

PASSENGER CONVEYOR

This invention relates to a passenger conveyor such as a moving stairway, a moving walkway, and particularly to a passenger conveyor in which a construction of a body frame and a handrail driving device is improved from saving space in a building.

- 5 In general a passenger conveyor comprises two kinds of moving bodies, that is, steps attached to continuously circulating endless belt or chain, and a pair of handrails which are symmetrically disposed on the sides of the steps so as to circulate with the steps for use in providing support for passengers. The moving bodies, handrail driving devices,
10 are mounted on the body frame which is installed between the floors. The body frame has upper and lower chords as main frames, and the handrail driving device is mounted on the upper chord in lateral relationship therewith.

It is a requirement that the passenger conveyor be manufactured
15 with the minimum size particularly with reference to a reduction in the overall width of the conveyor without reducing the transportation capacity, and without causing any problems or disadvantages. The whole width of the passenger conveyor includes the width of the steps, the body frame and the handrail driving device, and the distance between the body
20 frame and an outer or side panel covering the body frame, the handrail driving device. Generally this distance is 1.5 - 1.7m. The most effective space-saving would be achieved by reducing the whole width of the passenger conveyor. Such width reduction, however, is very difficult. Since the width of the steps cannot be reduced in view of the
25 transportation capacity, improvements on the width reduction are directed to the width of the elements other than the step width.

Various proposals have been made for the width reduction of passenger conveyors, and some of these proposals are disclosed for example in Japanese Patent Publication 56-38503/1981 and Japanese Patent
30 Laid-open 57-141379/1982.

In Japanese Patent Publication 56-38503, a handrail driving device as mentioned above is disposed over the body frame made of truss-like constructions as shown in Fig. 4. In this case a deck and side panel

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covering the handrail driving device and, the body frame, is necessarily raised fairly high to accommodate the handrail driving device. Since the handrail has a constant height suitable for person's gripping it, and the deck and the outer or side panel covering the inside of the

5 construction are made of opaque material, when the deck is too high, the transparent part of the balustrade is very little and aesthetic qualities due to transparency is lacking, which is disadvantageous. Japanese Patent Laid-open 57-141379/1982 discloses another example of the proposals in Figs. 3 and 4 in which the upper chord which is one of main
10 frames defining a body frame of a truss construction has a length removed thereby to leave opposed facing end surfaces and the handrail driving device is inserted between these surfaces and is welded to these surfaces. In this construction, the upper chord is disposed within the handrail driving device with respect to the width direction, so that the
15 whole width of the passenger conveyor decreases. However, this construction has such problems because the body frame decreases in strength since the part of the upper chord which is designed to bear a large load is removed, and as thermal strains caused by the welding are brought into the body frame and the handrail driving device.

20 Therefore it is desirable to provide a passenger conveyor in which the overall width is reduced and achieved saving in space without causing any problems or disadvantages.

According to the present invention there is provided
a passenger conveyor comprising framework, a plurality of steps
25 supported by the framework, the steps being connected together and mounted on the framework to circulate in an endless manner, a pair of handrails disposed on opposite sides of the steps, and handrail driving devices each mounted on the framework for driving the handrails to circulate the handrails at substantially the same speed
30 as the speed of the steps, wherein the framework comprises a main frame including upper and lower horizontal sections and an inclined section extending therebetween; and upper and lower auxiliary frames respectively mounted to the upper and lower horizontal sections, the upper auxiliary frame being disposed on the upper horizontal section
35 so as to provide for an exposed upper surface portion of the upper horizontal section adjacent the inclined section; a recessed portion for accommodating the handrail driving devices being defined by the exposed upper surface portion of the upper horizontal section of the main frame and a front side of the upper auxiliary frame; and each of
40 the handrail driving devices is disposed in the recessed portion such that the driving device is positioned over the main frame.

In one preferred embodiment the lower integral auxiliary frame and lower horizontal section of the main frame forms a machine room therein for accommodating machinery such as chain wheels.

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

Fig. 1 is a side view of an embodiment of a passenger conveyor according to the present invention;

Fig. 2 is an enlarged side view of a part of Fig. 1;

Fig. 3 is a sectional view taken along a line III-III of Fig. 2;

10 Fig. 4 is a sectional view of a modified form of passenger conveyor to that shown in Figs. 1-3;

Fig. 5 is a side view of another embodiment of a passenger conveyor according to the present invention;

Fig. 6 is an enlarged sectional view of a handrail driving device
15 shown in Fig. 5; and

Fig. 7 is a side view of a another embodiment of a passenger conveyor according to the present invention.

In Fig. 1, a passenger conveyor has two kinds of moving bodies, steps 1 attached to a continuously circulating endless chain belt 2 and a
20 pair of handrails 3, and in general is installed between the first and second floors of F_1 and F_2 of a building. These moving bodies are mounted on a framework 4. The framework 4 consists of a main frame 5, an upper auxiliary frame 6 and a lower auxiliary frame 7. The main frame 5 has substantially the same height (h) over the whole of its length and
25 consists of an upper horizontal section 501, a lower horizontal section 502 and an inclined section 503. The upper auxiliary frame 6 is of a boxlike framework and is fixedly mounted on the upper horizontal section 501 of the main frame 5 so that the upper surface of the framework 4 is recessed, that is, a part of the horizontal section 501 and the front
30 face of the auxiliary frame 6 form a recess 8 or space suitable for accommodating a handrail driving device 9 near the boundary between the

upper horizontal section 501 and the inclined section 503 of the main frame 5. The main frame 5 and the upper auxiliary frame 6 form an integral frame portion whose height H_1 is the same as that of a conventional apparatus and on which a floor plate is mounted. The 5 integral frame portion is at the same level as the second floor F_2 and forms therein a machine room 10 for accommodating machinery 11. The machinery 11 consists of a driving apparatus 12 for driving a chain 13, a driving wheel 14 drivable by the chain 13 and driving the above-mentioned endless chain belt 2 to which the steps 1 are attached. A driving chain 10 wheel 15 engages with a chain 16 for transmitting a driving force to the handrail driving device 9 via idle wheels 17.

The handrail driving device 9, as shown in Figs. 2 and 3, is disposed in the recess 8, and is mounted on standing bars or members 18, 19 which are secured to the main frame 5 by welding so as to project 15 upward from the surface of the main frame 5. The standing bars have brackets 20 secured thereto by welding. On the brackets 20 a frame 21 is fixedly mounted by means of screws for example. The frame 21 carries rollers 22 which are freely rotatable on pins 23 secured to the frame 21. The device 9 further includes a mounting plate 25 which has a shaft 26 20 secured thereto. Rotatably mounted on the shaft 26 is a sprocket 28 with driving wheels 29 joined to the sprocket by shaft 27 coaxial with the shaft 26. A sprocket 30 is rotatably mounted on a shaft secured to the mounting plate 25. Sprockets 31 and 32 are secured to each other and rotatably mounted on a shaft secured to the mounting plate 25. The 25 mounting plate 25 has guide pins 33 secured thereto by brackets 34. Each guide pin 33 extends downward, and is slidably inserted into a hole in a guide member 24 secured to the frame 21 so that the mounting plate 25 is movable vertically and the driving wheel 29 presses the handrail 3 on the roller 22 thereby causing frictional force between the handrail 3 and the 30 driving wheel 29. A chain 39 interconnects the sprockets 28, 30, 31. The chain 39 receives a driving force from the chain 16 and circulates so that the driving wheels 29 are rotated. As the driving wheels 29 rotate, the handrail 3 circulates.

The handrail 3 is provided along the circumference of the balustrade 35 and circulates therearound. The balustrade 35 is secured to a deck 36 which is secured to outer and inner panels 37 and 38. The panels 37, 38 and the deck 36 surround the handrail driving device 9.

5 The handrails 3, balustrade 35, handrail driving device 9 are each prepared as an assembly and they are symmetrically arranged with respect to the steps. The handrail driving device 9 is disposed in the recess 8 so that the mounting plate 25 and the main frame 5 are not disposed side by side, the former being disposed over the latter without changing the
10 height of the deck 36. According to this embodiment the overall width W_2 of the passenger conveyor is reduced by 100-150mm without changing the step width W_1 , compared with the conventional passenger conveyor in which the handrail driving device and the main frame are arranged side by side. Furthermore, the deck 36 is not too high and is at the same in height as
15 in conventional passenger conveyors. Therefore, when transparent balustrades are used, the feeling asthetic qualities of transparency is not lacking.

The lower auxiliary frame 7 is fixedly mounted on the lower horizontal section 502 of the main frame 5 to form an integral frame
20 portion, and the integral main frame portion forms a machine room 43 therein for accommodating machinery such as chain wheels. The upper surface of the auxiliary frame 7 and the inclined section of the main frame 5 are recessed in the vicinity of the boundary between the lower horizontal and inclined sections 502 and 503 thereby providing a recess 40. A standing
25 bar 41 is secured in the recess 40 by welding to the inclined section 503 so as to project upward from the upper surface thereto. A tension device 42 is connected to the bar 41 so that the tension device 42 and the main frame do not overlap in lateral relationship. The tension device 42 tensions the handrail 3 so that the handrail 3 will not project outside
30 the turning ends of the balustrade in the lengthwise direction thereof.

Thus, according to this embodiment, the total width of the passenger conveyor is reduced by 100-150mm, and the space corresponding to the reduced width is saved.

The above-mentioned main frame is preferably an I-shaped beam
35 having height (h), for example.

A modification of the handrail driving device 9 is described hereinafter referring to Figs. 1 and 4.

In Fig. 4, a modified handrail device 9a has a mounting plate or frame 25a secured to the standing bar 19 and a standing bar portion 601 5 of the upper auxiliary frame 6 (see Fig. 1). The mounting plate 25a is provided with a boss 251 which rotatably supports a shaft 27a via bearings 252. The shaft has a sprocket 28 at one end and a driving wheel 29 at the other end. The driving wheel 29 is rotatable by a chain 39 engaged with the sprocket 28 and a sprocket 31 which is coaxially secured 10 to a sprocket 32 and is supported by a pin secured to the mounting plate 25a. The sprocket 32 is driven by the chain 16 which is driven by the driving apparatus provided in the machine room of the body frame 4. The supporting beam 21 supports the roller 22 on a pin and has a bracket 24a secured thereto to which a vertical pin 33a is secured and the pin 33a is 15 slidably inserted in holes made in guide members 34a secured to the mounting plate 25a. The beam 21 is biased by a compression spring 45 provided between the beam 21 and a support 20a secured to the mounting plate 25a, so that the handrail 3 is pressed on the driving roller 29 by the roller 22, whereby the handrail 3 is circulated by a rotating force 20 from the driving wheel 29. The handrail driving device 9a is covered as previously disclosed in the last embodiment with the deck 36 and the outer panel 37.

The handrail driving device 9a and the main frame 5 are not laterally arranged and this construction also reduces the total width W_3 25 by about 100-150mm.

Another embodiment of the invention is described hereunder referring to Figs. 5 and 6.

In Fig. 5, a body frame 4b consists of a main frame 5b and upper and lower auxiliary frames 6 and 7. The main frame 5b is made in truss 30 construction and has upper and lower horizontal sections 501b and 502b the height of which is h, and an inclined section 503b. The inclined section 503b has a portion of height H which is higher than the height h and a portion of the height h at the lower region. The upper and lower auxiliary frames 6, 7 are rigidly mounted on the upper and lower 35 horizontal sections 501b and 502b, respectively, so as to form integral

upper and lower frame portions each of which has height H_1 higher than the height H or h and form therein machine rooms similar to the embodiment of Fig. 1. The upper and lower auxiliary frames 6 and 7 serve to mount thereon a floor plate for the entry or exit areas of the 5 passenger conveyor and to install the passenger conveyor on the floors F_1 and F_2 .

The upper auxiliary frame 6 and the upper horizontal section 501b of the main frame 5b form an upper recess or space 8 which is substantially the same as in the Fig. 1 embodiment. In the recess 8, a 10 handrail driving device 9a which is the same as shown in Fig. 4 is disposed and secured to a standing bar 19b secured to the frame 5b and the standing bar portion 601 of the upper auxiliary frame 6, by the mounting plate or frame 25a of the device 9a. The standing bar 19b is supported by a stay member 191 at the upper portion.

15 Referring to Fig. 6, it is best seen that the handrail driving device 9a is disposed directly over the main frame 5b and is secured to the main frame 5b through the standing bar 19b. And the handrail driving device 9a is covered with the deck and the outer panel. The total width W_3 of the passenger conveyor also is reduced by 100-150mm without 20 changing the width W_1 of the passage for passengers.

Referring back to Fig. 5, the lower auxiliary frame 7 and the lower portion 504b of the inclined section 503b of the main frame 5b form a recess 40 for installing a tension device 42. The tension device 42 is connected to a standing pole 41 secured to the upper surface of the main 25 frame 5b so that the tension device 42 including the standing pole 41, is not arranged laterally of the main frame 5b. The tension device 42 also is accommodated within the side panel 37 the width of which is reduced by 100-150mm.

Another embodiment of the passage conveyor according to the 30 present invention is described referring to Fig. 7.

This embodiment is the same as that shown in Figs. 5 and 6 except that a reinforcing member 192 is provided. The reinforcing member 192 is fixedly mounted on the upper portion of the standing bar 19b and the upper auxiliary frame 6 so as to span the handrail driving device 9a.

In all the above-mentioned embodiments, the height H_1 of integrated frame portion is about 1m, for example, and the height (h) of the horizontal section of the main frame is about one half of H_1 or less, for example 470mm.



CLAIMS:

1. A passenger conveyor comprising framework, a plurality of steps supported by the framework, the steps being connected together and mounted on the framework to circulate in an endless manner, a pair of handrails disposed on opposite sides of the steps, and handrail
5 driving devices each mounted on the framework for driving the handrails to circulate the handrails at substantially the same speed as the speed of the steps; wherein the framework comprises a main frame including upper and lower horizontal sections and an inclined section extending therebetween; and upper and lower auxiliary frames
10 respectively mounted to the upper and lower horizontal sections, the upper auxiliary frame being disposed on the upper horizontal section so as to provide for an exposed upper surface portion of the upper horizontal section adjacent the inclined section; a recessed portion for accomodating the handrail driving devices being defined by the
15 exposed upper surface portion of the upper horizontal section of the main frame and a front side of the upper auxiliary frame; and each of the handrail driving devices is disposed in the recessed portion such that the driving device is positioned over the main frame.
2. A passenger conveyor as claimed in claim 1, wherein each of the
20 upper and lower auxiliary frames is a boxlike framework having thereon an upper portion mounting a floor plate and wherein the framework forms a machine room in cooperation with a part of the first horizontal end section of the main frame.
3. A passenger conveyor as defined in claim 1, wherein each of the
25 handrail driving devices includes a fixed frame secured to a standing member provided on the main frame so as to project upwardly from an upper surface of the main frame; followers rotatably mounted on the main frame and supporting the handrail; a mounting member engaged with the main frame so as to be movable perpendicularly to a running
30 direction of the handrail; and driving wheels rotatably mounted on the mounting member to drive the handrail in a circulatory manner, the handrail sandwiched between the driving wheels and the followers.
4. A passenger conveyor as defined in claim 3 wherein the
35 main frame has a truss construction, the inclined section of the main frame is of a reduced height at both end portions of the inclined section and at the upper and lower horizontal sections than an intermediate portion extending between the end portions of the inclined section.



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5. A passenger conveyor as claimed in claim 4, wherein the handrail driving device including the mounting member is fixed to a standing member secured to the main frame and upper auxiliary frame.
 6. A passenger conveyor as claimed in claim 5, wherein there is
5 provided a reinforcing member fixed to the standing member and the upper auxiliary frame so as to span the handrail driving device.
 7. A passenger conveyor as claimed in claim 1, wherein the lower auxiliary frame and lower portion of the inclined section of the main frame define a recessed portion and a tension device for imparting
10 tension to the handrail is positioned in said recessed portion.
 8. A passenger conveyor substantially as hereinbefore described with reference to, and as illustrated in, Figs. 1 to 3; or Figs. 1 to 3 as modified by Fig. 4; or Figs. 5 and 6; or Fig. 7 of the accompanying drawings.
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