

TITLE OF THE INVENTION

Passenger conveyer

BACKGROUND OF THE INVENTION

5 Field of the Invention

The present invention relates to a passenger conveyer such as an escalator, a moving sidewalk and the like, and particularly to a passenger conveyer performing a novel braking operation.

10 Description of the Related Art

In general, there are two cases, in which the operation of a passenger conveyer is stopped; in one case, it is stopped at an end of its services operation by manipulating a dedicated operation key, and in the other
15 case, it is urgently stopped by the operation of a safety device.

JP-A-7-252074 discloses a passenger conveyer, the operation of which is urgently stopped in reply to the operation of a safety device.

20 The above conventional passenger conveyer does not take account of an accident that passengers fall down due to an unexpected emergency stoppage of the passenger conveyer.

25 SUMMARY OF THE INVENTION

An object of the present invention is to provide a passenger conveyer which can ensure safety of passengers,

even if an unexpected emergency stoppage of the passenger conveyer occurs.

Another object of the present invention is to provide a passenger conveyer which is capable of notifying
5 passengers that the passenger conveyer is to be urgently stopped.

To attain the above mentioned object, a passenger conveyer is provided with a plurality of step treads endlessly linked and circulating between both an upper and
10 a lower landing platforms, moving handrails provided on both sides of the step treads along the moving direction of the step treads, and a drive mechanism with a motor, a reduction gear and a brake for driving the step treads and the moving handrails, in which when the braking force is
15 applied to the passenger conveyer, it is performed over a plurality of times. Further, the braking force which is applied at the second time of breaking is larger than the braking force applied at the first time thereof.

With the measures as mentioned above, since
20 passengers feel abnormality and hold the moving handrail to take a protective posture when the passenger conveyer is decelerated by the first small braking force, the passengers can avoid falling down by deceleration of the following large braking force.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a block diagram showing a brake commanding device used in a passenger conveyer in accordance with the present invention;

5 FIG. 2 schematically shows a sectional side view of an escalator having the brake commanding device as shown in FIG. 1;

FIG. 3 shows a drive mechanism of a passenger conveyer in accordance with the present invention;

10 FIG. 4 shows a sectional view of a brake used in the drive mechanism of FIG. 3;

FIG. 5 is a diagram showing the relationship between voltage applied to a coil of the brake and the braking force effected thereby;

15 FIG. 6 shows a sectional view another example of the brake used in the drive mechanism of FIG. 3;

FIG. 7 is a diagram showing the relationship between voltage applied to a coil of the brake as shown in FIG. 6 and the braking force effected thereby;

20 FIG. 8 shows the comparison of braking patterns used in tests, in which (a) shows a braking pattern by one-step deceleration, and (b) and (c) show braking patterns by two-step deceleration, respectively;

FIG. 9 shows the actually measured results of the falling-down limit speed for the aged person; and

25 FIG. 10 shows the actually measured results of the falling-down limit speed for the young person.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

An embodiment of the present invention will be described below, referring to FIGs. 1 to 4.

Usually, as shown in FIG. 2, an escalator is
5 constructed such that frame structure 3 is installed between lower floor 1 and upper floor 2 and necessary components are attached to or assembled in the frame structure 3. There are provided lower and upper landing platforms 4, 5 in the respective ends of the frame
10 structure 3. A passenger transporting body is circulated between both the landing platforms 4, 5.

In a case of an escalator, as shown in FIG. 2, the passenger transporting body is composed of a plurality of step treads 6 endlessly linked by chain 7. In a case of
15 a moving walk (not shown), it can be composed of step plates endlessly linked, or a continuous endless belt.

The step chain 7, at one end thereof, is engaged with sprocket 8, which is journaled by bearings under the upper landing platform 5. Further, it is engaged, at the
20 other end thereof, with sprocket 9, which is journaled by bearings under the lower landing platform 4.

There are fixedly arranged handrail panels on both sides of the step treads 6, and moving handrails 10 are guided on the handrail panels to move in synchronism with
25 the movement of the step treads 6. There is provided drive unit 11 under the upper landing platform 5, which drives the sprocket 8.

As shown in FIG. 3, the drive unit 11 is composed of motor 12 and reduction gear 13. One end of shaft 13S of the reduction gear 13 is coupled to shaft 12S of the motor 12 through joint 15. Brake 14 is provided at the other end of the shaft 13S. Sprocket 17 is attached to another shaft 16 of the reduction gear 13. Driving chain 18 is engaged with the sprocket 17 at one end thereof and with sprocket 19, which is coaxially journaled with the sprocket 8.

10 The brake 14 is constructed as shown in FIG. 4. That is, circular disk 20 is fixed by bolts 21 to reduction gear box 13F on the side thereof, in which the other end of the shaft 13S extends outside the gear box 13F. The circular disk 20 is attached to the gear box 13F concentrically with the shaft 13S and functions as one of parts of the brake 14.

 Sprain hub 22, which has plural teeth extending in the direction of the shaft 13S in its periphery, is fixed to the part of the shaft 13S which extends outside the gear box 13F. Disk shaped lining 23 is engaged with the teeth of the sprain hub 22 so as to be movable in the shaft direction.

 The disk 20 is provided with supporting bolt 24 in parallel with the shaft 13S. The supporting bolt 24 penetrates iron core 26, and nut 25 is screwed to the end of the supporting bolt 24, whereby a space between the disk 20 and the core 26 is maintained constant.

The core 26 is made in a circular form, which is concentric with the shaft 13S. The core 26 has a ring shaped groove 27G and spring hole 28G, both of which have openings on the side facing the lining 23. Coil 27 is
5 accommodated in the ring shaped groove 27G of the core 26 to form an electromagnet, and compression spring 28 is contained in the spring hole 28G.

Armature 29 made of magnetic material, which is formed in a ring shaped disk, is placed between the
10 lining 23 and the iron core 26 concentrically with the shaft 13S. The concentricity of the armature 29 with the shaft 13S is kept by the supporting bolt 24.

In the above mentioned construction, force of the compression spring 28 acts on the armature 29 in the
15 direction, in which the iron core 26 and the armature 29 separate from each other. Thereby, the armature 29 displaces the lining 23 toward the disk 20. The lining 23 is pushed from both sides of the armature 29 and the disk 20. This is the braking state.

20 In this braking state, when current flows through the coil 27, the iron core 26 becomes an electromagnet, which generates the electromagnetic force to attract the armature 29, whereby the armature 29 is displaced. The lining 23 is released from the pressure by the armature
25 29 and the disk 20, and thereby the shaft 13S becomes rotatable. This is the released state of braking.

In addition, by manipulating dedicated operation key

switch 30 (FIG. 1), the operation of an escalator is initiated, when the service thereof is to begin, and stopped, when the service thereof has to end.

5 An escalator has first safety devices 31A, 31B at an inlet and an outlet, through which the moving handrail 10 comes in and out the inside of the handrail panel. Further, a plurality of second safety devices 32A to 32F inside the skirt guard, by which the step treads 6 and the handrail panel are separated from each other.

10 The first safety devices 31A, 31B are provided in order that operation of the escalator is immediately stopped, when a finger of an infant is about to be involved in the handrail together with the moving handrail 10. The second safety devices 32A to 32F are
15 provided in order that operation of the escalator is immediately stopped when a shoe or a foot of a passenger is about to be involved between the step tread 6 and the skirt guard.

Furthermore, the escalator has interruption detector
20 33, whereby power outage is detected and a power circuit of the motor 12 is switched off.

All of the operation key switch, the safety devices and the detector as mentioned above are means for generating the signal to stop operation of the escalator.
25 The brake 14 is operated by braking command means 34, based on the stop signal from the stop signal generating means as mentioned above.

The braking command means 34 comprises braking pattern selector 35 for selecting a braking pattern by discriminating the stop signal from the stop signal generating means as mentioned above and a plurality of
5 braking commanders 36A to 36N each having the different braking pattern, one of which is selected by the command from the braking pattern selector 35 to operate the brake 14.

Operation of the braking command means 34 will be
10 described below.

The description is made of the case, for example, where operation of the escalator is stopped by the manipulation of the operation key switch 30 at the end of services. When a stop signal from the key switch 30
15 occurs, the braking command means 34 judges that the stop signal is not based on the power interruption nor on the various safety devices and selects the braking commander 36A.

The selected braking commander 36A breaks off the
20 power to the motor 12 as well as breaks off the power to the coil 27 of the brake 14. The braking commander 36A has a braking pattern for commanding the braking that the escalator is decelerated very quickly by interrupting the power to the coil 27 of the brake 14. Such braking can
25 be called "one-step braking", so to speak, compared with the braking as described later.

When operation of the escalator is stopped at the end of service, it is seen very carefully that no passenger is on the escalator. In such a case, therefore, it is not necessary to take account of sudden
5 braking, which might be unexpected to passengers.

If any of the first safety devices 31A, 31B and the second safety devices 32A to 32F operates, it is necessary to immediately stop the escalator operation, since it is urgent. At the same time, it is also
10 necessary to prevent passengers from falling down due to the sudden deceleration unexpected. Therefore, the braking commander 36B is selected.

The braking commander 36B has a braking pattern for commanding the braking that the power to the motor 12 is
15 interrupted and the escalator 14 is at first decelerated through the primary deceleration process, in which the weak braking force is applied, and then stopped through the secondary deceleration process, in which the full braking force is applied. Therefore, the braking like
20 this can be called "two-step braking", as compared with the one-step braking as mentioned before. In this case, it is preferable to make the braking time period as short as possible, since it is necessary to stop the escalator 14 immediately.

25 Further, in case that the interruption detector 33 operates, the top priority must be given to preventing passengers from falling down due to sudden deceleration

unexpected. To this end, the braking commander 36N is selected.

The braking commander 36N has a braking pattern for commanding the same two-step braking as described before
5 in connection with the braking commander 36B. Different from the case of the braking commander 36B being selected, however, it is preferable to make the braking time period rather long, since it is unnecessary to immediately stop the escalator in this case.

10 In the case of power outage, the power to the motor 12 is immediately interrupted. However, the two-step braking as mentioned above can be performed by switching the power to the brake 14 to an auxiliary power source, such as a battery, a capacitor or the like.

15 The manner of operating or functioning of the escalator 14 is not the same, between the stoppage during the upward travelling of the escalator 14 and that during the downward travelling thereof. There is also the difference in the force of inertia passengers suffer.

20 Therefore, it is possible to employ a braking commander for commanding different braking pattern in the upward travelling of the escalator and in the downward travelling thereof. For example, there can be used the different patterns for the two-step braking with the
25 different deceleration distance in the secondary deceleration.

Further, the deceleration pattern is not limited to the two-step one as mentioned above, but to the multi-step one, in which the three or more steps of the deceleration are employed.

5 As described above, every braking commander 36B to 36N has the braking pattern that is prepared assuming that there are passengers on the escalator. Further, such braking commander is constructed so as to command the two-step braking consisting of the primary
10 deceleration and the secondary deceleration. Such the two-step braking will be described further in details, referring to FIG. 5.

Any one of the braking commanders 36B to 36N selected by the braking pattern selector 35 interrupts
15 the power to the coil 27 of the brake 14, when it receives a stop instruction signal. Assuming that the power interruption occurs at time point a, the voltage applied to the coil 27 is still of 100% at this time point, whereby no braking force is generated, of course.

20 Then, when the voltage applied decreases with time and time point b is reached, the attracting force of the iron core 26 begins to decrease and accordingly the compression spring 28 pushes the armature 29 to bring the lining 23 into contact with the disk 20. As a result,
25 the braking force is generated.

As shown in FIG. 5, it is assumed here that when the applied voltage to the coil 27 is "0", the braking force

generated is of 100%. The voltage decreasing is maintained at the value β for the predetermined time period from time point c to time point d so as to generate the weak braking force α predetermined for the
5 primary deceleration.

After that, the voltage applied is decreased down to "0", as shown at time point f. Thereby, it is possible to perform the two-step braking that the partial braking force α for the primary deceleration is at first generated
10 and then the full braking force for the secondary deceleration is generated.

As described above, according to the present invention, the partial braking force is generated during the primary deceleration process. Such state continues
15 for a predetermined time period, and then the full braking force is generated during the secondary deceleration process. Accordingly, passengers can quickly take the defensive posture during the primary deceleration process and withstand the inertia force
20 applied to them during the following secondary deceleration process.

In a conventional escalator, however, passengers cannot have sufficient time to take the defensive posture and therefore fall down, since after the power
25 interruption in the coil 27 of the brake 14, the voltage applied thereto is made at "0" rapidly in a short time, as shown at time point e.

On the other hand, in the present embodiment, the braking time period is extended from the time point e to the time point f. The extended braking time period (e to f) is equal to the time period (c to d), during which the
5 applied voltage is maintained at β .

In the following, description will be made of another embodiment of the brake 14, referring to FIG. 6. As shown in the figure, circular iron core 38 is fixed by bolts 37 to the reduction gear box 13F concentrically
10 with the shaft 13S. Coil 39 and permanent magnet 40 are embedded in the core 38.

Sprain hub 41 is attached to the part of the shaft 13S which extends outside the reduction gear box 13F. Elastic member 42, such as a coned disk spring or a flat
15 spring, is fixed by bolts 43 to the hub 41, in which the elastic member 42 is extended toward the outer radial direction. The elastic member 42 is provided, around its outer periphery, with circular armature 44, which is concentrically with the shaft 13S and faces the iron core
20 38, to which lining 45 is attached on the side thereof that faces the armature 44.

In the brake 14 having the structure as mentioned above, the elastic member 42 is displaced by the magnetic force generated by the permanent magnet 40 in the iron
25 core 38, so that the armature 44 is attracted. When the armature 44 is pushed onto the lining 45 on the core 38, the braking force is effected.

In order to release the braking force, the coil 39 is energized to generate the magnetic field in the direction opposite to that of the permanent magnet 40, whereby the attracting force of the permanent magnet 40 is offset. Since the force caused by the permanent magnet 40 is offset and therefore the force attracting the armature 44 disappears, the armature 44 is removed from the lining 45 by the restoring force of the elastic member 42 to allow the shaft 13S to rotate freely.

On the contrary, in order to stop the rotation of the shaft 13S, the current to the coil 39 is interrupted. Thereby, the attracting force of the permanent magnet 40, which has been offset, becomes effective to act on the armature 44. Therefore, the armature 44 deforms the elastic member 42 to be brought into contact with the lining 45 and is finally pushed thereto, whereby the rotation of the shaft 13S is stopped by a friction force acting between the armature 44 and the lining 45.

Referring next to FIG. 7, description will be done of the two-step braking, when performed by using the brake 14 constructed as above.

Let's assume that a stop instruction signal occurs and current to the coil 39 is interrupted at time point g. At this time point g, however, no braking force is generated, yet. When the voltage gradually decreases and time point h is reached, the attracting force of the permanent magnet 40, which has been offset so far,

becomes effective, since the reverse magnetic field generated by the coil 39 is decreased. Thereby, the armature 44 is brought into contact with the lining 45, and the braking force is generated by the friction therebetween.

Let's assume that as shown in FIG. 7, current to the coil 39 disappears at time point i and the permanent magnet 40 generates the full magnetic force (100%). Further, it is assumed that the braking force effected at such time point i is the weak braking force predetermined for the primary deceleration.

After the full braking force is maintained for the predetermined time period until time point j, the coil 39 is connected to the power source and the reverse voltage -y is applied thereto from time point j to time point k, whereby the coil 39 is made to generate a magnetic field in the same direction as that caused by the permanent magnet 40.

The armature 44 is attracted to the iron core 38 by the large attracting force caused by the magnetic field additionally generated by the permanent magnet 44 and the coil 39 in the same direction. As shown in FIG. 7, x % of the braking force is generated at time point k, which is for the secondary deceleration process and larger than the 100% braking force for the primary deceleration process.

In this manner, the very large braking force can be obtained by applying such voltage to the coil 39 that varies between positive and negative, when a stop command occurs. Further, compared with the case where the coil
5 39 is supplied with the voltage of one polarity, i.e. varying on the positive side only or on the negative side only, a coil with the reduced capacity can be utilized.

By the way, there is a type of escalator, in which a motor of a drive unit is controlled by an inverter. In
10 such an escalator, the power to the motor 12 is not necessary to be interrupted, even if any one of the various kinds of stop commands is generated, but the primary deceleration with the weak braking force is performed by the brake 14, when a stop command occurs, as
15 described above.

Thereafter, the rotation of the motor is decreased down to zero by controlling of the inverter, and finally, power to the brake 14 and the motor 12 are interrupted. The escalator is maintained by the brake 14 in the
20 stopping state. In this case, the secondary deceleration process after the primary one is of the deceleration by the motor 12 controlled by the inverter. The deceleration in the secondary deceleration process by the motor 12 is larger than that of the primary one.

25 Further, it is of course that both of the primary and the secondary deceleration processes can be performed by controlling the rotation of the motor 14 by means of

the inverter to decelerate and stop the escalator. In this case, the brake 14 is used only for maintaining the escalator in the stopping state, after it is stopped.

Therefore, the primary deceleration and the
5 secondary deceleration processes are not always performed by the brake 14, but may be done by the other appropriate apparatus or by combination thereof.

In each of the above mentioned embodiments, the braking command means 34 and the brake 14 may be
10 expressed or modified as follows: means for varying the changing rate of braking speed; means for allowing the small peak of deceleration to appear before a maximum peak thereof, which is smaller than one half of the latter; means for applying braking forces in plural
15 numbers of times; means for allowing the maximum deceleration to appear in the latter half of a braking period; means for applying braking forces such that the force is larger in the second time and the following than in the first time; means for maintaining the braking
20 force within a predetermined range; means for generating the large deceleration after the small deceleration; or means for generating the braking force in such a manner that the force is weak in the initial period and thereafter is made stronger.

25 Further, in the above mentioned embodiments, the dedicated operation key switch 30, the first safety devices 31A, 31B, the second safety devices 32A to 32F

and the interruption detector 33 may be expressed as a plurality of stop signal generating means. The braking command means 34 may be expressed as means for controlling braking force such that it is larger in the
5 second time and the following than in the first time.

Furthermore, in a method of braking a passenger conveyer according to the present invention, it is of course that the above mentioned braking command means 34 and the brake 14 are used. However, it may be performed
10 by combination of the brake 14 and the inverter-controlled motor 12. Similarly, a passenger conveyer according to the present invention can be embodied by the combination of the brake 14 and the inverter-controlled motor 12.

15 In the following, description will be done of the results of the monitoring tests carried out on the emergency stoppage of the above mentioned escalator. [Actually measured results of deceleration and the braking pattern at the time of emergency stoppage]

20 FIGs. 8a to 8c show deceleration waveforms measured when the emergency stoppage occurs in a test apparatus, which is equivalent to a usual escalator installed with the inclination of 30 degrees and operated at the speed of 30 meters per minute. In these figures, a solid line
25 indicates the speed of the escalator, and a broken line indicates the deceleration thereof.

FIG. 8a shows a one step deceleration braking pattern, which is composed of the single sinusoidal wave, that is, has only one peak. FIG. 8b shows a two step deceleration braking pattern, which is composed of two kinds of the sinusoidal wave, that is, has two peaks. The first one of the two peaks is smaller than one half of the second one, the maximum peak. Further, the smaller first peak positions before the maximum second one.

FIG. 8c shows another two step deceleration braking pattern, which is composed of two kinds of the sinusoidal wave, that is, has two peaks. The first one of the two peaks is the maximum peak and twice as large as the second one. Further, the maximum first peak positions before the smaller second one.

[Test apparatus]

A linear accelerator developed by the Safety Research Laboratory, the Japanese Governmental Institute, was used in the escalator test apparatus.

The linear accelerator is an apparatus, which controls a servomotor by a computer with a predetermined program to accelerate and decelerate a movable table, on which a passenger stands, in a desired mode. The linear accelerator can control the deceleration time period and the braking patterns. Further, the linear accelerator has a start-up unit, a movable table with handrails, a drive unit and a control unit.

Some kinds of the specification of the apparatus are as follows: the maximum movable distance of the movable table is 9.2 m; and the motor torque of the drive unit is 105 kg·cm and the instantaneous torque thereof is 800 kg·cm.

5 Further, the reason why the test has been performed using such linear accelerator as mentioned above is as follows.

There is a limit value in a moving speed of an escalator, a moving walk and so on. This is defined as a
10 speed that if an escalator or a moving walk, which is traveled at the speed over such limit value, is stopped suddenly, most passengers thereon will fall down. Such speed limit is called a passenger's "standing posture maintainable traveling speed limit" or simply "a
15 traveling speed limit" in the description relating to this, hereinafter.

There is the difference as follows between an escalator and a moving walk; namely, the former has the difference in level between steps and the latter does not
20 have such difference. However, there is no difference in the traveling speed limit in an essential sense. The traveling speed limit (V) in an escalator, which has the inclination angle θ of 30 degrees, can be converted from that (V_h) in a moving walk, which travels horizontally;
25 i.e., $V = V_h \cdot \sec\theta$. In view of the foregoing reason, the linear accelerator as mentioned above has been used for the test.

[Test method]

1) Items of test

Test were performed with respect to the following three for every braking pattern as shown FIGs. 8a, 8b and
5 8c.

a: Standing posture maintainable traveling speed limit;

b: Backward standing posture maintainable traveling speed limit; and

10 c: Time, in which a standing passenger holds a handrail at braking

The posture evaluation that a passenger maintains his standing posture and whether or not he or she falls down was performed by an expert's monitoring pictures of
15 a video camera. In addition, a posture judging method of measuring foot pressure of a testee was also utilized.

2) Testees

a. Aged testees (65 to 73 years old); five males and five females, the average age of whom is 69.2
20 years old, the average height thereof is 153 cm, and the average weight thereof is 55.1 kg.

b. Young testees (18 to 19 years old); two males and three females, the average age of whom is 18.8 years old, the average height thereof is 167.4 cm,
25 and the average weight thereof is 60.8 kg.

In the above mentioned method, the traveling speed limit, at which the testee can not stand straight (is

about to fall down), was measured. The results are shown in FIG. 9 for the aged testees, and in FIG. 10 for the young testees.

In those figures, the solid lines show the test
5 results under the one step deceleration braking pattern of FIG. 8a, the broken lines show the test results under the two step deceleration braking pattern of FIG. 8b, in which the first peak of deceleration is small and the large peak follows, and the chain lines with two dots
10 show the test results under the two step deceleration braking pattern of FIG. 8c, in which the first peak of deceleration is large and the small peak follows.

Referring to FIGs. 9 and 10, both of the results for the aged and the young are nearly similar to each other,
15 though there is the difference in the traveling speed limit between both.

That is, the traveling speed limit in the two step deceleration braking pattern as shown in FIG. 8c is small, compared with that in the one step deceleration
20 braking pattern as shown in FIG. 8a. The traveling speed limit in the two step deceleration braking pattern shown in FIG. 8(b) is higher.

It was clarified that the two step deceleration braking pattern composed of two kinds of the sinusoidal
25 wave, the first one having a small peak and the then coming second one having a larger peak, is effective for keeping the standing posture of passengers stably.

In regard to the backward standing posture maintainable speed limit, it was understood from the measurement that the deceleration based on the braking pattern as shown in FIG. 8b is superior, though there
5 exists the negative effect of approximately 15%, compared to the forward one.

Further, when a testee was stood on the movable table with handrails, which was gradually inclined at 4 degrees, at 8 degrees and at 12 degrees, the reaction
10 time, in which the testee first holds the handrail, was measured, with respect to the various braking pattern. As a result, it was confirmed that the deceleration based on the braking pattern as shown in FIG. 8b was also superior, compared with the others.

15 From the above test results, it becomes clear that when compared two kinds of the two step deceleration braking patterns as shown in FIGs. 8b and 8c, the pattern with the large deceleration peak after the small one, as shown in FIG. 8b, is better for the stabilization of the
20 standing posture (prevention of falling-down), regardless of the age difference, the direction of a standing posture and the inclination of a moving table (steps). Particularly, it has the remarkable effect in the deceleration time exceeding 800 ms.

25 On the other hand, in the braking pattern with the small deceleration peak after the large one, as shown in FIG. 8c, it seems that since the large standing load is

applied to a passenger suddenly, the passenger cannot recover from the initial shock and accordingly cannot take the defensive posture.

The braking pattern shown in FIG. 8b has two peaks.

5 However, it is possible to make a single peak of the deceleration appear in the second half of the braking time period. Further, in case where there are plural peaks, it is possible to make the single largest peak (maximum value) appear in the second half of the braking
10 time period. With this, since the emergency stop occurs at first, the passenger's attention can be called at the earlier time, whereby the number of accidents of passenger's falling down is reduced.

The above description has been made, taking an
15 escalator as an example of the passenger conveyer. The present invention can be also applied to an inclined type moving walk installed in a slope or between an upper and a lower floors in a building and, of course, to a moving walk installed horizontally.

20 As having been described above, according to the present invention, it is possible to provide a passenger conveyer which can ensure the safety of passengers, even if an unexpected emergency stoppage of the passenger conveyer occurs, and which is capable of notifying the
25 passengers that the passenger conveyer will be urgently stopped.



CLAIMS

1. A passenger conveyer comprising means for decreasing the changing rate of a braking speed in the
5 course of a braking process.
2. A passenger conveyer comprising means for changing a braking process at least to a first step and a second step, in which the changing rate of a braking
10 speed in the second step is smaller than that in the first step.
3. A passenger conveyer comprising means for applying the small peak of deceleration before applying
15 the maximum peak of deceleration during a braking process, the small peak of deceleration being smaller than the maximum one.
4. A passenger conveyer comprising means for
20 applying the braking force over plural times on the basis of a stop command.
5. A passenger conveyer comprising means for applying the braking force on the basis of a stop command
25 and means for controlling in such a manner that the maximum value of deceleration appears in the second half of a braking process.



6. A passenger conveyer comprising a passenger transporting body moving between two landing platforms and means for applying the braking force over plural times during a braking process, in which the braking
5 force in the second time of braking and the following being larger than that in the first time.

7. A passenger conveyer comprising a passenger transporting body moving between two landing platforms
10 and means for maintaining the braking force within a predetermined range in the course of the braking process.

8. A passenger conveyer comprising a passenger transporting body moving between two landing platforms
15 and means for generating the large deceleration following to the smaller deceleration during a braking process.

9. A passenger conveyer comprising a passenger transporting body moving between two landing platforms,
20 plural means for each generating a respective stop signal, means for generating the braking force on the basis of the signals from said plural stop signal generating means, a braking pattern selector for selecting one of the braking patterns by discriminating
25 the stop signals from said plural stop signal generating means, and plural braking commanders, one of which is selected by said braking pattern selector to operate said



braking force generating means.

10. A passenger conveyer comprising means for generating the braking force, in response to the
5 operation of a safety device, in such a manner that the braking force is weak in an initial period of the braking process and is made stronger thereafter.

11. A passenger conveyer comprising braking means
10 for stopping the operation of the passenger conveyer, various kinds of safety devices provided in the passenger conveyer, and control means for applying the braking force over plural times by operating said braking means by said safety devices, in which the force at the second
15 time of braking and the following is larger than that at the first time.

12. A passenger conveyer according to claim 11, wherein said braking means is constructed such that the
20 braking force is caused by a spring force and released by exciting an electromagnetic coil, and further comprising means for changing the voltage applied to said electromagnetic coil, when said braking means is in operation.

25

13. A passenger conveyer according to claim 12, which further comprises means for changing the voltage applied to said coil on the side of positive voltage.



14. A passenger conveyer according to claim 12, which further comprises means for changing the voltage applied to said coil over both sides of positive voltage and negative voltage.

5

15. A method of braking a passenger conveyer, wherein deceleration stimulation is applied to passengers by an emergency braking command, and then the passenger conveyer is braked.

10

16. A method of braking a passenger conveyer, wherein at the emergency braking, the passenger conveyer is decelerated for a predetermined time period and then braked.

15

17. A method of braking a passenger conveyer, wherein at the emergency braking, the passenger conveyer is braked by repeating the application of the braking force and releasing thereof at the emergency braking.