is economical of manufacture, convenient to install and use, and readily adapted for application to a wide variety of passenger conveyor situations.

Still other objects, uses and advantages will be obvious or become apparent from a consideration of the following description and the application drawings in which like reference numerals are used to designate like parts throughout the several views.

In the drawings:

FIGURE 1 is a diagrammatic perspective view illustrating the principal features of the invention;

FIGURE 2 is a side elevational view taken from the far side of the apparatus shown in FIGURE 1 showing the arrangement diagrammatically but with somewhat greater detail;

FIGURE 3 is a plan view of the upper and lower ends of the specific arrangement that is shown in FIGURES 4 and 5 with the conveyor belt omitted and the central portion of the apparatus broken away;

FIGURE 4 is a side elevational view of a specific inclined moving walkway arrangement of the type shown in FIGURE 1 with parts shown in section and illustrating only the upper level end of the conveyor and the inclined mid portion;

FIGURE 5 is a view similar to that of FIGURE 4 showing the lower end of the conveyor arrangement of FIGURE 4;

FIGURE 6 is a diagrammatic fragmental plan view substantially along line 6—6 of FIGURE 4 illustrating the manner in which the lower run of the hand rail is guided from the balustrade into cooperation with the lower run of the conveyor belt in accordance with this invention;

FIGURE 7 is a cross-sectional view through a typical portion of the inclined moving walkway and for purposes of the description it is taken substantially along line 7—7 of FIGURE 1;

FIGURE 8 is a fragmental cross-sectional view taken substantially along line 8—8 of FIGURE 4 and illus-

trating the arrangement for clamping the hand rail to the lower run of the conveyor for purposes of driving the hand rail;

FIGURE 8A is a fragmental cross-sectional view along line 8A—8A of FIGURE 6;

FIGURE 9 is a view similar to that of FIGURE 8 but illustrating a modified arrangement for clamping the hand rail to the conveyor lower run;

FIGURE 10 is a fragmental perspective view illustrating the relation between the hand rail and conveyor lower run that is involved in the embodiment of FIGURE 9;

FIGURE 11 is a transverse cross-sectional view along line 11—11 of FIGURE 3, showing the upper run of the conveyor belt in its operating position;

FIGURE 12 is a plan view of a fragment of the conveyor belt used in accordance with this invention, with parts being broken away to better illustrate details;

FIGURE 13 is a fragmental cross-sectional view along line 13—13 of FIGURE 12;

FIGURE 14 is a fragmental perspective view illustrating the manner in which the hand rail of the arrangement of FIGURES 9 and 10 is applied to the lower run of the conveyor; and

FIGURE 15 is a view similar to that of FIGURE 8 but illustrating another modified arrangement for clamping the hand rail to the conveyor lower run.

However, it is to be understood that the specific drawing illustrations provided are supplied primarily to comply with the requirements of the Patent Code and that the invention may have other embodiments which will be obvious to those skilled in this art and which are intended to be covered by the appended claims.

GENERAL DESCRIPTION

Reference numeral **10** of FIGURE 1 generally indicates a diagrammatically illustrated embodiment of this invention which comprises an endless conveyor belt **12** trained over head and tail pulleys **14** and **16**, head snub pulley **18**, drive pulley **20**, take up pulley **22**, and drive snub pulley **24**, and shaped to define a level entry **26**, a level exit **28**, and an inclined portion **30** that is connected to the entry **26** by concave portion **32** and is connected to the exit portion **28** by convex portion **34**.

The conveyor **12** is a continuous ribbon belt defining upper run **36** and lower run **38** and moves in the direction indicated by the arrow **40** in the arrangement illustrated. When the apparatus **10** moves in the other direction, the entry to the apparatus **10** is at the upper end of the conveyor while the exit **28** is at the lower end, as will be immediately apparent, and it is preferred that the drive actuating drive pulley **20** be reversible. However, for purposes of this description it will be assumed that the belt is moving so that the upper run **36** is moving upwardly in the direction of the arrow **40** and the entry **26** and the exit **28** are located as indicated.

The conveyor member **12** thus defines a continuous transport surface **39** on the upwardly facing side of the upper run **36** composed of the entry portion **26**, the concave portion **32**, the convex portion **34**, and the exit portion **28** in that order.

In accordance with this invention, the conveyor member **12** is a composite laminated construction (see FIGURES 12 and 13) comprising two layers **41** and **42** of closely spaced cables formed from steel or the like embedded within a suitable belt forming elastomer that can be of a natural or synthetic rubber composition or a synthetic resin composition such as a plasticized polyvinyl chloride composition. The cables **44** are closely spaced and a spacing on the order of 1/16th to 1/8th of an inch is preferred; as indicated in FIGURES 1, 12 and 13, the cables **44** extend transversely of the conveyor belt **12** and thus at right angles to its longitudinal axis. This gives the conveyor member **12** substantial lateral stiffness while providing for substantial flexure longitudinally thereof that permits the belt to be readily flexed about the illustrated pulleys.

Preferably, the surface of belt **12** defining transport surface **39** is formed with a plurality of shallow closely spaced longitudinally extending grooves **43** that are preferably on the order of 1/4th inch deep and are spaced on the order of 1/4th inch apart, which thus define spaced ribs **45**.

Further in accordance with this invention, the upper run of the belt is supported between its head and tail pulleys, and on either side thereof, by wheel type rollers **46**.

It will be noted from FIGURE 7 that the rollers **46** have a dimension transversely of the belt that is on the order of the belt thickness and that they are positioned closely adjacent to the opposing edges **50** and **52** of the belt. As indicated in FIGURE 1, the conveyor **12** has no solid support along its longitudinal center except for the special features now to be pointed out to thus define between said edges **50** and **52** and their supporting rollers **46** a smooth pathway along which the passengers are moved that avoids the bumpy conveyance of conventional roller beds and yet provides adequate support for the passengers due to the internal stiffness of the belt.

At the concave portion **32**, the belt **12** is held down at its edges **50** and **52** against the tension in the belt by roller hold down devices **54**, while at the convex portion **34** of the belt a narrow supporting plate or prop structure **56** is provided across the length of the convex portion (longitudinally of the belt) which has a dimension transversely of the belt on the order of 1/3rd the belt width (see FIGURE 11).

Associated with the conveyor belt **12** is an endless hand rail **58** mounted on a suitable guide **60** that is secured about the top and ends of balustrade **62**.

In accordance with this invention, the hand rail **58** is moved or driven by releasably clamping same to the lower run **38** of the conveyor **12**. The hand rail is positioned for this by employing the special guide bars **64** and **66** that are shown in FIGURES 4–6 to guide the hand rail from the plane of the balustrade to a position in between the upper and lower runs of the conveyor at the exit end thereof and from that relative position back to the plane of the balustrade at the entry end thereof.

The hand rail **58** thus defines an upper run **68** that is disposed in the usual position for hand gripping by passengers riding the conveyor **10**, and a lower run **70** which on its downward movement is guided into the spaced between the conveyor belt upper and lower runs.

In accordance with this invention, the hand rail lower run **70** is clamped to the upwardly facing surface **72** (the inside surface of the belt) of the conveyor lower run **38** by one or more clamping devices **74**.

In the specific embodiments illustrated, the clamping devices **74** are two in number and are located within the inclined portion **30** of the apparatus **10** adjacent the concave and convex portions **32** and **34**, respectively. The specifics of the devices **74** are illustrated in FIGURE 8, wherein it will be seen that each comprises a lower set of rollers **76** journalled in a fixed base **78** that engage the grooved load supporting surface **39** of the lower or return run of the belt, and upper rollers **78** journalled in a frame **80** that are held in clamping engagement with the hand rail **68** by springs **82**. It will be noted that the rollers **78** in the form of FIGURES 1–8 ride on the inside surface **84** of the hand rail.

When the apparatus **10** is moved in the direction that will move the upper run of the belt in the direction of arrow **40**, it is the upper clamping device **74** that does the main driving action on the hand rail, with the bottom or lower device **74** pulling the slack in the hand rail away from the area of the drive roller **20** and its cooperating rollers **22** and **24**. More specifically, the clamping devices **74** act as a single unit, providing simultaneous pulling and

pushing forces on the handrail so that the handrail is pulled around the upper guide structure **60** from the midpoint of the lower newel curve to the clamping devices and pushed past the lower special guide bar **66** to the midpoint of the lower newel curve. The action is reversed when the direction of movement is reversed.

In operation, the drive actuating drive pulley **20** is actuated in any suitable manner to move the conveyor belt **12**, for instance, in the direction indicated by the arrow **40**, with passengers stepping from landing **90** directly onto the conveyor level entry portion **26** and gripping the hand rail upper run **68**, if desired, for support, which, in moving at the same speed as the conveyor, avoids the possibility of passengers being thrown off balance. The conveyor belt **12** is driven at the conventional moving sidewalk speed of a mile and one-half an hour and the passengers experience a smooth ride across the entry portion **26**, the concave portion **32**, and up the inclined portion **30**. The plate structure **56** at the convex portion **34** supports the mid portion of the belt under the weight of the passengers so that as they ride over it the belt in the area of the convex portion is maintained level transversely thereof and the passengers experience no uncertainty due to a dip being formed at the longitudinal center of the belt at this area of the conveyor. The passengers continue to move smoothly onto the exit portion **28** and thence to the fixed upper landing **92**.

The hand rail drive provided by this invention inherently effects the driving of the hand rail at the same speed as the conveyor **12** without having to use chain and sprocket type mechanical motion transmitting structures or the like and the large driving and idler hand rail engaging sheaves, usually located at the side of the conveyor at each end thereof, to drive the hand rail off the head or other pulley of the conveyor. Consequently, conventional balustrade double panelling employed to hide such mechanisms may be eliminated and the balustrade may be a single panel in thickness, which may optionally be transparent to the extent desired, thereby reducing the overall width of the unit and creating a slimmer silouette that is highly compatible with modern architecture.

SPECIFIC DESCRIPTION

The conveyor pulleys and supporting rollers **46** are mounted on a suitable framework **100** which as shown in FIGURE 7 in the form illustrated comprises spaced channel members **102** fixed in place in any suitable manner on which the balustrades **62** are fixed in any suitable manner. The structural arrangement of and journalling for the conveyor pulleys may be of any conventional type and is not illustrated in the drawings in any great detail.

In the form shown, the conveyor belt upper run supporting rollers **46** are journalled in removably mounted channel shaped racks or holders **104** that are fixed between spaced support members **106** that extend transversely of the conveyor belt **12** and are in turn fixed between the respective channel members **102** in any suitable manner, such as by being affixed to webs **108** that are in turn fixed to the respective members **102**.

The individual rollers **46** each comprise a wheel member **110** keyed to a spindle **112** which is appropriately and preferably removably journalled between the side walls **114** of the respective supporting channel members **104**. It will be noted from the showing of FIGURE 3 that the rollers **112** of most of the holders **104** are staggered transversely of the belt to reduce wear and in practice the rollers **46** have a dimension transversely of the belt on the order of ½ an inch.

Preferably, the roller holders **104** are releasably secured in place, as by employing bolts or the like, so that they may be separately removed as required to service and/or replace the roller devices **46** they carry. As indicated in FIGURES 4 and 5, the support members **106** for holders **104** angle members, I-sectioned members or the like that include flange portions **117** and **119** on which the holders **104** seat on either side of the conveyor.

The hold down devices **54** at the concave portion **32** are in the form of rollers **120** in sets on either side of the conveyor and in practice comprise a plurality of rollers **120** journalled on an angle member **122** which is in turn held in place in any suitable manner as by being affixed to the adjacent portion of the main channel member **102**. As indicated at the left hand side of FIGURE 7, the rollers **120** ride at the very edge of the transport surface on either side of the conveyor **12** across the length of the concave portion **32**, and thus are to one side of the adjacent rollers **46**, thereby acting on the belt through a leverage system.

The plate structure **56** at the convex belt portion **34** in practice need be applied only across the length of the convex portion longitudinally of the belt, but in the specific form shown in FIGURES 3–5, the plate structure is in the form of an elongate plate structure **130** provided with a wear resisting surface **131** (see FIGURE 11) and that extends from a point adjacent the head pulley **14** to the point on the conveyor **12** somewhat beyond where inclined portion **30** thereof is tangent with the concave portion **34** (see FIGURE 4) to provide smooth transition for the passenger's weight riding onto plate structure **56** and from the plate structure **56** to the platform **92** (and its floating comb plate device **142**). In this form, the plate structure **130** is in the form of a channel member **133** (see FIGURE 11) mounted in place by being affixed as by welding to ribs **132** that are in turn fixed to a web plate **134** that is connected between the two channel shaped holders **104** of the rollers **46** at the exit side of belt convex portion **34**. The plate structure **130** extends to the left of FIGURE 4 for support by end support members **106A** and to the right of FIGURE 4 down over the convex portion **56**.

The rollers **46** at the belt portions **28** and **34** are mounted in place so that their upwardly disposed peripheries project above the surface **131** a distance on the order of ¼ inch, to permit belt **12** to ride free of plate structure **56** under no load conditions.

At the level entry **26**, the conveyor **10** is provided with a short support plate structure **138** that is indicated in FIGURES 3 and 5 to provide a smooth transition between fixed platform **90** (and its floating comb plate device **142**) and the belt **12**. Again, the rollers **46** adjacent same are mounted in place so that their upper peripheries are disposed above plate structure on the order of ¼ inch.

This plate structure **138** is indicated in FIGURE 5 as being supported by the adjacent end transverse support member **106B**, and has a width laterally of the belt similar to that of plate structure **56**.

It is preferred that a floating comb plate device of the type described in U.S. Patent 3,071,234 be applied where indicated at **142** at the entry and exit ends of the conveyors as a safety feature.

In the forms of FIGURES 1–8, the hand rail **68** is of conventional form and has the usual C-shaped configuration defining an endless band member **150** (see FIGURE 8) provided with a continuous, relative flat hand grip surface **152** on the exterior of its back **153** and hooked edges or flanges **154** which form a continuous recess **156** provided with a continuous open mouth **158** through which the clamping rollers **78** of device **74** have access to internal surface **84** of back **153**.

As indicated in FIGURE 7, the hand rail is supported on the upper or top portion of the balustrade **62** on a guide structure **60** having a complementarily shaped exterior **159** and is in sliding engagement therewith, although a suitable roller support may be employed if so desired. The hand rail guide **60** continues on around the ends of the balustrade and in the return direction where at the upper and lower ends of the conveyor the guide **60** has secured thereto the respective special guide bars **64** and **66** that continue the projection of the guide **60** but bend the hand

rail out of the plane of the balustrade and into the space between the conveyor upper and lower runs in the manner suggested in FIGURE 6 for guide bar **64** (the guide bar **66** is similarly arranged but in reverse manner).

As indicated in FIGURE 8A, the guide bars **64** and **66** widthwise substantially complement the width of the hand rail recess **156** to slidably guide the hand rail between the positions indicated. The bars **64** and **66** are secured in place in any suitable manner, as by fixing supporting straps **161** (see FIGURE 6) to the main channel supports **102**.

The clamping roller devices **74** each specifically comprise a channel member **160** that forms base **78** and is fixed between spaced angle members **162** that are fixed between the conveyor main channel members **102** in any suitable manner such as that suggested in FIGURE 8 with the rollers **76** being journalled within the respective channel member **78** in any suitable manner for rotation about axes that extend transversely of the conveyor.

The frame **80** of each device **74** that journals the rollers **78** is in the form of a channel member **164** having fixed thereto a pair of spaced swing arms **165** that are pivotally connected to the adjacent channel members **102** for swinging movement about an axis that extends longitudinally of the conveyor. Arms **165** are joined together by a plate **163** through which extends a plurality of bolt members **167** that extend between spring seats **166** and an angle member **168** that is fixed between the respective frame members **162**.

Interposed between the respective spring seats **166** and the plate **162** are the compression springs **82** that are placed under suitable compression to bias rollers **78** against the hand rail **86** by drawing nuts **170** upon the respective bolts **164**.

In the form of FIGURES 9 and 10, the roller type clamping devices **74A** are similar to devices **74** but their rollers **78A** operate against the hand gripping surface **152** of the hand rail to press the hand rail edges or flanges **154** against the belt surface **72**.

In this form of the invention, guide plates similar to guide plates **64** and **66** are employed to move the hand rail from the plane of the balustrade into between the upper and lower runs of the conveyor but the guide plate employed must invert the hand rail 180 degrees so that it assumes the position of FIGURE 9 with respect to the lower run of the belt. The modified guide bars are thus similar to the guide bar **64A** shown in FIGURE 14 which in addition to providing the lateral bending indicated in FIGURE 6 must have a 180 degree bend about its axis to invert the hand rail.

In this form of the invention, we prefer that the underedge portions **170** of the hand rail be serrated as at **171** in the manner indicated in FIGURE 10 to provide an improved gripping action on the surface of the belt they engage. The projections **173** thus formed provide a self wiping action on the belt surface **72** that helps eliminate the adverse effects of moisture that might be present on surface **72**.

The clamping roller arrangement **74B** of FIGURE 15 is the same as that shown in FIGURE 8 except that the hand gripping surface **152A** of the hand rail is formed with notches **181** that complement ridges **183** formed in the inside surface **72A** of the belt, and the hand rail is positioned with respect to the belt lower run so that it engages the transport surface on its return run with its respective ridges and notches aligned with the notches and ridges of the surface **72A**; the compressing action of the rollers **78A** is made such that the ridges of the hand rail will be pressed into the notches of the transport surface for interlocking of these components and thus establishing maximum traction between the two moving components.

The clamping arrangement of FIGURE 15 provides a self wiping relation between the hand rail and the belt as well as very positive driving action with little normal force.

One of the significant benefits of the hand rail drive arrangement of this invention is that the hand rail can be lubricated inside its recess **156** to facilitate its movement about guide structure **60**. Heretofore hand rails could not be lubricated at this point since the driving sheaves therefor required frictional engagement with the hand rail in this recess to establish driving traction therewith.

We claim:

1. Moving walkway apparatus for conveying passengers between floor levels at different elevations, said apparatus comprising:

a conveyor including an endless conveyor member and means for training same mounted to dispose the upper run of said member to present a transport surface defining a level entry portion at one end thereof at one of the floor levels, a level exit portion at the other end thereof at the other floor level, an inclined portion intermediate said level entry and exit portions, and convex and concave portions respectively interconnecting said entry and exit portions with said inclined portion, with the lower run of said member being disposed under said upper run,

means in driving relation to said conveyor member lower run for moving said member in a forward direction to convey passengers on said surface lengthwise thereof from said entry portion to said exit portion,

said endless member comprising belt means characterized by being resistant to bending laterally thereof while permitting substantial flexure longitudinally thereof,

said training means comprising:

end pulley means at either end of said conveyor, and

wheels positioned along either longitudinally extending edge of said run of said portions of said member,

said portions of said member being suspended between said wheels of either edge thereof,

roller guide means engaging said surface at either edge of said concave portion of said upper run,

and prop means engaging said member upper run under said convex portion thereof along the longitudinal axis thereof for holding said convex portion of said member level transversely thereof under the weight of passengers boarding said upper run entry portion,

an endless flexible hand rail member mounted at one side of said conveyor and trained to position the upper run thereof for ready gripping by the passengers,

said hand rail including a hand grip surface that is upwardly disposed in said upper run,

and means for coupling said hand rail member to said conveyor member for utilizing the movement of said conveyor member under the action of said moving means to move said hand rail member at the speed said conveyor member is moved,

said coupling means comprising means for releasably clamping the lower run of said hand rail member to the lower run of said conveyor member,

and including means for guiding said hand rail member lower run into vertical alignment with said conveyor member lower run for cooperation with said clamping means.

2. The apparatus set forth in claim **1** wherein:

said clamping means clamps said hand rail hand grip surface to said conveyor member lower run.

3. The apparatus set forth in claim **1** wherein:

said hand rail includes a serrated undersurface,

said guiding means orienting said hand rail lower run to bring said hand rail undersurface into juxtaposition with said conveyor member lower run.

4. The apparatus set forth in claim **1** wherein the undersurface of said conveyor member and said hand rail hand grip surface are formed with interlocking indentations that releasably lock together under the action of said clamping means.

5. In moving walkway apparatus for conveying passengers between floor levels at different elevations including an endless conveyor member mounted to present an inclined transport surface that extends between said levels, means for moving said member in a forward direction, and an endless hand rail mounted at one side of said conveyor member and trained to position the upper run thereof for ready gripping by the passengers on said member, the improvement including:

means for guiding the lower run of said hand rail into the space between said conveyor member upper and lower runs and into juxtaposition with the undersurface of said conveyor member at the lower run thereof,

and means for releasably clamping said hand rail lower run to said conveyor member lower run for driving said hand rail by said moving means through said conveyor member.

6. The improvement set forth in claim 5 wherein said clamping means comprises:

roller means engaging said hand rail,

roller means engaging said conveyor member in opposition to said hand rail engaging roller means,

and resilient means for biasing said hand rail roller engaging means against said hand rail to releasably clamp said hand rail to said conveyor member.

7. In moving walkway apparatus for conveying passengers between floor levels at different elevations including an endless conveyor member mounted to present an inclined transport surface that extends between said levels, means for moving said member in a forward direction, and an endless hand rail mounted at one side of said conveyor member on a balustrade and trained on said balustrade to position the upper run thereof for ready gripping by the passengers on said member, the improvement including:

means for guiding the lower run of said hand rail into and out of the space between said conveyor member upper and lower runs and into juxtaposition with the undersurface of said conveyor member at the lower run thereof,

and means for releasably clamping said hand rail lower run to said conveyor member lower run for driving said hand rail by said moving means through said conveyor member,

said balustrade including hand rail guide means for guiding the hand rail upper run between the ends of said transport surface and thence to and from said hand rail lower run guiding means,

said balustrade thereby being free of unsightly hand rail drive mechanisms.

8. In moving walkway apparatus for conveying passengers between floor levels at different elevations in which said apparatus comprises a conveyor including an endless conveyor member and means for training same to dispose said member to form an upper run shaped to present a transport surface defining a level entry portion at one end of the conveyor at one of the floor levels, a level exit portion at the other end of the conveyor at the other floor level, an inclined portion interconnecting said entry and exit portions, and convex and concave portions respectively connecting said entry and exit portions with said inclined portion, a lower run, and means for moving said member in a forward direction to convey passengers from said entry portion to said exit portion, the improvement wherein both said entry and exit portions are made possible in an arrangement wherein said conveyor member is to be an endless ribbon belt, said improvement comprising:

an endless ribbon belt that includes stiffener means extending laterally thereof for making same resistant to bending laterally thereof while permitting substantial flexure longitudinally thereof to permit said belt to bend around pulley means,

said training means comprising:

pulley means including end pulley means at either end of said conveyor,

and belt supporting wheels positioned to support said belt upper run between said end pulley means and along the longitudinally extending edges of the belt upper run and disposed to shape said belt upper run to define said transport surface portions when said belt upper run rides thereon,

said pulley means including bend pulley means in operative relation to the belt lower run,

said belt being trained over said pulley means and said wheels,

means for driving one of said pulley means,

means for tensioning said belt against said pulley means and said wheels whereby the drive of said one pulley means is transmitted to said belt through traction thereby established between said belt and said one pulley means,

said driving means and said tensioning means comprising said moving means,

said wheels having a width transversely of the belt substantially less than the width of said belt and being disposed along either of said edges of said belt upper run to define between said belt edges a smooth pathway extending lengthwise of said surface along which the passengers are moved,

roller guide means engaging said surface of said belt at said edges thereof along said concave portion of said belt upper run to hold said belt concave portion against those of said wheels defining same in opposition to the tension in said belt,

and prop means positioned to engage said belt upper run when loaded under said convex portion thereof along the longtudinal axis thereof for holding said convex portion of said belt level transversely thereof under the weight of passengers being conveyed thereacross,

said prop means comprising a plate member having a dimension transversely of said belt that is substantially less than the width of said belt,

those of said wheels adjacent said prop means spacing the belt when unloaded above said prop means whereby said belt rides free of said prop means under no load conditions,

whereby under no load conditions said belt upper run between said end pulleys is suspended between said wheels at said edges thereof, and under load conditions said prop means holds said belt upper run convex portion level transversely thereof,

and whereby the belt upper run, in being resistant to bending laterally thereof, in being suspended between said wheels, and in being supported by said prop means at said convex portion when loaded, provides smooth transit for passengers along said surface at said pathway between said entry and exit portions thereof and between said wheels on either side thereof without requiring a slider bed type support for said belt upper run extending continuously between said belt entry and exit portions and said edges thereof.

9. The apparatus set forth in claim 8 including:

an endless flexible hand rail member mounted at one side of said conveyor and trained to position the upper run thereof for ready gripping by the passengers,

said hand rail member including a hand grip surface that is upwardly disposed in said upper run,

and means for releasably clamping a portion of the lower run of said hand rail member to a portion of the lower run of said belt for utilizing the movement of said belt under the action of said moving means to move said hand rail member at the speed said belt is moved.

10. The apparatus set forth in claim 8 wherein:

said wheels are staggered laterally of said belt at said edges thereof.

11. The apparatus set forth in claim 8 wherein:
said roller guide means comprises a plurality of rollers engaging said belt surface laterally outwardly of the location of said wheels on either of said edges of said belt.

12. In moving walkway apparatus for conveying passengers including an endless conveyor member mounted to dispose the upper run thereof to present a transport surface on which the passengers ride, means for moving said upper run of said member in a forward direction to convey the passengers riding same, and an endless hand rail mounted at one side of said conveyor member and trained to position the upper run thereof for ready gripping by the passengers when on said member, said hand rail including a hand grip surface that is upwardly disposed in the upper run thereof, the improvement including:
means for guiding a portion of the lower run of said hand rail into juxtaposition with a portion of the lower run of said conveyor member,
and means for releasably clamping said hand rail lower run portion to said conveyor member lower run portion for driving said hand rail by said moving means through said conveyor member.

13. The improvement set forth in claim 12 wherein:

said clamping means clamps said hand rail hand grip surface to said conveyor member lower run at said portions thereof.

14. The improvement set forth in claim 12 wherein:
said hand rail includes a serrated undersurface,
said guiding means orienting said hand rail lower run portion to bring said hand rail undersurface at said portion thereof into juxtaposition with said conveyor member lower run at said portion thereof.

15. The improvement set forth in claim 12 wherein:
said conveyor member and said hand rail hand grip surface are formed with interlocking indentations that releasably lock together under the action of said clamping means at said portions thereof.

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UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,414,108 December 3, 1968

Randolph H. Jackson et al.

It is certified that error appears in the above identified patent and that said Letters Patent are hereby corrected as shown below:

Column 8, line 35, after "said", first occurrence, insert -- upper --.

Signed and sealed this 10th day of March 1970.

(SEAL)
Attest:

Edward M. Fletcher, Jr.
Attesting Officer

WILLIAM E. SCHUYLER, JR.
Commissioner of Patents