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(54) PERSONNEL-CONVEYOR

(71) We, HITACHI, LTD., a Corporation organised under the laws of Japan, of 5-1, 1-chome, Marunouchi, Chiyoda-ku, Tokyo, Japan, and HITACHI-MITO KOGYO, LTD., a Corporation organised under the laws of Japan, of 1450-20, Aza Nishihara, Tarazaki, Katsuta-shi, Ibaraki-ken, Japan, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to a personnel-conveyor such as an escalator.

An escalator which is typical of personnel-conveyors is arranged as follows: Endlessly continuous steps connected to one another are placed between a pair of balustrades positioned respectively on either side of the steps and driven by upper and lower drive units, being guided by tracks on their upper line as well as by other tracks on their return, thereby travelling on tracks. In addition, a pair of endless hand rails, on each side, are guided on the balustrades on their upper line, and by guide rollers on their return run, and travel at the same speed and in the same direction as the endlessly continuous steps.

An escalator of this type includes a main frame body on the both sides consisting of an upper main member and a lower main member, and subsidiary members fixed thereto, thus providing a truss construction. In addition, track supporting members are rigidly connected to the subsidiary members positioned on both sides of the steps in the transverse direction and cantilever track supporting beams are fixed to each subsidiary member, while tracks for an upper line of the steps are fixed to the track supporting members and other tracks for return of steps are fixed to the cantilever track supporting beams, respectively. Step-supporting wheels attached to the side edges of the steps roll on the aforesaid tracks, being driven by step chains which connect the steps into an endless form. Guide rollers for use with the handrails are attached to guide-roller-sup-

porting bases secured to the subsidiary members in the main frame body, and roll and guide the handrails on their return. In addition, the lower main members in the main frame body on the both sides are connected together rigidly by connecting members, to which is secured a drip pan adapted to receive lubricating oils fed to step-chains and tracks or dusts carried by passengers. As has been described, the main frame body is of a welded truss construction consisting of upper main members, lower main members and subsidiary members, which are independent of each other, so that a large number of members have to be used. In addition, the subsidiary members in general have varying lengths depending on the positions thereof, i.e., in upper and lower horizontal step portions (entrance and exit portions), or in intermediate inclined portions. Still furthermore, the subsidiary members should bear various kinds of stresses, unlike the main members, so that subsidiary members of varying sizes and lengths are required, resulting in a complicated main frame body. Yet furthermore, independent members are welded together to provide a truss construction, thereby incurring assembly errors and hence lowering in dimensional accuracy of tracks. As a result, there is required an expenditure of much time and efforts for correcting dimensional errors, preparation of materials, quality control of members, and accuracy in assembly. Furthermore, supporting beams and supporting members consist of entirely independent members welded to the subsidiary members, thus suffering from the shortcomings similar thereto.

For allowing endless steps to travel smoothly in carrying passengers with safety, the dimensional accuracy of tracks upon attaching should be highly controlled. However, these tracks have to be fixed in supporting members or supporting beams welded to the subsidiary members of a main frame body, resulting in an assembly operation in narrow spaces within the main frame body, with the accompanying lowered operational efficiency, thus dictating much time

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and efforts and high level of skill. In addition, even if the supporting bases are attached normally or properly, the supporting beams provide a canti-lever construction, so that the supporting beams are susceptible to deformation due to vertical loads given by such as passengers, steps and the like, thus leading to improper dimensional accuracy of tracks, thereby hindering smooth travelling of steps.

While description has been had for an escalator in conjunction with the shortcomings thereof, personnel conveyors such as electrically driven passages, in general, all suffer from the shortcoming similar thereto.

It is an object of the present invention to provide a personnel conveyor which is simple in construction and allows ease of assembly and dimensional adjustment.

According to the present invention there is provided a personnel conveyor comprising: a continuous flight of steps formed from a plurality of steps which are connected with one another by connecting means into an endless form which is disposed in a running direction of the conveyor, each of said steps having front and rear wheels on opposing transverse sides; guide tracks disposed beneath said front and rear wheels and extending in the running direction of said steps so as to guide said front and rear wheels; balustrade constructions provided at the sides of said continuous flight of steps; main frame members arranged beneath said balustrade constructions and extending the length of said continuous flight of steps at the sides thereof, each main frame member consisting essentially of upper and lower horizontal elements and a vertical element interconnecting said horizontal elements; transverse beams interconnecting said upper horizontal elements of said main frame members; transverse connecting members interconnecting said lower horizontal elements of said main frame members; and support brackets carried by said transverse beams and extending in the running direction of said steps, said brackets supporting said guide tracks for said front and rear wheels.

Embodiments of the present invention will now be described by way of example with reference to the accompanying drawings, in which:

Fig. 1 is a side view of an escalator showing one embodiment of the present invention;

Fig. 2 is an enlarged partial cross-sectional view of the escalator, taken along the line II-II of Fig. 1; and

Figs. 3 to 6 are cross-sectional views of essential parts of other embodiments of the invention.

An outline of an escalator embodying the present invention will now be described in more detail in conjunction with Figs. 1 and 2. Provided within each of a pair of balustrades

1 is a main frame member 4 of a beam form, which is made of steel with an "I" shaped cross-section. Each of the main frame members 4 consists of upper and lower horizontal edge portions 2, 2' and vertical portions 3 which is between the upper and lower horizontal edge portions 2, 2' therebetween. Transverse beams 5 are secured to the upper edge portions 2 of the main frame members 4, while transverse connecting members 6 are secured to the lower edge portions 2', respectively. Thus, there is formed a main frame body of a box type. In addition, track supporting brackets 16, 17 are secured to transverse beams 5, while tracks 9, 10 for upper line are integrally secured to the supporting brackets 16, and tracks 11, 12 for return run are integrally secured to the supporting brackets 17. Guide rollers adapted to guide a hand-rail 13 on its return are mounted by the medium of guide-roller supporting brackets (not shown) on the upper edge portions of the main frame members 4.

Front wheels 7 and rear wheels 8 attached to the left and right sides of steps 15 roll and travel on the tracks 9 to 12, while hand-rail 13 travel on the guide rollers on its return.

In this embodiment, a steel beam having an "I" shaped cross-section is used as the main frame member 4, while the upper edge portions 2 are coupled together by transverse beams 5, and the lower edge portions 2' are coupled together by transverse connecting members 6 which support a drip pan 22 thereon, thereby forming a main frame body. Thus, the main frame body is not of such a construction as that of the prior art, in which independent members are assembled or welded together for providing a truss construction. In contrast thereto, the construction of the personnel-conveyor according to the present invention is simple, and provides ease of assembly and toughness because of a box-shaped construction of the main frame body.

As is clear from the foregoing, the construction of the main frame body is simplified, and in addition, the portions which require dimensional accuracy upon assembly of the main frame body are only the upper horizontal edge portions 2 of the main frame member 4, to which the transverse beams 5 holding tracks 9 to 12 are to be secured, and to which guide rollers are to be attached, thereby allowing easy assembly and dimensional adjustment of the main frame body. In addition, the supporting brackets 16, 17 for tracks 9 to 12 each support the two tracks such as 9, 10 and 11, 12 respectively, thus improving the efficiency of attaching operation.

Furthermore, the rail supporting brackets 16, 17 are secured to the transverse beams

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5, so that the rail supporting brackets 16, 17 may bear vertical loads acting on the tracks 9 to 12 in the vertical direction, i.e., in the same direction as that of the loads, thus preventing deformation of guide rails 9 to 12, and maintaining dimensional accuracy thereof achieved upon assembly, for a long period of time.

As a result, improper dimensional adjustment of guide rails due to improper assembly, and deformation of guide rails due to loads may be completely prevented, thus avoiding zig-zag travelling of steps and resulting vibrations and noises, so that there may be achieved an escalator providing a high and consistent performances for a long period of time.

On the other hand, according to the prior art escalator, the rail-supporting members support respective rails individually, and are welded to the main frame body, so that rails 9 to 12 have to be assembled in the main frame body within a limited narrow space therein and adjusted for proper dimensions. In contrast thereto, according to this embodiment of the present invention, a pair of tracks 9, 10 for the upper line and a pair of tracks 11, 12 for the return on one side may be integrally supported by the supporting brackets 16, 17, as an integral construction, respectively, and thereafter the assemblies of tracks and supporting brackets may be fixed in the main frame body, respectively. As a result, before the aforesaid tracks are constructed in the main frame body, several tracks may be assembled, thus allowing easy dimensional adjustment and an improved attaching operation of the aforesaid assemblies, when assembled into the main frame body.

Meanwhile, in the embodiment shown in Fig. 2, description has been given of the supporting brackets adapted to each support a pair of tracks for an upper line or a return on one side of the escalator, respectively, integrally. Alternatively, Fig. 3 shows a single supporting bracket 18 adapted to integrally support four tracks for upper line and return on one side. Further alternatively, Figs. 4 and 5 show supporting brackets 19, 20 which are each adapted to support four tracks 9, 10 on the upper line on the left and right sides or four tracks 11, 12 on the return on the left and right sides, integrally, on the same bracket. In addition, Fig. 6 shows a single supporting bracket 21 which may support eight tracks 9 to 12 for the upper line and return on the both sides integrally.

In case two or more tracks 9 to 12 are integrally supported by a single supporting bracket, each of the tracks are fixed to the several supporting brackets at intervals of 0.5 to 1.5 m. More particularly, two to eight of guide tracks 9 to 12 are rigidly as-

sembled on several track-supporting brackets 16 to 21, and then the brackets are secured to the transverse beams 5 which are in turn secured to the upper edge portions 2 of the main frame members 4 at the same interval as that of the supporting brackets.

As shown in Figs. 4 to 6, transverse connecting portions 19a, 20a, 21a may be commonly used as transverse beams 5, and in such a case, rail supporting bases 19 to 21 are directly secured to the main frame members 4, without using the transverse beams 5.

From viewpoints of manufacture and transportation, respective tracks 9 to 12 are generally cut to a suitable length as shown by the lines A—A, B—B in Fig. 1. In this embodiment, as well, tracks are secured to their supporting brackets to provide integral constructions for each division of the escalator.

As is apparent from the foregoing description, the positional relationship of mutual guide tracks may be adjusted independently from the dimensional accuracy of the main frame body, and yet the adjustment or assembly of the tracks may be carried out outside of the main frame body, thus providing ease of adjustment. In addition, assembly of tracks and main frame body may be carried out in line with each other, or at the same time, resulting in much improvement in operational efficiency. In addition, track supporting bracket 16 to 21 may be secured to the transverse beams 5 before-hand, and then tracks 9 to 12 may be secured to the supporting brackets. In this case, two or more track supporting brackets may be secured in position to the main frame body according to a single attaching operation of a beam, thereby saving the effort required for the attaching operation.

While the main frame members 4 of an 'I' shaped cross section ('I' steel) are used in the aforesaid embodiment, main frame members of a 'U' shaped cross section may be used, with their open sides being directed inwardly or outwardly, with the same results achieved as those of the preceding case. In addition, while description has been given for the case of an escalator, the present invention is apparently applicable to general type man-conveyors such as electrically driven passages and the like.

As is apparent from the foregoing, the main frame body is not only tough but also its construction is simplified, thereby permitting ease of assembly of respective components such as tracks, as well as ease of adjustment thereof, with the resulting improvement in efficiency of the attaching operation of respective components, and reduction in manufacturing cost.

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WHAT WE CLAIM IS:—

1. A personnel conveyor comprising: a continuous flight of steps formed from a plurality of steps which are connected with one another by connecting means into an endless form which is disposed in a running direction of the conveyor, each of said steps having front and rear wheels on opposing transverse sides; guide tracks disposed beneath said front and rear wheels and extending in the running direction of said steps so as to guide said front and rear wheels; balustrade constructions provided at the sides of said continuous flight of steps; main frame members arranged beneath said balustrade constructions and extending the length of said continuous flight of steps at the sides thereof, each main frame member consisting essentially of upper and lower horizontal elements and a vertical element interconnecting said horizontal elements; transverse beams interconnecting said upper horizontal elements of said frame members; transverse connecting members interconnecting said lower horizontal elements of said main frame members; and support brackets carried by said transverse beams and extending in the running direction of said steps, said brackets supporting said guide tracks for said front and rear wheels.
2. A conveyor as claimed in claim 1, in which each transverse beam carries a unitary

support bracket for supporting the guide tracks for the front and rear wheels of at least one side of the continuous flight of steps.

3. A conveyor as claimed in claim 1 or 2, in which each support bracket comprises a unitary construction for supporting the guide tracks for the front and rear wheels of both sides of the continuous flight of steps.

4. A conveyor as claimed in claim 3, wherein a transverse portion interconnecting guide track support portions of each integral support bracket on opposite sides of the continuous flight of steps serves as the transverse beam.

5. A conveyor as claimed in any of the preceding claims, further comprising endless hand rails are disposed above and below said balustrade constructions, said hand rails being adapted to move in the running direction of said steps at the same speed as said steps.

6. A personnel conveyor substantially as hereinbefore described with reference to Figures 1 and 2, or Figure 3, or Figure 4 or Figure 5 or Figure 6 of the accompanying drawings.

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