

Passenger Conveyor

FIELD OF THE INVENTION

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Embodiments of the present application relate to a passenger conveyor, especially to a step bushing of the passenger conveyor.

BACKGROUND

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A passenger conveyor for an escalator, a powerwalk or the like usually comprises: a plurality of steps moving circularly; a step shaft assigned to each step; a loop-shaped step chain coupled to the step shaft at either side of each step; and a plurality of chain wheels for engaging between the step chains to drive the steps via the step shafts.

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As mentioned above, in such a passenger conveyor, each step is assigned with the step shaft. Moreover, a bushing is provided between the step and the step shaft. With regard to the bushing, patent publication No. 1 discloses a kind of bushing, which comprises bushing body. An oil groove is provided in an inner wall of the bushing body. An oil filling hole is opened in the bushing body such that it passes through the bushing body's wall and thus is in communication with the oil groove. Lubricant oil or grease can be filled into the oil groove by the oil filling hole. According to the bushing recorded by the patent publication No. 1, lubricating effect between the bushing body and the step shaft can be greatly improved, and refilling the lubricant oil can be readily carried out without disassembling the bushing from the step shaft.

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However, several shortcomings exist in the bushing recorded by the patent publication No. 1. Particularly, as the passenger conveyor is being operated, the step shaft may rotate and in the meanwhile may swing from side to side along the step's left-right direction. If the swing is too great in amplitude and too long in time, the bushing of the step shaft may escape from the step shaft and the step. Therefore, the step shaft may be separated from the step, or even may escape from it, which leads to a risk that the step falls down.

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PATENT PUBLICATION No. 1: Chinese Utility Model Patent CN201520029050.2.

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SUMMARY OF THE INVENTION

5 In order to overcome the above-mentioned shortcomings, it is an objective of the present application to propose a passenger whose step bushing hardly escapes without increasing its installation difficulty and whose safety is enhanced.

10 In order to achieve the above objective, a first technical solution according to the present application comprises a passenger conveyor. The passenger conveyor comprises a plurality of steps; a loop-shaped step chain coupling the plurality of steps; and a step shaft rotatably mounted to each of the plurality of steps, the step shaft being connected to the step chain at either end, the passenger conveyor being characterized in that a step bushing is provided between the step shaft and the step, and the step bushing is provided with a clip for engaging with the step. The clip as a whole is resilient and wedge-shaped which narrows from a free end towards a joint through which the clip connects to the step bushing.

20 According to a second technical solution of the present application, the passenger conveyor is characterized in that the step is provided with a shaft mounting seat, and the clip engages with the shaft mounting seat.

According to a third technical solution of the present application, the passenger conveyor is characterized in that the clip is integrally formed in the step bushing.

25 According to a fourth technical solution of the present application, the passenger conveyor is characterized in that the clip is formed such that it can be separated from the step bushing.

30 According to a fifth technical solution of the present application, the passenger conveyor is characterized in that the step is provided with a fastening piece for constraining the step bushing between the step and the step shaft.

According to the passenger conveyor of the present application, the step bushing is enabled not to escape without increasing installation difficulty and the passenger

conveyor's safety is further enhanced.

BRIEF DESCRIPTION OF THE DRAWINGS

- 5 Fig. 1 is a schematic view illustrating the whole construction of a passenger conveyor according to an embodiment of the present application.

Fig. 2 is a perspective view illustrating a step provided for the passenger conveyor.

- 10 Fig. 3 is a schematic view illustrating the construction of a step according to the prior art.

Fig. 4 is a perspective view illustrating a step bushing according to the prior art.

- 15 Fig. 5A is a perspective view illustrating a step bushing according to an embodiment of the present application.

Fig. 5B is a lateral view illustrating the step bushing according to the embodiment of the present application.

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Fig. 5C is a front view illustrating the step bushing according to the embodiment of the present application.

- 25 Fig. 5D is a cross-sectional view illustrating the step bushing according to the embodiment of the present application.

Fig. 6 is a schematic view illustrating the construction of a step according to an embodiment of the present application.

- 30 Fig. 7 is a perspective view illustrating how the step shaft according to the embodiment of the present application is mounted.

Fig. 8 is a perspective view illustrating how the step shaft according to the embodiment of the present application is mounted.

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Fig. 9 is a perspective view illustrating how the step shaft according to the embodiment of the present application is mounted.

Explanation of Reference Numerals

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1 Main frame; 2 Chain wheel; 3 Step chain; 4 Driving device; 5 Step; 6 Rail; 7 Step wheel; 8 Step shaft; 9 Step bushing; 10 Fastening piece; 60 Step frame; 70 Shaft mounting seat; 13 Flange; 14 Platform part; 15 Clip.

10 DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

In the following, embodiments will be explained with respect to the drawings.

(1) The Whole Construction of a Passenger Conveyor

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Fig. 1 is a schematic view illustrating the whole construction of a passenger conveyor according to an embodiment of the present application. Further, in Fig. 1, as a concrete example, the passenger conveyor according to the present application is applied to an escalator in which steps are moved between an upper floor and a lower floor. However, the present application is not limited to the escalator. Rather, the present application can be effectively applied to a powerwalk in which steps are moved horizontally.

As shown in Fig. 1, the passenger conveyor according to the present application comprises a main frame 1 which is, in order to bridge an upper floor and a lower floor of a building, provided at the floor and is called as a truss. A pair of left and right chain wheels 2 (only those facing the drawing paper being illustrated) are assigned to each of an upper floor layer and a lower floor layer in the interior of the main frame 1. A pair of left and right loop-shaped step chains 3 (only that facing the drawing paper being illustrated) are wound between the chain wheel 2 of the upper floor layer and the chain wheel 2 of the lower floor layer respectively. The chain wheels 2 of at least one of the upper and lower floor layers are configured such that they can be driven by a driving device 4, having an electric motor, a speed reducer and so on, to rotate. Moreover, by rotating the chain wheel 2, a driving force can be transferred to the step chain 3 engaging with the chain wheel 2, and thus the step chain 3 is moved circularly between the upper and lower floors in the main frame 1.

A plurality of steps 5 are coupled between the pair of left and right step chains 3 in such way that the steps can be moved circularly in the main frame 1. That is to say, the pair of left and right step chains 3 are respectively coupled to left and right ends of the plurality of steps 5, which are spaced apart from each other by a specified distance. Moreover, by rotating the chain wheel 2, the step chains 3 are moved circularly in the main frame 1 such that the steps 5 coupled to the step chains 3 can be moved circularly in the main frame 5 and the step's moving direction can be reversed at the location of the chain wheel 2. Moreover, a pair of left rails 6 and a pair of right rails 6 (only those facing the drawing paper being illustrated) are provided in the main frame 1. Step wheels 7 (see Fig. 2) of the steps 5 moving circularly in the main frame 1 are guided by the rails 6 along the moving direction.

(2) The Construction of the Step

Now, the concrete construction of the step 5 will be explained with respect to Fig. 2.

The step 5 has a step frame 60 made of die-cast aluminum. As shown in Fig. 2, the step frame 60 is integrally cast with a clamping side 64 (upper side) at top sides of a pair of left and right triangle skeleton components 62, and is integrally cast with a riser side 66 (rear side) at rear sides of the skeleton components 62. Moreover, in order that the weight of the step 5 can be reduced and an operator can readily grasp it, a grasping aperture 68 is opened in a central portion of the triangle skeleton component 62. A shaft mounting seat 70 whose cross-section is C-shaped is provided at left and right sides of a front and upper part of the step frame 60 respectively. A step shaft 8 which will be explained below can be installed in the shaft mounting seats 70, and both ends of the step shaft 8 are fitted with the step chains 3 respectively (all of them being not illustrated here). Moreover, the step wheel 7 is free-rotatably mounted at left and right sides of a rear and lower part of the skeleton component 62.

(3) The Construction of the Step Shaft

Now, the concrete construction of the step shaft 8 will be explained with respect to Fig. 3.

As shown in Fig. 3, the shaft mounting seats 70 are provided at the left and right sides of the front part of the step frame 60 respectively. The step shaft 8 is free-rotatably installed in the shaft mounting seats 70. Either end of the step shaft 8 is fitted with the step chain 3. Moreover, a step bushing 9 is installed between the step shaft 8 and the shaft mounting seat 70 of the step 5. Furthermore, since the step 5 is constructed such that it is bilaterally symmetrical, only one lateral part of the step 5 is illustrated in Fig. 3. Similarly, in the following description, only one lateral part of a bilaterally symmetrical structure is explained.

(4) The Construction of the Step Bushing

Now, the concrete construction of the step bushing 9 will be explained with respect to Fig. 4.

As shown in Fig. 4, the step bushing 9 is substantially hollow cylinder-shaped. One end of the step bushing is provided with a flange 13. An oil groove 11 is provided in an inner wall of the step bushing 9. An oil filling hole 12 is opened in a wall part of the step bushing 9 such that the oil filling hole 12 passes through the wall part and is in communication with the oil groove. Lubricant oil or grease can be filled in the oil groove 11 by the hole. Moreover, the oil filling hole 12 is provided in a platform part 14 which will be explained later. In case that the step bushing 9 is installed between the step shaft 8 and the shaft mounting seat 70 of the step 5, the platform part 14 is snapped in place into the shaft mounting seat 70's C-shaped opening. Therefore, the flange 30 can tightly contact a fastening piece 10.

(5) The Installation Construction of the Step Bushing

Now, the following description will be aimed at Fig. 3. The fastening piece 10 is mounted on the step shaft 8 adjacent a central side of the step 5 such that the fastening piece 10 bears tightly against the step bushing 9. The fastening piece 10 is for example a C-shaped hoop. Using the fastening piece, the step bushing 9 is constrained between the step shaft 8 and the shaft mounting seat 70 such that the step bushing is prevented from side-to-side moving along the left-right direction.

However, with regard to the step bushing 9 mentioned above, as the passenger conveyor

is being operated, the step shaft 8 may rotate following movement of the step chain 3, and the step shaft 8 may carry out side-to-side movement along the left-right direction of the step 5. In case that the fastening piece 10 is damaged, the step shaft 9 may sometimes escape from the step shaft 8 and the shaft mounting seat 70 due to the side-to-side movement. In this case, the step shaft 8 may be separated from the step 5 or even escape from the step 5, which leads to a risk that the step 5 falls down.

(6) Concrete Embodiments

In order to solve those problems, as shown in Figs. 5A to 5D, the step bushing 9 according to the present application is further provided with a clip 15. Specifically, the step bushing 9 is provided with the platform part 14 on its side wall. The platform 14 has a plane in the axial direction of the step bushing 9. The width of the platform part 14 corresponds to the width of the C-shaped opening of the shaft mounting seat 70. The clip 15 is disposed at a side of the platform part 14 opposite to the flange 13. The clip 15 can be formed by cutting the platform part 14 such that an end of the clip 15 facing the flange 13 becomes a free end and thus the clip 15 is resilient. Therefore, the clip 15 can be pressed down relative to a side wall of the platform part 14 and bounces. Therefore, the clip 15 is formed as a wedged shape which narrows from the free end towards a joint of the clip connected to the platform part 14, such that the clip has a step-shaped projection at the end facing the flange 13.

Furthermore, Fig. 6 is a schematic view illustrating how to install the step bushing 9 according to the embodiment of the present application between the step shaft 8 and the shaft mounting seat 70. In case that the step bushing 9 is installed between the step shaft 8 and the shaft mounting seat 70, the step-shaped projection of the clip 15 engages with an edge of the shaft mounting seat 70 such that the step bushing 9 is further secured relative to the step 5 and it is further prevented from falling off. Moreover, since the fastening piece 10 is tightly secured to an inner side of the flange 13 of the step bushing 9, it is hard for the step bushing 9 to fall off and thus the passenger conveyor's safety is further enhanced.

Now, how to assemble the step according to the present application will be explained with regard to Figs. 7 to 9.

First, as shown in Fig. 7, the step bushing 9 and the fastening piece 10 are in this order sleeved onto the step shaft 8 from one end thereof. Then, the step shaft 8 installed with the step bushing 9 and the fastening piece 10 is installed in the shaft mounting seat 70 of the step 5. Alternatively, it is also possible that the step shaft 8 is first installed in the shaft mounting seat 70 of the step 5, and then the step bushing 9 and the fastening piece 10 are in this order sleeved onto the step shaft 8 from one end thereof. Then, the step bushing 9 is pushed and pressed between the step shaft 8 and the shaft mounting seat 70. Therefore, a state illustrated by Fig. 8 can be achieved. That is to say, the clips 15 reaches a width which is the same as the width of the platform part 14 such that they are embedded in the C-shaped opening of the shaft mounting seat 70.

When the step bushing 9 is pushed and pressed from the state illustrated by Fig. 8 along the C-shaped opening between the step shaft 8 and the shaft mounting seat 70, as shown in Fig. 9, the clips 15 will bounce towards both sides of the platform part 14 and the step-shaped projections of the clips 15 of the step bushing 9 will engage with the edge of the shaft mounting seat 70 at the moment when the step-shaped projections pass over the shaft mounting seat 70. In this way, the step bushing 9 is secured relative to the shaft mounting seat 70 or the step 5 by the clips 15.

Then, the fastening piece 10 is pushed towards a side of the step bushing 9 such that the fastening piece bears closely against an end face of the flange 13 of the step bushing 9. The fastening piece 10 is fastened onto the step shaft 8 by a fastener such as a bolt and a nut, a clamping fixture or the like. Therefore, the step bushing 9 is further secured relative to the shaft mounting seat 70 or the step 5 by the fastening piece 10.

By operations mentioned above, the installation of the step bushing 9 relative to the step 5 is carried out. Therefore, in case that the step shaft 8 is moved side-to-side along the left-right direction of the step 5 as the passenger conveyor is being operated, even if the fastening piece 10 is damaged, the step bushing 9 can be secured relative to the step 5 by the clips 15 such that the step bushing 9 is prevented from escaping from the step shaft 8 and the shaft mounting seat 70. Therefore, before the damage of the fastening piece 10 is detected by a maintainer, it ensures that the step shaft 8 will not be separated from the step 5 in a longer period and the risk that the step 5 falls down is thus eliminated. Therefore, according to the passenger conveyor according to the present application, its safety can be enhanced.

Moreover, in the passenger conveyor according to the present application, the safety of the passenger conveyor is enhanced only by providing the step bushing 9 with the clip 15. More importantly, the provided clip 15 will not lead to manufacturing costs increasing. Because the clip 15 as a whole is wedge-shaped and resilient, the installation can be carried out, as usual, by pushing and pressing the step bushing 9 along the C-shaped opening between the step shaft 8 and the shaft mounting seat 70. The safety of the passenger conveyor can be enhanced without increasing installation difficulty.

(7) Other Embodiments

In the present application, the fastening piece 10 is for example a fixation tool such as a metal clamping fixture. Moreover, the construction and material of the fastening piece 10 should be optional as long as it enables the step bushing to be constrained between the step shaft 8 and the shaft mounting seat 70.

In the above description of the present application, the clip 15 is integrally formed in the step bushing 9. However, the present application is not limited by this. For example, the clip 15 can be a resilient member such as a leaf spring made of metal. It can be fixed to the step bushing 9 by engaging with a slot of the step bushing 9 such that the step bushing 9 can be secured relative to the shaft mounting seat 70.

Moreover, in the above description of the present application, the clip 15 is embodied as the wedged shape narrowing from the free end towards the connecting joint. However, the clip 15 can be alternatively embodied as a wedged shape narrowing from the connecting joint towards the free end and can be provided to have a step-shaped projection at an end facing a side of the flange 13. Furthermore, the number of clips can be suitably modified, and the position of each clip also can be modified. For example, as an alternative, a plurality of clips 15 can be provided in a circumferential surface of the step bushing 9. Alternatively, the step-shaped projection can be omitted at the end of the clip 15 and the end of the clip 15 itself is enabled to engage with the shaft mounting seat 70 so as to achieve similar functions of the present application.

Further, in the present application, only the width of the platform part 14 is limited to correspond to that of the C-shaped opening of the shaft mounting seat 70. It is

unnecessary to specify the height of the platform 14 as soon as it will not obstruct the assembling and operation of the passenger conveyor.

Furthermore, in the present application, the step bushing 9 can be made of any suitable materials such as metal, resin, rubber or the like.

Furthermore, in the present application, the step bushing 9 is described to be pushed and pressed between the step shaft 8 and the shaft mounting seat 70 from one end side of the step shaft 8. However, the step bushing 9 can be installed in a different manner. It can be installed in a reversed manner such that the step bushing 9 is pushed and pressed from an inner side of the skeleton component 62 between the step shaft 8 and the shaft mounting seat 70. Moreover, the step bushings 9 can be installed in different installation directions at both sides of the step shaft 8 respectively. However, corresponding to the installation direction of the step bushing 9, the fastening piece 10 should be always mounted to bear closely against the end face of the flange 13 of the step bushing 9.

Although several embodiments according to the present application have already been explained, they are given as examples only and cannot be considered to make any limitation to the scope of the present application. The embodiments can be carried out in other suitable manners, and their alternations, changes or modifications can be made without departing from the spirit of the present application. Those embodiments and their modifications should be deemed as being included in the scope and content of the present application, and included in the application recorded by appended claims and theirs equivalents.

CLAIMS

1. A passenger conveyor comprising: a plurality of steps; a loop-shaped step chain coupling the plurality of steps; and a step shaft rotatably mounted to each of the plurality of steps, the step shaft being connected to the step chain at either end, wherein
5 a step bushing is provided between the step shaft and the step, and
the step bushing is provided with a clip for engaging with the step, and wherein the clip as a whole is resilient and wedge-shaped which narrows from a free end towards a joint through which the clip connects to the step bushing.
- 10 2. The passenger conveyor as claimed in claim 1, characterized in that
the step is provided with a shaft mounting seat, and the clip engages with the shaft mounting seat.
- 15 3. The passenger conveyor as claimed in claim 1 or 2, characterized in that
the clip is integrally formed in the step bushing.
4. The passenger conveyor as claimed in claim 1 or 2, characterized in that
the clip is formed such that it can be separated from the step bushing.
- 20 5. The passenger conveyor as claimed in claim 1, characterized in that
the step is provided with a fastening piece for constraining the step bushing between the step and the step shaft.