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CONTINUOUS AUTO-WAY FOR USE IN STRAIGHT, CURVED, ELEVATING AND DESCENDING PATHS

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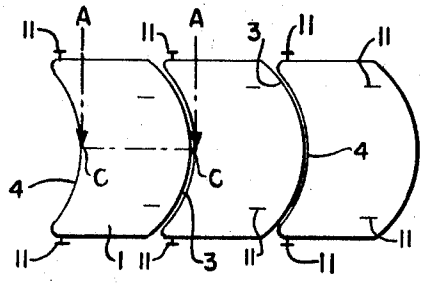

FIG. 1.

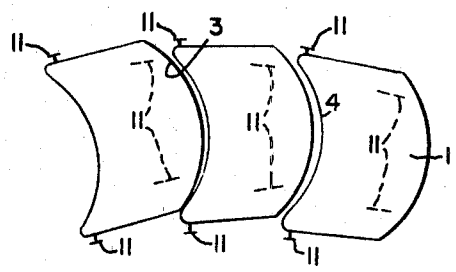

FIG. 4.

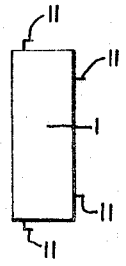

FIG. 2.

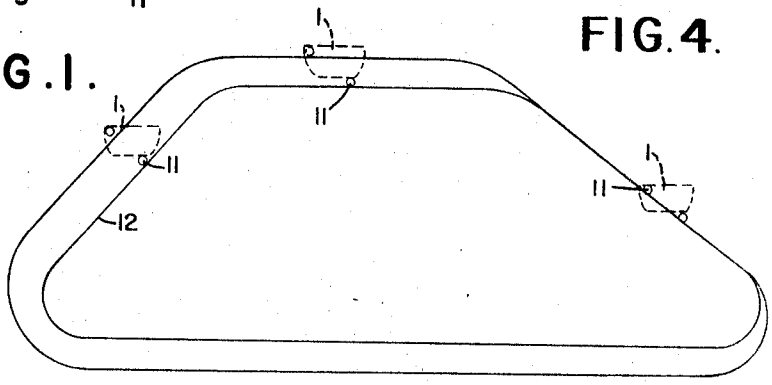

FIG. 8.

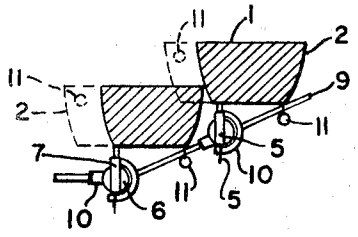

FIG. 5.

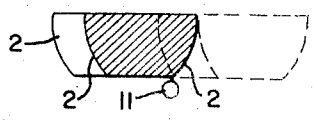

FIG. 3.

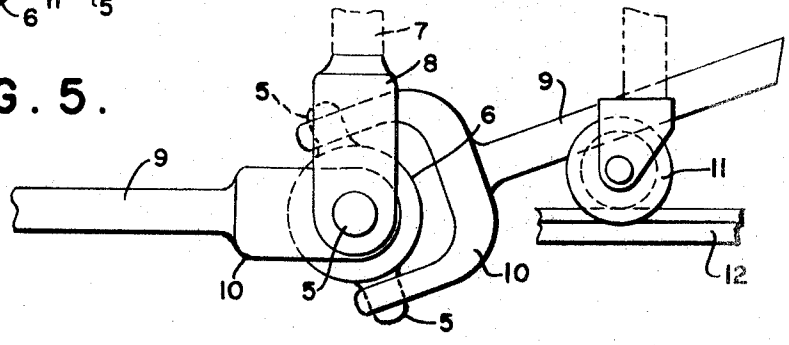

FIG. 6.

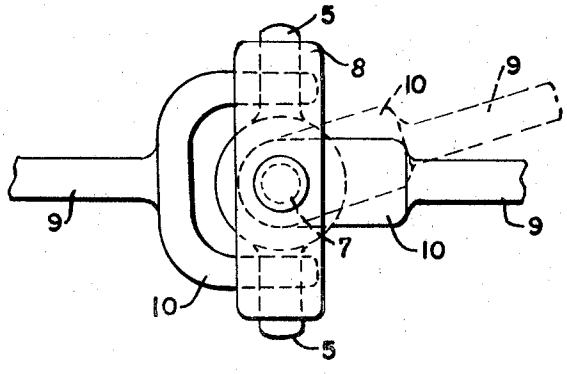

FIG. 7.

INVENTOR

Saburo Yamada

BY

Alvin Browdy

ATTORNEY

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CONTINUOUS AUTO-WAY FOR USE IN STRAIGHT, CURVED, ELEVATING AND DESCENDING PATHS

Saburo Yamada, Sakai-shi, Japan, assignor to Senyo Kogyo Kabushiki Kaisha, Naniwa-ku, Osaka, Japan, a corporation of Japan

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Int. Cl. B66b 9/12
U.S. Cl. 198—17 2 Claims

ABSTRACT OF THE DISCLOSURE

The disclosure relates to an auto-way or conveyor, such as for the continuous transportation of people, comprising a plurality of running boards interconnected by links through ball joints each having vertically and horizontally extending cross-like pins; the front and rear side edges of each board are arcuately formed and the front and rear ends have bowl-like surfaces; the side edges and end surfaces have the same curvatures respectively, whereby two adjacent boards make line-contact with each other and said boards can follow one another in their continuous path smoothly without creaking whether the path is straight, curved, elevating or descending, by means of wheels carried by the board so as to ride on rails suitably laid according to said paths.

The present invention relates to a continuous auto-way for use in straight, curved, elevating and descending paths.

In the design of running boards interconnected with one another in series and used in a continuous auto-way having straight, curved, elevating and descending paths, it has been proposed to curve both of the front and rear sides in each running board with the same curvature in order to permit the running boards to follow a curved path, and to dispose at the back or bottom surface of the running board a longer leg about twice as long as the thickness of the running board and also a shorter leg about one half of the longer leg in order to provide the elevating and descending paths. In this case, the adjacent running boards are made to contact as a whole with each other in one plane so that when they are traveling along an intermediate path between a horizontal path and a elevating path or between a descending path and a horizontal path, the sliding contact of the adjacent running boards causes a rough contact therebetween and creaking. Furthermore, there is still another defect in that the longer leg—twice the thickness of the running board—tends to be broken or fractured by the buckling load applied thereon from the running board, so that the stability of the running board is of course lost.

The reason for the provision of the longer and shorter legs are described above is that at both of the lower ends of the longer and shorter legs there are provided small wheels respectively, which ride on the inclined rails each having the same height, so that when the running board reaches the descending path the shorter leg is located at the relatively higher position whereas the longer leg is located at the relatively lower position. Now let it be assumed that the inclination of the rails is about 45°, then the length of the shorter leg plus the thickness of the preceding running board is substantially equal to the length of the longer leg of the following running board. This is the condition required for arranging the running board in steps, i.e. escalators, with the upper surface of each running board being maintained horizontal.

The height of the rail to be laid is dependent upon the descending horizontal, elevating and the intermediate paths. This will be discussed in more detail hereinafter.

The present invention, therefore, has for its object to eliminate or substantially reduce the above-described defects or disadvantages, and relates to a continuous auto-way for use in straight, curved, elevating and descending paths.

Primary objects of the invention are: to provide an improved conveyor having substantially universal movement along a guide path defined by guide rails or the like, and in which series-connected support members are articulated by universal connecting means connected at the lower leading edge and below the longitudinal axis of the conveyor and in a plane passing therethrough, and in which each support member has transversely-arcuate forward and rear ends in which adjacent ends of adjacent members are complementary and concentric to a center point on the longitudinal axis to facilitate relative movement horizontally and in which the members are arcuate inwardly and beneath the forward and rear ends to facilitate relative movement vertically between adjacent members.

In order that the present invention may be more readily understood, one embodiment thereof will be described by way of example with reference to the accompanying drawing, in which:

FIG. 1 is a top view;

FIG. 2 is a front view;

FIG. 3 is a sectional view taken along the line A—A of FIG. 1;

FIG. 4 is a schematic view of the running boards in a curved path;

FIG. 5 is a schematic view of the running boards in an elevating or descending path;

FIG. 6 is a side view of a link coupling mechanism;

FIG. 7 is a bottom view of the link coupling mechanism of FIG. 6; and

FIG. 8 is a diagrammatic side elevation showing the closed track circuit and the cooperative relation of the boards.

According to the present invention, both of the front **3** and rear **4** ends of a running board **1** have the same arcuate curves **2** in the form of a bowl as best shown in FIG. 3. The front side **3** of one running board **1** and the rear side **4** of the adjacent running boards are arcuately formed with the same arc of a circle the center of which is located at, for example, a point C at the back portion of and on the center line of the upper surface of said one running board.

Immediately below the center of the circle and along the vertical line passing through said center there is disposed a link coupling mechanism at the bottom portion of the running board **1**. The link coupling mechanism comprises a movable ball **6** provided with vertically and horizontally extending cross-like pins **5** (see FIGS. 5–7). Over the horizontally extending pins **5** is rotatably fitted a yoke **8** of a supporter **7** and a yoke **10** at the forward end of a link **9**; over the vertically extending pins **5** is also rotatably fitted a yoke **10** at the rear end of another link **9**. Each of the running boards is continuously connected together as a whole by successively interlocking both ends of the links **9** with the front side **3** being successively in a slidable contact relation with the rear side **4** of the adjacent running board.

The design is made with due regard to the lengths of the supporter **7** and the link **9** as well as the curvature of the curved end surfaces **2** of the boards so that when the running boards **1** are moved upwardly or downwardly there may exist essentially no gap or space between the front and rear curved end surfaces **2** of the two adjacent running boards **1** along the horizontal contact line therebetween. Wheels **11** are freely rotatably disposed respectively along both sides of each board **1** near the edge

of the rear end and wheels **11** are also provided at the front bottom portion of each running board **1**.

The novel and essential features which are believed to be characteristic of the present invention as to its construction have been described hereinbefore. Now the operation of the present invention will be described. When the running boards **1** are travelling along the horizontal path, the upper surface of each running board **1** is maintained always at the same horizontal level, while when the running boards **1** are on the elevating or descending path each of the running boards is arranged in step with the upper surface thereof being maintained also horizontally. This will be effected by riding the freely rotatable wheels **11** upon two pairs of rails **12** which are laid along the predetermined straight, curved, elevating or descending path and which have the different heights according to the above-described paths.

When the running boards **1** are travelling along the horizontal path, the continuous running boards **1** are driven by means of a chain drive or the like (not shown) which drives the lateral sides of the running board. Alternatively, the lower end of the supporter **7** disposed at the bottom of the running board **1**, as described above, is utilized as a pawl, which is driven by means of a chain drive or the like (not shown). It is preferable that the boards be restrained on each side of a casing (not shown) which has the same contour or form as the rail course; the casings hold therebetween slidably both lateral sides of the running board.

As described hereinbefore, each of the running boards **1** is provided with freely rotatable wheels **11**, which are disposed at both lateral sides and the bottom of the running board **1** and ride on the rails **12**. Therefore, the running board of the present invention has substantially no legs compared with the conventional running board which is provided with longer and shorter legs respectively. Thus, the resultant force of the compressive and bending forces acting from the running board **1** to the supporter **7** is negligible, so that the supporter **7** is not likely damage and the freely rotatable wheels **11** can rotate very smoothly.

The reason why the front side **3** of the running board **1** and the rear side **4** of the proceeding adjacent running board are arcuately formed with the same arc of a circle, the center of which is found at C at the back portion of and on the center line of the upper surface of the first mentioned running board **1**, is as follows: When the running boards **1** are on a curved path, as shown in FIG. 4, sliding displacement of the adjacent front and rear end surfaces becomes possible along one curved line, so that the running boards **1** can smoothly follow the curved path and then return to the initial straight path. When viewed from above, the bowl-like curved end surfaces **2** of the two adjacent running boards have no extending portion at all so that there exists essentially no space or gap between the upper surfaces of the two adjacent running boards **1**.

Furthermore, when the running boards **1** are moved vertically, as shown in FIG. 5, the curved end surfaces **2** always contact with each other along the arcuate curve line so that there exists also essentially no gap therebetween. Thus, even after a series of steps are formed, there is no gap throughout the whole running boards **1**. This is also true when the running boards **1** return to the horizontal path from the step path. The line contact of the running boards which is effected according to the present invention permits a light vertical movement of the running boards and causes no creaking compared with the conventional running boards in which both of the front and rear ends are formed flat with the large sliding contact area. When the running boards are arranged in the step form, a part of the upper end curved surface of the upper running board **1** is always somewhat superposed on the lower running board **1** so that a part of the board applied upon the upper running board is imparted to the lower running board **1**, whereby the stability of the whole structure is improved.

The links **9** are for connecting continuously the whole running boards **1**. When the running boards make straight, curved, elevating and descending paths or when they return to their original path. Front and back yokes of the link **9** are fitted over the crosspins **5** extending from the ball **6** can freely move vertically and towards right or left so that the formation of various paths of the continuous running boards is not prevented. Furthermore, the links **9** facilitate the movements and operations of the running boards for forming the various paths.

A typical installation, not illustrated, would be four rails laid in any desired course having straight, curved, elevating and descending paths. The wheels **11** carried on both lateral sides of the back upper portion of the running board ride on two rails while the wheels carried by both sides of the front bottom portion of the running board ride on the remaining two rails. On any path, the upper surface of the running board **1** is maintained horizontally. For this purpose, on the flat or horizontal path, the rails upon which the upper wheels **11** ride and the rails upon which the lower wheels ride are vertically spaced apart from each other. In the intermediate path from the flat or horizontal path to the descending path, the distance between two pairs of rails is gradually reduced and laid on the same level. In the intermediate path from the descending path to the horizontal path the distance between said two pairs of rails is gradually increased so that said two pairs of rails are vertically spaced apart from each other by a predetermined distance. In the intermediate path from the horizontal path to the elevating path, the distance between said two pairs of rails is gradually further increased. In the intermediate path from the elevating path to the horizontal path, the distance between said two pairs of rails are gradually reduced so that the distance therebetween returns to its initial distance in the initial path.

When the continuous running boards are driven along the rails on the above-described course, an auto-way running on a series of courses including the straight, curved, elevating and descending paths is obtained. The auto-way according to the present invention is not limited to the conventional escalator, the use of which is limited to the straight path, or to the auto-way the use of which is limited to the horizontal path. The present invention makes it possible to provide an auto-way for use in any complicated path along the whole course thereof so that it becomes unnecessary for a man to walk the course. The auto-way according to the present invention is very advantageous because this auto-way can provide the flat or horizontal straight and curved paths on a bridge crossing a road, a river, etc. or interconnecting between the skyscrapers where inward and outward paths are required.

The essential features of the present invention have been described in this specification without restricting the invention in minor details other than by the scope of the following claims.

What is claimed is:

1. An articulated conveyor mechanism for movement in a multitude of directions and particularly adapted for transporting personnel comprising:

a plurality of running boards (**1**) having an upper support surface for continuous movement in a horizontal plane,

said running boards having transversely-arcuate forward and trailing ends (**3**, **4**) symmetrical about a longitudinal axis of said boards,

the adjacent forward and trailing ends of adjacent boards being complementary for facilitating relative horizontal movement therebetween,

the forward and trailing ends of said boards converging (**2**) uniformly and arcuately beneath the

forward and trailing ends for facilitating relatively vertical movement therebetween; and

coupling means operatively connecting adjacent boards to each other and permitting relative universal movement between adjacent boards,

said coupling means comprising a plurality of elongated links (**9**) disposed beneath the center (C) of said boards and including a universal connector at one end providing both vertical and horizontal pivot axes (**5**),

each said coupling means including a support (**7**) connected at a lower portion to the horizontal pivot axis, and fixedly secured at an upper portion to one of the boards at the center of the board

said support being secured to a respective board beneath the lower trailing end of the respective board, said universal connector comprising a horizontal and vertical yoke (**10**) at opposite ends of said links (**9**), a ball element (**6**) have diametrically intersecting normal axle portions (**5**), the forward yoke of one link being journaled to a horizontal axle of one ball element, and the vertical yoke of an immediate leading

link being journaled to the vertical axle of said one ball element, said supports (**7**) including a yoke (**8**) journaled on said horizontal axles of the one ball element and projecting vertically to a lower portion of a board inwardly of the converging arcuate surface at the trailing end.

2. The structure as claimed in claim **1** in which said boards each include two pairs of rollers, one pair comprising lateral rollers (**11**) for engaging guide tracks or the like, and one pair comprising depending rollers (**11**) flanking the longitudinal axis of the board whereby the conveyor mechanism follows a fixed path of travel.

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EVON C. BLUNK, Primary Examiner

D. D. WATTS, Assistant Examiner