

[DESCRIPTION]

[Title of Invention] OPERATION CONTROL SYSTEM AND OPERATION
CONTROL METHOD FOR PASSENGER CONVEYOR

[Technical Field]

[0001]

The present invention relates to an operation control system and an operation control method for a passenger conveyor. Particularly, it relates to an operation control system and an operation control method for a passenger conveyor, which automatically monitors whether steps are attached or detached and which controls operation when the steps are detached.

[Background Art]

[0002]

Passenger conveyors in which a plurality of steps linked to one another endlessly are made to travel between upper and lower boarding areas include escalators in which steps are made to travel as they are steps, and inclined type moving sidewalks in which steps having tread surfaces linked to form one and the same plane move while carrying passengers. In those inclined type passenger conveyors, steps on which passengers stand may be partially removed to make an opening at the time of maintenance work so that various maintenance works can be

performed through the opening. An opening may be made not at the time of maintenance or inspection but because of some problem causing a part of the steps to fall down.

[0003]

In such a passenger conveyor using steps, it is necessary to execute processing (control) for diagnosing whether a part of steps fall down to make an opening or not, and securing safety based on the result of the diagnosis. For example, the invention described in Patent Literature 1 has been well known as such an operation control apparatus. This invention is an apparatus for detecting a missing step in an escalator, characterized by including: an optical sensor unit for detecting a missing step optically; and a control panel for suspending operation of the escalator when the missing step is detected by the optical sensor unit. Since the apparatus can automatically suspend the operation of the escalator when a missing step is detected, it is claimed that the apparatus has an effect that a large number of other steps can be prevented from being damaged due to the missing step and an accident caused by passenger's falling down into to the opening portion of the step can be prevented from occurring.

[0004]

Conventionally, the existence of each step is checked by eye observation while the passenger conveyor is repetitively started and suspended little by little. However, the operation control apparatus for the passenger conveyor according to the well known example is configured in such a manner that the existence of each step can be automatically detected in a process for processing a sensor signal in a continuous operation instruction. Thus, the existence of each step can be detected automatically and surely.

[Citation List]

[Patent Literature]

[0005]

[Patent Literature 1] JP-A-7-257866

[Summary of Invention]

[Technical Problem]

[0006]

However, in the operation control apparatus according to the invention described in Patent Literature 1, the existence of each step is detected by a special-purpose optical sensor disposed in a predetermined position. Therefore, the existence of a portion where a step has been removed cannot be recognized unless the portion where the step has been removed is moved

to the position where the portion passes the sensor. Thus, the operation control apparatus cannot determine whether each step is in a dangerous state or not immediately after the passenger conveyor starts up. In addition, in order to operate the passenger conveyor during maintenance and inspection in the state where there is an opening portion from which a step has been removed, it is necessary to invalidate the detection function of the optical sensor. In order to invalidate the detection function of the optical sensor, it is necessary to perform operation for the invalidation. In addition, unless the invalidated function is surely resumed to be valid, the invalidated function may cause an accident afterwards.

[0007]

In any case, the fact that there is a portion from which a step has been removed cannot be recognized immediately after a start-up instruction is given to the passenger conveyor. Therefore, there remains a problem to secure safety during the work of maintenance and immediately after the work of maintenance.

[0008]

Therefore, a problem to be solved by the invention is to detect the existence of a portion from which a step has been

removed immediately after a start-up instruction is given to a passenger conveyor so that safety of passengers and workers can be secured before the passenger conveyor is operated at a rated velocity.

[Solution to Problem]

[0009]

In order to solve the aforementioned problem, according to the invention, there is provided an operation control system for a passenger conveyor which includes a plurality of steps linked to one another endlessly and travels between upper and lower boarding areas. The system diagnoses the existence of an opening portion caused by a missing one of the steps of the passenger conveyor and controls the travelling of the passenger conveyor based on a result of the diagnosis. The system is characterized by including: a starting torque calculating unit which calculates driving torque with which the passenger conveyor starts up; and an opening existence diagnosing unit which diagnoses the existence of the opening portion caused by the step, based on a value of the driving torque with which the passenger conveyor starts up and conditions of an operation direction of the passenger conveyor.

[Advantageous Effects of Invention]

[0010]

According to the invention, the existence of a portion from which a step has been removed can be detected immediately after a start-up instruction is given to a passenger conveyor, so that safety of passengers and workers can be secured before the passenger conveyor is operated at a rated velocity.

[Brief Description of Drawings]

[0011]

[Fig. 1] A front view showing a configuration for driving an escalator as a passenger conveyor according to an embodiment of the invention.

[Fig. 2] A functional block diagram showing an operation control apparatus for the escalator according to Example 1.

[Fig. 3] A flow chart showing an operation control procedure for the escalator in Example 1.

[Fig. 4] A functional block diagram showing an operation control apparatus for the escalator according to Example 2.

[Fig. 5] A flow chart showing an operation control procedure for the escalator in Example 2.

[Fig. 6] A functional block diagram showing an operation control apparatus for the escalator according to Example 3.

[Fig. 7] A flow chart showing an operation control

procedure for the escalator in Example 3.

[Description of Embodiments]

[0012]

An embodiment of the invention will be described below with reference to the drawings.

[0013]

Fig. 1 is a front view showing a configuration for driving an escalator as a passenger conveyor according to an embodiment of the invention. In Fig. 1, an escalator E is fundamentally constituted by steps 1, a step chain 2, upper and lower sprockets 3 and 4, a drive motor 5 and a drive torque control unit 6. An upper boarding area 1a and a lower boarding area 1b are provided in an upper portion and a lower portion of the escalator E respectively. Passengers get on the steps 1 from one of the upper boarding area 1a and the lower boarding area 1b, and get off to the other boarding area.

[0014]

The steps 1 are pivotally supported on the step chain 2 which is connected endlessly. The step chain 2 is wound around the upper sprocket 3 and the lower sprocket 4. The upper sprocket 3 is driven to rotate by the drive power of the drive motor 5. Thus, when the drive motor 5 is driven, the upper sprocket

3 rotates so that the step chain 2 receiving the drive power rotates. The steps 1 rotate and run integrally with the rotation of the step chain 2. When the steps 1 are running, steps exposed to the outside between the upper boarding area 1a and the lower boarding area 1b are steps on which passengers can stand, and the outside steps 1 are going into the inside from the upper boarding area 1a or the lower boarding area 1b in accordance with the running direction.

[0015]

The reference sign 15 represents a handrail held by hands of the passengers. The drive torque control unit 6 controls acceleration, velocity, torque, etc. of the drive motor 5. Therefore, the running of the steps 1 is controlled by the drive torque control unit 6.

[0016]

Examples will be described below in details.

[Example 1]

[0017]

Fig. 2 is a functional block diagram showing an operation control apparatus for the escalator according to Example 1. The configuration itself for driving the escalator is the same as that in Fig. 1.

[0018]

As shown in Fig. 2, an operation control apparatus 100 for the escalator in Example 1 has a starting torque calculating portion 8 and an opening existence diagnosing portion 9. The starting torque calculating portion 8 detects an operation instruction issued by an operator 7 and calculates drive torque with which the escalator starts up. The opening existence diagnosing portion 9 diagnoses the existence of an opening portion caused by a step from the value of the starting torque calculated by the starting torque calculating portion 8, and operation direction information. Notification of the result of the diagnosis is given to an information unit 10, which informs the operator 7 of the result. The information unit 10 also provides various information in addition to the result of the diagnosis.

[0019]

The starting torque calculating portion 8 and the opening existence diagnosing portion 9 are set in a not-shown control portion including a CPU, a ROM, a RAM, an EPROM, etc. The CPU is a central control unit, which reads program codes stored in the ROM, expands the program codes on the RAM, and executes a program using the RAM as a work area so as to control each

portion. The RAM is also used as a data buffer. The EPROM stores data that are used for control by the CPU.

[0020]

Fig. 3 is a flow chart showing an operation control procedure for the escalator in Example 1. Diagnosis and operation control are executed by the CPU.

[0021]

In Example 1, first, determination is made as to whether there is an operation instruction or not (Step S1). When an operation instruction is detected, the operation direction is determined (Step S2). When determination is made that the instructed operation direction is a descending direction, starting torque (hereinafter also referred to as "first starting torque") T_1 with which descending operation has been initiated is calculated (Step S3). When the first starting torque T_1 is calculated in Step S3, the calculated value of the first starting torque T_1 is compared with a reference torque value (hereinafter referred to as "first reference value") T_d serving as a reference at the time of initiating descending operation and stored in a memory (e.g. EPROM) in advance (Step S4).

[0022]

When the first starting torque T_1 is substantially equal

to the first reference value T_d ($T_1 \approx T_d$) as the comparison result in Step S4, the running resistance caused by the steps 1 is regarded as balanced between the outside and the inside so that determination is made that there is no opening in the steps 1 (Step S5). Thus, an instruction to operate the escalator at a rated velocity is initiated (Step S6). Then, this operation control procedure is terminated.

[0023]

Due to the running resistance caused by the handrail 15 and the running resistance caused by the steps 1, there occurs a little difference in the first reference value T_d for the start-up of the escalator between the ascending operation and the descending operation. The difference is about several % to 10% of the rated torque of the drive motor 5. This value varies in accordance with the floor height or structure of the passenger conveyor, but the value for the same conveyor is fixed at every start-up of the escalator.

[0024]

When determination is made in Step S4 that the first starting torque T_1 is different from the first reference value T_d , the processing flow shifts to Step S7 in which determination is made as to whether the first starting torque T_1 is smaller

than the first reference torque T_d or not. When determination is made in Step S7 that the first starting torque T_1 is smaller, determination is made that there is an opening in an inside step 1 the operator cannot observe (Step S8).

[0025]

In the case where determination is made thus that the first starting torque T_1 is smaller, the total weight of the inside steps 1 is smaller than the total weight of the outside steps 1 and the lighter side is lifted up while the heavier side is put down, with the result that the unbalance leads to the reduction of the first reference value T_d in the descending operation. When determination is made thus in Step S8 that there is an opening in an inside step 1 the operator cannot observe, the information unit 10 provides a caution announcement "there is an opening in an inside step", and an instruction of gentler acceleration than usual acceleration is then issued (Step S9). Thus, the gentler acceleration is started to increase the velocity to the rated velocity and operation at the rated velocity is then initiated (Step S6). Then, this operation control procedure is terminated.

[0026]

On the contrary, when determination is made in Step S7

that the first starting torque T_1 is not smaller than the first reference value T_d , the first starting torque T_1 is regarded as larger than the first reference value T_d so that determination is made that there is an opening in an outside step 1 the operator can observe (Step S10). The information unit 10 provides a caution announcement "there is an opening in an outside step", and an instruction of gentler acceleration than usual acceleration is then issued (Step S11). Thus, the gentler acceleration is started to increase the velocity to the rated velocity and operation at the rated velocity is then initiated (Step S6). Then, this operation control procedure is terminated.

[0027]

On the other hand, when determination is made in Step S2 that the operation is an ascending operation, starting torque (hereinafter also referred to as "second starting torque") T_2 with which the ascending operation has been initiated is calculated (Step S12). When the second starting torque T_2 is calculated, the calculated value of the second starting torque T_2 is compared with a reference torque value (hereinafter referred to as "second reference value") T_u serving as a reference at the time of initiating ascending operation and

stored in advance (Step S13). When the second starting torque T_2 is substantially equal to the second reference value T_u , the running resistance caused by the steps 1 is regarded as balanced between the outside and the inside so that determination is made that there is no opening in the steps 1 (Step S14). Thus, an instruction to operate the escalator at a rated velocity is initiated (Step S6). Then, this operation control procedure is terminated.

[0028]

When determination is made in Step S13 that the second starting torque T_2 is different from the second reference value T_u , the processing flow shifts to Step S15 in which determination is made as to whether the second starting torque T_2 is smaller than the second reference torque T_u or not. When determination is made in Step S15 that the second starting torque T_2 is smaller, conclusion is made that there is an opening in an outside step 1 the operator can observe (Step S16). The information unit 10 provides a caution announcement "there is an opening in an outside step", and an instruction of gentler acceleration than usual acceleration is then issued (Step S17). Thus, the gentler acceleration is started to increase the velocity to the rated velocity and operation at the rated velocity is then initiated

(Step S6). Then, this operation control procedure is terminated.

[0029]

On the contrary, when determination is made in Step S15 that the second starting torque T_2 is not smaller than the second reference value T_u , the second starting torque T_2 is regarded as larger than the second reference value T_u so that conclusion is made that there is an opening in an inside step 1 the operator cannot observe (Step S18). The information unit 10 provides a caution announcement "there is an opening in an inside step", and an instruction of gentler acceleration than usual acceleration is then issued (Step S19). Thus, the gentler acceleration is started to increase the velocity to the rated velocity and operation at the rated velocity is then initiated (Step S6). Then, this operation control procedure is terminated.

[0030]

Thus, according to Example 1, even when start-up operation is performed in the state where an opening portion caused by a removed step 1 fails to be noticed or even when start-up operation is performed in the state where the existence of the opening portion is not recognized, the operation control

apparatus 100 detects the existence of the opening portion automatically and gives a caution announcement to the operator and people nearby before diagnosis operation is performed with gentler acceleration than usual acceleration. Thus, elevator control superior in safety during inspection work can be performed to secure safety of passengers and workers.

[Example 2]

[0031]

Fig. 4 is a functional block diagram showing an operation control apparatus for the escalator according to Example 2. The configuration itself for driving the escalator is the same as that in Fig. 1.

[0032]

As shown in Fig. 4, an operation control apparatus 200 for the escalator E in Example 2 has opening detection sensors 11 and an opening position calculating portion 12. Each opening detection sensor 11 is a reflection type sensor using a reflection signal of infrared rays, acoustic waves, or the like, for detecting whether any step 1 has been removed or not. The opening detection sensor 11 detects the absence of a step 1 when the escalator E is running on the inside. In Example 2, two opening detection sensors 11 are provided. One of the

opening detection sensors 11 is disposed in a position just before the steps 1 appear on the upper boarding area 1a side when the steps 1 are running in the descending direction, while the other opening detection sensor is disposed just before the steps 1 appear on the lower boarding area 1b side when the steps 1 are running in the ascending direction. The opening position calculating portion 12 calculates the moving distance of the opening portion having passed through the detection position of the opening detection sensor 11 based on velocity information or time information, and stores the moving distance of the opening portion. The other portions are configured in the same manner as those in Example 1.

[0033]

Fig. 5 is a flow chart showing an operation control procedure for the escalator in Example 2. Diagnosis and operation control are performed by the CPU.

[0034]

In Example 2, first, determination is made as to whether an opening in a step 1 is detected between the last start and the last suspension or not (Step S21). When not detected, determination is made as to whether the escalator is currently in operation or not (Step S22). When in operation,

determination is made as to whether an opening portion passes or not based on a signal from each opening detection sensor 11 (Step S23). As soon as the opening portion is detected, in other words, as soon as detection is made that the opening portion passes through the position of the sensor 11 (Yes in Step S23), the position of the opening portion is calculated from the velocity information and the operation direction information of the escalator E and the opening portion passing information (information about the passing time), and determination is made as to whether the current position of the opening portion is stored in a memory or not (Step S24). In Step S24, the position of the opening portion is always calculated whenever the opening portion is detected in Step S23, and the position of the opening portion is updated whenever calculated. Once the opening portion is detected, the current position of the opening portion which moves with movement of the steps 1 can be always grasped by the CPU of the operation control apparatus 200.

[0035]

When the current position is stored in Step S24, the information unit 10 provides a caution announcement such as "Opening portion running on the inside will appear on the outside

after five seconds" at suitable intervals (Step S25). During the announcement, the running information is always updated to indicate the latest position. In addition, the suitable interval of the announcement is about 5 to 15 seconds.

[0036]

Finally, determination is made as to whether an instruction of suspension is received or not (Step S26). When determination is made that the instruction of suspension is received, this operation control procedure is terminated.

[0037]

On the other hand, when determination is made in Step S21 that an opening in a step 1 is detected between the last start and the last suspension, determination is made as to whether a new instruction of operation is received or not (Step S27). When the new instruction of operation is received, the information unit 10 provides a caution announcement such as "Operation is suspended with opening portion left as it was at last start. Be careful about the existence of the opening portion", and operation is then initiated with gentle acceleration (Step S28).

[0038]

Then, the position of the opening portion stored in the

memory is read out (Step S29). In consideration of new operation velocity information and operation direction information additionally, the current opening position is calculated and a caution announcement such as "Opening portion running on the inside will appear on the outside after five seconds" is issued at suitable intervals (Step S30). Next, determination is made as to whether an instruction of suspension is received or not (Step S31). When the instruction of suspension is not received, the processing flow shifts to Step S23 in which the latest passage of the opening portion is detected based on a signal from the opening detection sensor 11. While the current position information is updated to the latest one, the processing in Step S24 et seq. is repeated. When determination is made in Step S31 that the instruction of suspension is received, this operation control procedure is terminated.

[0039]

Example 2 may be combined with Example 1 so as to diagnose and control running.

[0040]

Thus, according to Example 2, at the start-up after a break or a change of a worker during inspection work in which the steps 1 are removed, a caution announcement about the

existence of an opening portion in the steps 1 can be given to an operator and people nearby immediately after an instruction of operation is issued. Thus, elevator control superior in safety for work requiring a long time or a larger number of workers can be performed to secure safety of passengers and workers.

[Example 3]

[0041]

Fig. 6 is a functional block diagram showing an operation control apparatus for the escalator according to Example 3. The configuration itself for driving the escalator is the same as that in Fig. 1.

[0042]

As shown in Fig. 6, an operation control apparatus 300 for the escalator E in Example 3 has a cover opening/closing detection portion 13 and a remote operation portion 14 in addition to the starting torque calculating portion 8, the opening existence diagnosing portion 9, the opening detection sensors 11 and the opening position calculating portion 12 in Examples 1 and 2. The cover opening/closing detection portion 13 has a detection function to detect that a cover 17 covering an underfloor machine room 16 containing driving equipment is

open. The remote operation portion 14 issues an instruction to start up or suspend the escalator E from a remote site. The other portions are configured and serve in the same manner as those in Examples 1 and 2.

[0043]

Fig. 7 is a flow chart showing an operation control procedure for the escalator in Example 3. Diagnosis and operation control are executed by the CPU.

[0044]

According to Example 3, first, determination is made as to whether an instruction of operation made without intervention of the operator 7 has been received by remote operation or scheduled operation or not (Step S41). When determination is made that the instruction of operation has been received, determination is made as to whether the cover 17 covering the underfloor machine room 16 is closed or not based on a signal from the cover opening/closing detection portion 13 (Step S42). When determination is made in Step S42 that the cover 17 is closed, determination is made as to whether an opening in a step 1 is detected between the last start and the last suspension or not (Step S43). This determination is carried out in the procedure from Step S21 to Step S31 in Example 2 (Fig. 5).

[0045]

When determination is made in Step S43 that no opening is detected, a ringing sound is made in Step S44, and an announcement that the escalator E will be started up is then issued. Next, the escalator E is started up with gentle acceleration and kept at a very low velocity (Step S45). The velocity mentioned herein is roughly about 1% to 10% of the rated velocity. The first and second starting torques T1 and T2 are calculated by the starting torque calculating portion 8 in Step S46, and determination is made in Step S47 as to whether the first and second starting torques T1 and T2 are equal to the first and second reference values Td and Tu or not. The determination is performed in the procedure described in Steps S2 to S4, S12 and S13 in Example 1 (Fig. 3).

[0046]

When determination is made that the first and second starting torques T1 and T2 are equal to the first and second reference values Td and Tu respectively, a caution announcement to initiate increase in velocity is issued by the information unit 10, and gentle acceleration is then applied to initiate operation at the rated velocity (Step S48). Then, the operation control procedure is terminated.

[0047]

On the contrary, when determination is made in Step S42 that the cover 19 is opened and when determination is made in Step S43 that there is an opening caused by a missing step 1, information about the state determined in Steps S42 and S43 is given to a remote operation terminal or a worker's portable terminal (Step S49), and an announcement indicating the state in which the escalator E cannot be started up remotely is continuously issued at suitable intervals (Step S50). Then, this operation control procedure is terminated.

[0048]

On the other hand, when determination is made in Step S47 that at least one of the first and second starting torques T1 and T2 is different to corresponding one of the first and second reference values Td and Tu, information about such a possibility of instrumental abnormality that a step 1 may be removed or a belt may be slippery is given to the remote operation terminal or the worker's portable terminal (Step S51), and an announcement indicating the state where the CPU of the operation control apparatus 300 cannot start up the escalator E remotely is continuously issued from the information unit 10 at suitable intervals (Step S52). Then, this operation control procedure

is terminated.

[0049]

Thus, according to Example 3, the escalator E can be started up safely by remote operation or scheduled operation without requiring any device that does not directly engage in controlling the escalator E, such as a monitoring camera or a motion sensor. Therefore, the burden on an equipment manager who operates start-up every day can be reduced. Thus, elevator control superior in safety management can be performed to secure safety of passengers and workers.

[0050]

According to the embodiment, as described above, the existence of a portion where a step 1 is missing is detected immediately after a start-up instruction is given to the escalator E. When an opening portion caused by a missing step 1 is detected, information about the detection is provided. It is therefore possible to secure safety of passengers and workers before the escalator E is operated at a rated velocity.

[0051]

A passenger conveyor in the scope of claims corresponds to the escalator E in the embodiment; steps correspond to the reference sign 1; upper and lower boarding areas correspond

to the upper boarding area 1a and the lower boarding area 1b; a starting torque calculating unit corresponds to the starting torque calculating portion 8; an opening existence diagnosing unit corresponds to the opening existence diagnosing portion 9; an opening detection unit corresponds to the opening detection sensor 11; an opening position calculating unit corresponds to the opening position calculating portion 12; a storage unit corresponds to the memory (e.g. EMROM); an information unit corresponds to the information unit 10; an underfloor machine room corresponds to the reference sign 16; a cover corresponds to the reference sign 17; a cover opening/closing detection unit corresponds to the cover opening/closing detection portion 13; and a remote operation unit corresponds to the remote operation portion 14. The operation of the escalator E is controlled by the CPU of the operation control apparatus 100, 200, 300.

[0052]

Further, the invention is not limited to the aforementioned embodiment, but various modifications can be made on the invention without departing from the gist of the invention, and all the technical items included in the technical ideas stated in the scope of claims are the subject matters

of the invention. The aforementioned Examples show preferred examples. From the contents disclosed herein, those skilled in the art can make various alternatives, revisions, modifications or improvements, which are included in the technical scope stated in the scope of accompanying claims.

[Reference Signs List]

[0053]

- 1 step
- 1a upper boarding area
- 1b lower boarding area
- 8 starting torque calculating portion
- 9 opening existence diagnosing portion
- 10 information unit
- 11 opening detection sensor
- 12 opening position calculating portion
- 13 cover opening/closing detection unit
- 14 remote operation portion
- 16 underfloor machine room
- 17 cover
- 100, 200, 300 operation control apparatus
- E escalator

[CLAIMS]

[Claim 1]

An operation control system for a passenger conveyor which includes a plurality of steps linked to one another endlessly and travels between upper and lower boarding areas, the system diagnosing existence of an opening portion caused by a missing one of the steps of the passenger conveyor and controlling operation of the passenger conveyor based on a result of the diagnosis, the system being characterized by comprising:

a starting torque calculating unit which calculates driving torque with which the passenger conveyor starts up; and

an opening existence diagnosing unit which diagnoses the existence of the opening portion caused by the step, based on a value of the driving torque with which the passenger conveyor starts up and conditions of an operation direction of the passenger conveyor.

[Claim 2]

An operation control system for a passenger conveyor according to Claim 1, characterized by further comprising:

an opening detection unit which detects the existence of the opening portion when the steps are travelling on the

inner side of the passenger conveyor; and

an opening position calculating unit which calculates a moving distance of the opening portion after the opening portion passes the opening detection unit when the opening detection unit detects the opening portion, and which stores the calculated distance into a storage unit.

[Claim 3]

An operation control system for a passenger conveyor according to Claim 2, characterized in that:

the opening position calculating unit continuously performs calculation of the distance and storage of the distance into the storage unit.

[Claim 4]

An operation control system for a passenger conveyor according to any one of Claims 1 through 3, characterized by further comprising:

an information unit which provides information about a current position of the opening portion when the opening existence diagnosing unit diagnoses the existence of the opening portion.

[Claim 5]

An operation control system for a passenger conveyor

according to Claim 4, characterized in that:

after the information unit provides the information, the passenger conveyor is accelerated gently and started to operate.

[Claim 6]

An operation control system for a passenger conveyor according to any one of Claims 1 through 5, further comprises:

a cover which covers an underfloor machine room containing driving equipment;

a cover opening/closing detection unit which detects an opening/closing state of the cover; and

a remote operation unit which issues from a remote site an instruction to start or suspend the passenger conveyor; characterized in that:

when the cover opening/closing detection unit detects that the cover is not closed, notification of the state of the cover is given to the remote operation unit and the information unit provides information about the fact that the passenger conveyor cannot be remotely started.

[Claim 7]

An operation control system for a passenger conveyor according to Claim 4 or 5, further comprising:

a remote operation unit which issues from a remote site

an instruction to start or suspend the passenger conveyor;
characterized in that:

when the opening detection unit detects the opening portion between the last start and the last suspension, notification of the state of the opening portion is given to the remote operation unit and the information unit provides information about the fact that the passenger conveyor cannot be remotely started.

[Claim 8]

An operation control system for a passenger conveyor according to Claim 7, further comprising:

a cover which covers an underfloor machine room containing driving equipment; and

a cover opening/closing detection unit which detects an opening/closing state of the cover; characterized in that:

when the cover opening/closing detection unit detects that the cover is not closed and when the opening detection unit detects the opening portion between the last start and the last suspension, notification of the state of the cover and the state of the opening portion is given to the remote operation unit and the information unit provides information about the fact that the passenger conveyor cannot be remotely

started.

[Claim 9]

An operation control system for a passenger conveyor according to Claim 6 or 8, characterized in that:

when the cover opening/closing detection unit detects that the cover is closed but when the opening detection unit does not detect the opening portion between the last start and the last suspension, the passenger conveyor is started with gentle acceleration and kept at a very low velocity state.

[Claim 10]

An operation control method for a passenger conveyor which includes a plurality of steps linked to one another endlessly and travels between upper and lower boarding areas, the method diagnosing existence of an opening portion caused by a missing one of the steps of the passenger conveyor and controlling operation of the passenger conveyor based on a result of the diagnosis, the method being characterized by comprising the steps of:

using a starting torque calculating unit to calculate driving torque with which the passenger conveyor starts up;

using an opening existence diagnosing unit to diagnose the existence of the opening portion caused by the step based

on a value of the driving torque with which the passenger conveyor starts up and which is calculated in the calculation step, and conditions of an operation direction of the passenger conveyor; and

using an information unit to provide information about a current position of the opening portion when the existence of the opening portion is diagnosed in the diagnosis step.