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(71) Applicant: **Skd Hi-Tec Co., Ltd.**  
**Gwangyang-si, Jeollanam-do 57714 (KR)**

(72) Inventor: **HAN, Seong-Moo**  
**59619 Jeollanam-do (KR)**

(74) Representative: **Mammel und Maser**  
**Patentanwälte**  
**Tilsiter Straße 3**  
**71065 Sindelfingen (DE)**

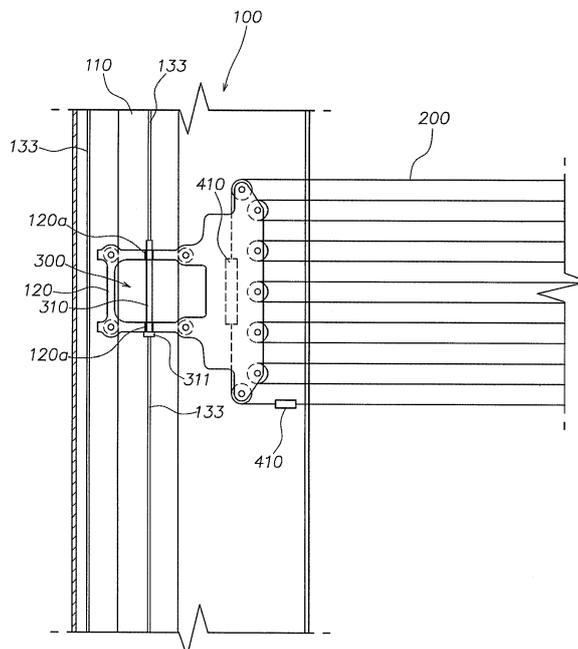
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(54) **TRAIN PLATFORM SAFETY DEVICE INCLUDING PASSENGER AND OBSTACLE DETECTION FUNCTION**

(57) The present invention relates to a train platform safety device including a passenger and obstacle detection function, the train platform safety device including: multiple lifting/lowering units provided on selected portions of an entrance and an exit of a platform; at least two moving bodies provided in the lifting/lowering units; ropes provided horizontally; a motor moving the moving body upward and downward; and a detection means controlling the upward and downward movements of the

moving body. According to the present invention, when the ropes hit a passenger or an obstacle while moving upward and downward, the platform safety device detects the hitting and stops or moves the ropes in a direction contrary to a direction in which each of the ropes is moving, thereby preventing accidents. Unlike the conventional detection device, frequent malfunctions or misoperations of the sensor caused by foreign materials do not occur, so that operation reliability is obtained.

**FIG. 4**



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**Description**

## BACKGROUND OF THE INVENTION

## Field of the Invention

**[0001]** The present invention generally relates to a train platform safety device including a passenger and obstacle detection function. More particularly, the present invention relates to a train platform safety device (Rope Screen Door, RSD) including a passenger and obstacle detection function, wherein when moving ropes hit a passenger or an obstacle, the platform safety device stops or moves the ropes in a direction contrary to a direction in which each of the ropes is moving so as to minimize accidents.

## Description of the Related Art

**[0002]** Generally, as shown in FIGS. 1 and 2, a train platform safety device includes multiple lifting/lowering units 100 provided on selected portions of an entrance and an exit of a platform to which a train approaches, moving bodies 120 provided in the lifting/lowering units 100 so as to move upward and downward, and ropes 200 provided horizontally so as to connect each of the moving bodies 120 to each other.

**[0003]** Each of the lifting/lowering units 100 constitutes a main body in a vertical direction and includes rotating bodies 131, 132 provided respectively on an upper part and a lower part of an inner side of the main body, a connector 133 connecting the rotating bodies 131, 132 to each other so as to be connected to the moving body 120, and a motor 130 rotating the rotating bodies 131, 132 so as to move the moving body 120 upward and downward.

**[0004]** The lifting/lowering unit 100 includes an infrared ray sensor or a laser sensor provided on an inner side or an outer side thereof so as to detect passenger trespass such that accidents are prevented.

**[0005]** However, according to the conventional detection device, when foreign materials settle on the sensor or a passenger pushes or pulls the ropes 200 by holding the ropes 200, misoperation or malfunction of the sensor occurs, so that a detection function of the sensor cannot be performed. Particularly, since the conventional detection device detects passengers and obstacles via electrical structure, the detection device cannot detect the passengers or the obstacles when power supply stops or when maintenance is performed. Furthermore, when the ropes 200 moving upward and downward hit a passenger or an obstacle, impact is applied directly to the passenger or the obstacle, so that an injury or damage occurs.

## Documents of Related Art

**[0006]**

(Patent Document 1) Korean Patent No. 10-0601112 (2006.07.19.);

(Patent Document 2) Japanese Patent Application Publication No. 2008-534827 (2008.08.28.);

(Patent Document 3) Korean Patent No. 10-1143843 (2012.05.04.);

(Patent Document 4) Korean Patent Application Publication No. 10-2014-0009813 (2014.01.23.);

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(Patent Document 7) Korean Patent Application Publication No. 10-2014-0007980 (2014.01.20.);

and

(Patent Document 8) Korean Patent No. 10-1471543 (2014.12.11.)

## SUMMARY OF THE INVENTION

**[0007]** Accordingly, the present invention has been made keeping in mind the above problems occurring in the related art, and the present invention is intended to propose a train platform safety device including a passenger and obstacle detection function, wherein when ropes hit a passenger or an obstacle while moving upward and downward, the platform safety device can stop or move the ropes in a direction contrary to a direction in which each of the ropes is moving.

**[0008]** Particularly, the present invention is further intended to propose a train platform safety device including a passenger and obstacle detection function, wherein the platform safety device can stop or move ropes in a direction contrary to a direction in which each of the ropes is moving according to a torque change value of a motor or an overload of the motor occurring when the ropes hit a passenger or an obstacle.

**[0009]** In addition, the present invention is still intended to propose a train platform safety device including a passenger and obstacle detection function, wherein the platform safety device can stop or move ropes in a direction contrary to a direction in which each of the ropes is moving by detecting a tensile force change of the ropes occurring when the moving ropes hit a passenger or an obstacle.

**[0010]** In order to achieve the above object, according to one aspect of the present invention, there is provided a train platform safety device including a passenger and obstacle detection function, the train platform safety device including: multiple lifting/lowering units provided on selected portions of an entrance and an exit of a platform at which a train stops; at least two moving bodies provided in the lifting/lowering units so as to move upward and downward; ropes provided horizontally so as to connect each of the moving bodies to each other; a motor moving the moving body upward and downward; and a detection means controlling the upward and downward movements of the moving body when the ropes hit a passenger

or an obstacle while moving.

**[0011]** Here, the moving body may be connected to each of rotating bodies having different diameters provided on an upper part and a lower part of each of the lifting/lowering units and may move upward such that the ropes are folded when the rotating bodies are rotated clockwise by an operation of the motor, and move downward such that the ropes are unfolded to each other when the rotating bodies are rotated counterclockwise by an operation of the motor.

**[0012]** Meanwhile, the detection means may include: a moving unit provided on one side of the moving body such that the moving body is moved upward or downward by upward and downward shakings occurring when the ropes hit a passenger or an obstacle while moving; and a controller controlling positions of the ropes according to a torque change value of the motor occurring while a position of the moving body, which is moving, changes when the ropes hit a passenger or an obstacle.

**[0013]** Particularly, the moving unit may be provided by passing through the moving body so as to move upward and downward, the moving unit including a support part provided on a lower part thereof so as to lift the moving body by being in contact with a lower surface of the moving body, and a guide shaft provided on an upper part of the moving unit, wherein a first end of a connector connecting rotating bodies to each other so as to rotate the rotating bodies may be combined with an upper part of the guide shaft, and a second end of the connector may be combined with a lower part of the support part.

**[0014]** Furthermore, the guide shaft may include an assistant support part provided on an upper part thereof so as to lower the moving body by being in contact with an upper surface of the moving body, wherein each of elastic bodies may be provided between the support part and the moving body and between the assistant support part and the moving body.

**[0015]** In addition, the controller may store as a reference value a torque occurring while the motor moves the moving body and the ropes upward and downward when the ropes normally do not hit a passenger or an obstacle, and compare the torque of the reference value with a torque of the motor occurring when the ropes hit a passenger or an obstacle while moving upward and downward, and when difference between the compared torques goes beyond allowable error range, the controller may determine that the ropes hit the passenger or the obstacle and control the motor so as to move the moving body and the ropes upward or downward.

**[0016]** Additionally, the detection means may include an overload detection sensor connected to the motor so as to detect an overload of the motor occurring when the ropes hit a passenger or an obstacle.

**[0017]** Furthermore, the detection means may include a tensile force detection sensor provided on a middle part or one end of each of the ropes so as to detect a tensile force change of the rope occurring when the ropes hit a passenger or an obstacle.

**[0018]** According to the present invention, when the ropes hit a passenger or an obstacle while moving upward and downward, the platform safety device detects the hitting and stops or moves the ropes in a direction contrary to a direction in which each of the ropes is moving, thereby preventing accidents. Particularly, according to the present invention, unlike the conventional detection device, frequent malfunctions or misoperations of the sensor caused by foreign materials do not occur, so that operation reliability is obtained. Furthermore, according to the present invention, a heavy detection device such as the conventional touch bar provided under the ropes is not required. In addition, according to the present invention, a structure is simple and maintenance is easy, so that durability and life can be improved.

#### BRIEF DESCRIPTION OF THE DRAWINGS

**[0019]** The above and other objects, features and other advantages of the present invention will be more clearly understood from the following detailed description when taken in conjunction with the accompanying drawings, in which:

FIG. 1 is a front view roughly showing a configuration of a conventional train platform safety device; FIG. 2 is an enlarged view showing an important part of the conventional train platform safety device; FIG. 3 is a front view roughly showing a configuration of a train platform safety device including a passenger and obstacle detection function according to the present invention; FIGS. 4 and 5 are enlarged views showing an important part of the train platform safety device according to the present invention; and FIG. 6 is an enlarged view showing an operation state of the train platform safety device according to the present invention.

#### DETAILED DESCRIPTION OF THE INVENTION

**[0020]** Hereinbelow, a technological configuration for achieving an object of the present invention will be described in detail with reference to the accompanying drawings.

**[0021]** FIG. 3 is a front view roughly showing a configuration of a train platform safety device including a passenger and obstacle detection function according to the present invention; FIGS. 4 and 5 are enlarged views showing an important part of the train platform safety device according to the present invention; and FIG. 6 is an enlarged view showing an operation state of the train platform safety device according to the present invention.

**[0022]** According to the present invention, the train platform safety device may include: multiple lifting/lowering units 100 provided on selected portions of an entrance and an exit of a platform at which a train stops; at least two moving bodies 120 provided in the lifting/low-

ering units 100 so as to move upward and downward; ropes 200 provided horizontally so as to connect each of the moving bodies 120 to each other; a motor 130 moving the moving body 120 upward and downward; and a detection means controlling the upward and downward movements of the moving body 120 when the ropes 200 hit a passenger or an obstacle while moving. The moving body 120 may be configured to move upward and downward along a support 110 acting as a guide.

**[0023]** Each of the lifting/lowering units 100 is a means guiding efficient movements of the moving body 120 and the ropes 200 upward and downward, and the ropes 200 are a means used to control passenger access. This is a commonly-used technology in the related art and a detailed description concerning an operation principle and a detailed structure will be omitted.

**[0024]** Each of the multiple moving bodies 120 is connected to each of multiple rotating bodies 131 having different diameters provided on an upper part and a lower part of the lifting/lowering unit 100 and moves upward such that the ropes 200 are folded when the rotating bodies 131 are rotated clockwise by an operation of the motor 130, and moves downward such that the ropes 200 are unfolded to each other when the rotating bodies are rotated counterclockwise by an operation of the motor 130.

**[0025]** Accordingly, according to the present invention, while the moving body 120 and the ropes 200 are moved upward by an operation of the motor 130, the ropes are positioned to be folded together, so that passing height may be obtained for passengers to pass, and contrarily, while the moving body 120 and the ropes 200 move downward, the ropes are unfolded to each other so as to stop passenger access.

**[0026]** Meanwhile, the detection means includes a moving unit 300 provided on one side of the moving body 120 such that the moving body 120 is moved upward or downward by upward and downward shakings occurring when the ropes 200 hit the passenger or the obstacle while moving, and a controller 400 controlling positions of the ropes 200 according to a torque change value of the motor 130 occurring while a position of the moving body 120, which is moving, changes when the ropes 200 hit the passenger or the obstacle.

**[0027]** Particularly, the moving unit 300 allows the moving body 120 to move upward and downward when the ropes 200 hit a passenger or an obstacle while moving upward and downward so as to check whether the passenger or the obstacle is detected by comparing the torque change value of the motor 130 with an allowable error range via the controller 400.

**[0028]** That is, the conventional train platform safety device does not include a safety device stopping or controlling the ropes 200 such that the ropes 200 do not move upward or downward any longer when the ropes 200 hit a passenger or an obstacle while moving upward and downward.

**[0029]** Accordingly, according to the present invention, when the ropes 200 hit a passenger or an obstacle, the

moving unit 300 moves the ropes 200 upward and downward, and more particularly, changes a torque of the motor 130 so as to induce an immediate response of the ropes and stops or moves the ropes 200 in a direction contrary to a direction in which the ropes 200 are moving, so that accidents can be prevented.

**[0030]** Particularly, each of the ropes 200 is made of a metal or synthetic resins material having a length of several meters to tens of meters, and when the ropes 200 hit a passenger or an obstacle, the ropes 200 assist the moving body such that the moving body 120 may be moved easily upward and downward by the moving unit 300 by using an elastic force of the ropes waving upward and downward so as to efficiently measure the torque change value of the motor 130.

**[0031]** When like the conventional technology, a screen door or a heavy object of a plate shape is used instead of the ropes 200, a moving body 120 cannot be easily moved upward and downward when the screen door or the heavy object hits a passenger or an obstacle, so that a torque change value of a motor 130 cannot be checked.

**[0032]** As shown in FIGS. 3 and 4, the moving unit 300 is provided by passing through the moving body 120 so as to move upward and downward, the moving unit including a support part 311 provided on a lower part thereof so as to lift the moving body by being in contact with a lower surface of the moving body 120, and a guide shaft 310 provided on an upper part of the moving unit, wherein a first end of a connector 133 connecting rotating bodies 131, 132 to each other so as to rotate the rotating bodies is combined with an upper part of the guide shaft, and a second end of the connector 133 is combined with a lower part of the support part 311.

**[0033]** Here, sprockets or pulleys having various sizes and shapes may be used as the rotating bodies 131, 132, and a chain or a belt may be used as the connector 133. The motor 130 may be a motor having various shapes and structures, include a reduction gear provided on one side thereof, and may be an inverter or a servo motor controlling torques changing when the ropes 200 and the moving body 120 move upward and downward.

**[0034]** Meanwhile, the guide shaft 310 may normally move the moving body 120 upward, with the support part 311 being in contact with the lower surface of the moving body 120, and contrarily, when the moving body 120 moves downward, the moving body can be moved by weights of the ropes 200 and the moving body 120.

**[0035]** However, when the ropes 200 hit an obstacle while moving downward, the moving body 120 reverses the moving direction thereof and moves upward along the guide shaft 310, and simultaneously, a torque change value is produced such that the motor 130 moves the moving body 120 downward. Accordingly, the controller 400 stops or rotates the motor 130 clockwise or counterclockwise so as to move the ropes 200 upward and downward.

**[0036]** The moving body 120 may include through

holes 120a having a bearing provided on one side thereof such that the guide shaft 310 is inserted into the moving body in a vertical direction so as to move efficiently.

**[0037]** As shown in FIG. 5, the guide shaft 310 may include an assistant support part 312 provided on an upper part thereof such that the assistant support part forcibly moves the moving body 120 downward by being in contact with an upper surface of the moving body 120 when the moving body 120 is not moved downward by a weight thereof.

**[0038]** Each of elastic bodies 313 is provided between the support part 311 and the moving body 120 and between the assistant support part 312 and the moving body 120, and assists impact absorptions of the ropes 200 and the moving body 120 upward and downward when the ropes 200 hit an obstacle. Compressed springs having various sizes and elastic forces may be used as the elastic bodies 313.

**[0039]** The controller 400 performs a function stopping or controlling the motor 130 according to the torque change value of the motor 130 occurring while the moving body 120 moves upward and downward.

**[0040]** The controller 400 stores as a reference value a torque occurring while the motor 130 moves the moving body 120 and the ropes 200 upward and downward when the ropes 200 normally do not hit a passenger or an obstacle, and compares the torque of the reference value with a torque of the motor 130 occurring when the ropes 200 hit a passenger or an obstacle while moving upward and downward, and when difference between the compared torques goes beyond allowable error range, the controller 400 determines that the ropes 200 hit the passenger or the obstacle and controls the motor 130 so as to move the moving body 120 and the ropes 200 upward or downward.

**[0041]** That is, the controller 400 stores as a reference value a torque occurring while the motor 130 moves the moving body 120 and the ropes 200 upward and downward when the ropes normally do not hit a passenger or an obstacle, and when the ropes 200 hit a passenger or an obstacle while moving upward and downward, the ropes 200 and the moving body 120 move upward and downward along the guide shaft 310 and a torque of the motor 130 is abruptly changed, so that the controller can determine that the ropes hit the passenger or the obstacle since the torque change value goes beyond allowable error range.

**[0042]** The controller 400 may include a central processing unit module storing a torque reference value and comparing the reference value with a torque change value so as to determine an error range.

**[0043]** The controller 400 ignores a torque change value of the motor 130 caused by an external impact or a vibration, and compares the torque reference value with the torque change value of the motor 130 caused by the upward and downward movements of the ropes when the ropes 200 hit a passenger or an obstacle so as to set an error range.

**[0044]** The controller 400 may include Flash Memory or EPROM so as to set and store the torque reference value.

**[0045]** Furthermore, according to another embodiment of the present invention, the detection means may include an overload detection sensor connected to the motor 130 so as to detect an overload of the motor 130 occurring when the ropes 200 hit a passenger or an obstacle.

**[0046]** In addition, according to still another embodiment of the present invention, as shown in FIG. 4, the detection means includes a tensile force detection sensor 410 provided on a middle part or one end of each of the ropes 200 so as to detect a tensile force change occurring when the ropes 200 hit a passenger or an obstacle.

**[0047]** Accordingly, as shown in FIG. 6, when the ropes 200 hit a passenger or an obstacle while moving upward and downward, the platform safety device of the present invention stops or moves the ropes 200 upward or downward according to the torque change value of the motor 130 occurring while the ropes 200 and the moving body 120 move upward and downward so as to minimize accidents.

**[0048]** While the invention has been described with reference to an embodiment thereof, it will be understood by those skilled in the art that various changes and modifications may be made therein without departing from the spirit and scope of the invention as defined by the appended claims.

## Claims

1. A train platform safety device including a passenger and obstacle detection function, the train platform safety device comprising:

multiple lifting/lowering units provided on selected portions of an entrance and an exit of a platform at which a train stops;  
 at least two moving bodies provided in the lifting/lowering units so as to move upward and downward;  
 ropes provided horizontally so as to connect each of the moving bodies to each other;  
 a motor moving the moving body upward and downward; and  
 a detection means controlling the upward and downward movements of the moving body when the ropes hit a passenger or an obstacle while moving.

2. The train platform safety device of claim 1, wherein the moving body is connected to each of rotating bodies having different diameters provided on an upper part and a lower part of each of the lifting/lowering units and moves upward such that the ropes are folded when the rotating bodies are rotated clockwise

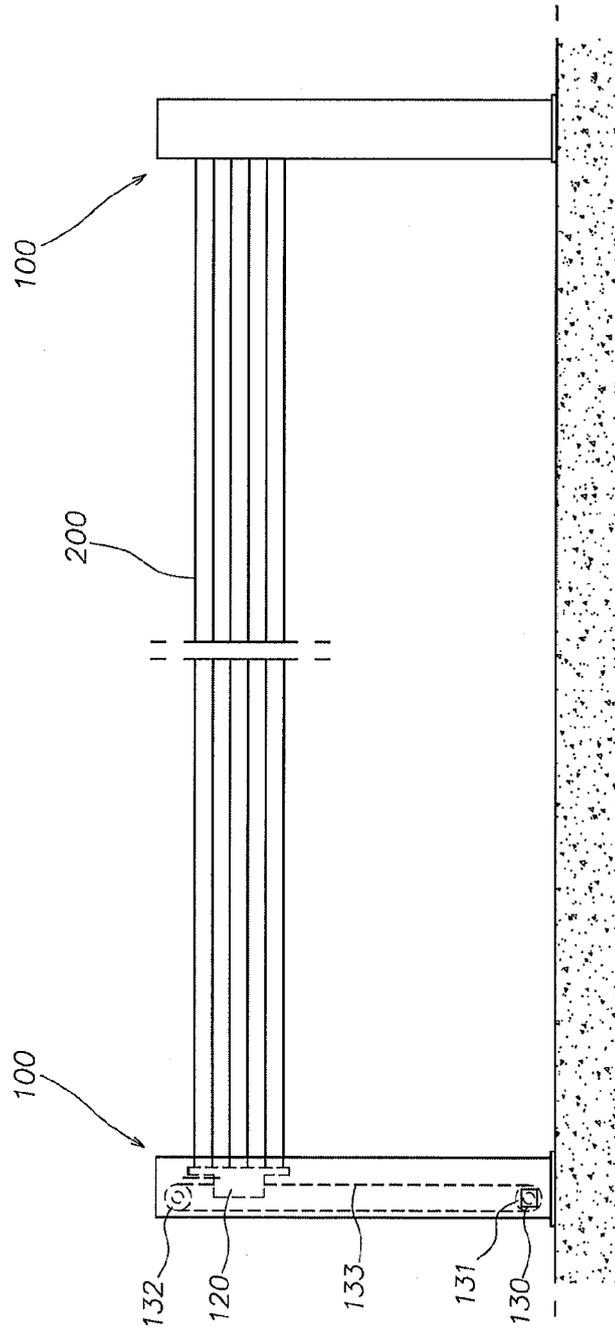
by an operation of the motor, and moves downward such that the ropes are unfolded to each other when the rotating bodies are rotated counterclockwise by an operation of the motor.

- 3. The train platform safety device of claim 1, wherein the detection means includes: a moving unit provided on one side of the moving body such that the moving body is moved upward or downward by upward and downward shakings occurring when the ropes hit a passenger or an obstacle while moving; and a controller controlling positions of the ropes according to a torque change value of the motor occurring while a position of the moving body, which is moving, changes when the ropes hit a passenger or an obstacle. 5
  
- 4. The train platform safety device of claim 3, wherein the moving unit is provided by passing through the moving body so as to move upward and downward, the moving unit including a support part provided on a lower part thereof so as to lift the moving body by being in contact with a lower surface of the moving body, and a guide shaft provided on an upper part of the moving unit, wherein a first end of a connector connecting rotating bodies to each other so as to rotate the rotating bodies is combined with an upper part of the guide shaft, and a second end of the connector is combined with a lower part of the support part. 10
  
- 5. The train platform safety device of claim 4, wherein the guide shaft includes an assistant support part provided on an upper part thereof so as to lower the moving body by being in contact with an upper surface of the moving body, wherein each of elastic bodies is provided between the support part and the moving body and between the assistant support part and the moving body. 15
  
- 6. The train platform safety device of claim 3, wherein the controller stores as a reference value a torque occurring while the motor moves the moving body and the ropes upward and downward when the ropes normally do not hit a passenger or an obstacle, and compares the torque of the reference value with a torque of the motor occurring when the ropes hit a passenger or an obstacle while moving upward and downward, and when difference between the compared torques goes beyond allowable error range, the controller determines that the ropes hit the passenger or the obstacle and controls the motor so as to move the moving body and the ropes upward or downward. 20
  
- 7. The train platform safety device of claim 1, wherein the detection means includes an overload detection sensor connected to the motor so as to detect an 25

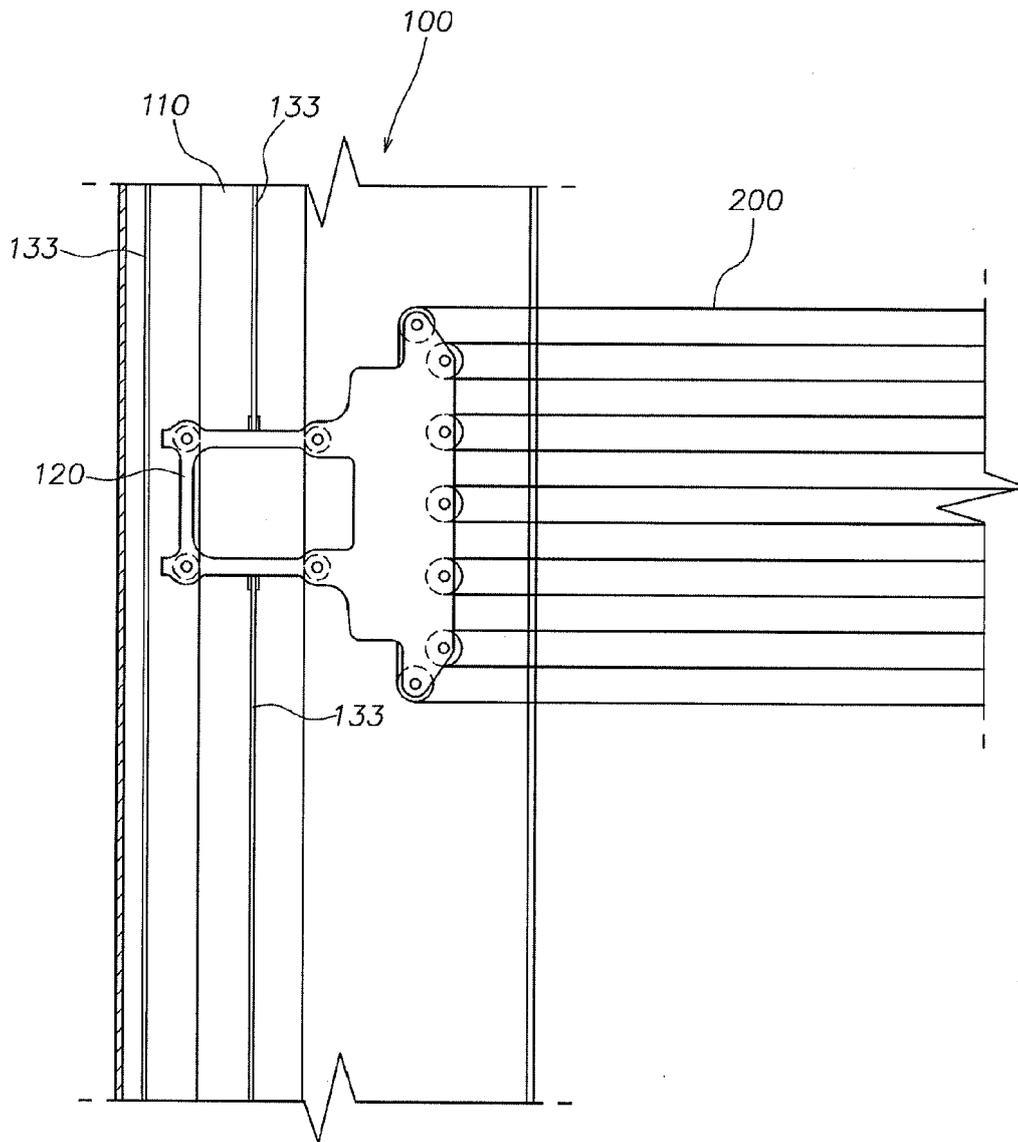
overload of the motor occurring when the ropes hit a passenger or an obstacle.

- 8. The train platform safety device of claim 1, wherein the detection means includes a tensile force detection sensor provided on a middle part or one end of each of the ropes so as to detect a tensile force change of the rope occurring when the ropes hit a passenger or an obstacle. 30

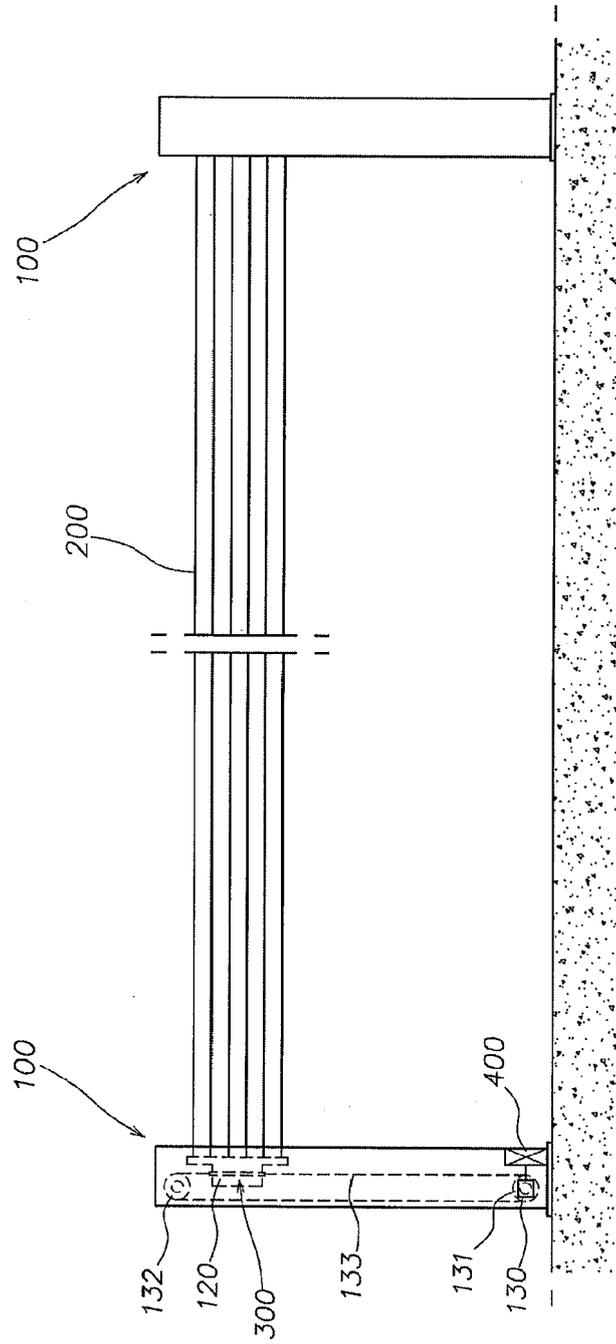
FIG. 1



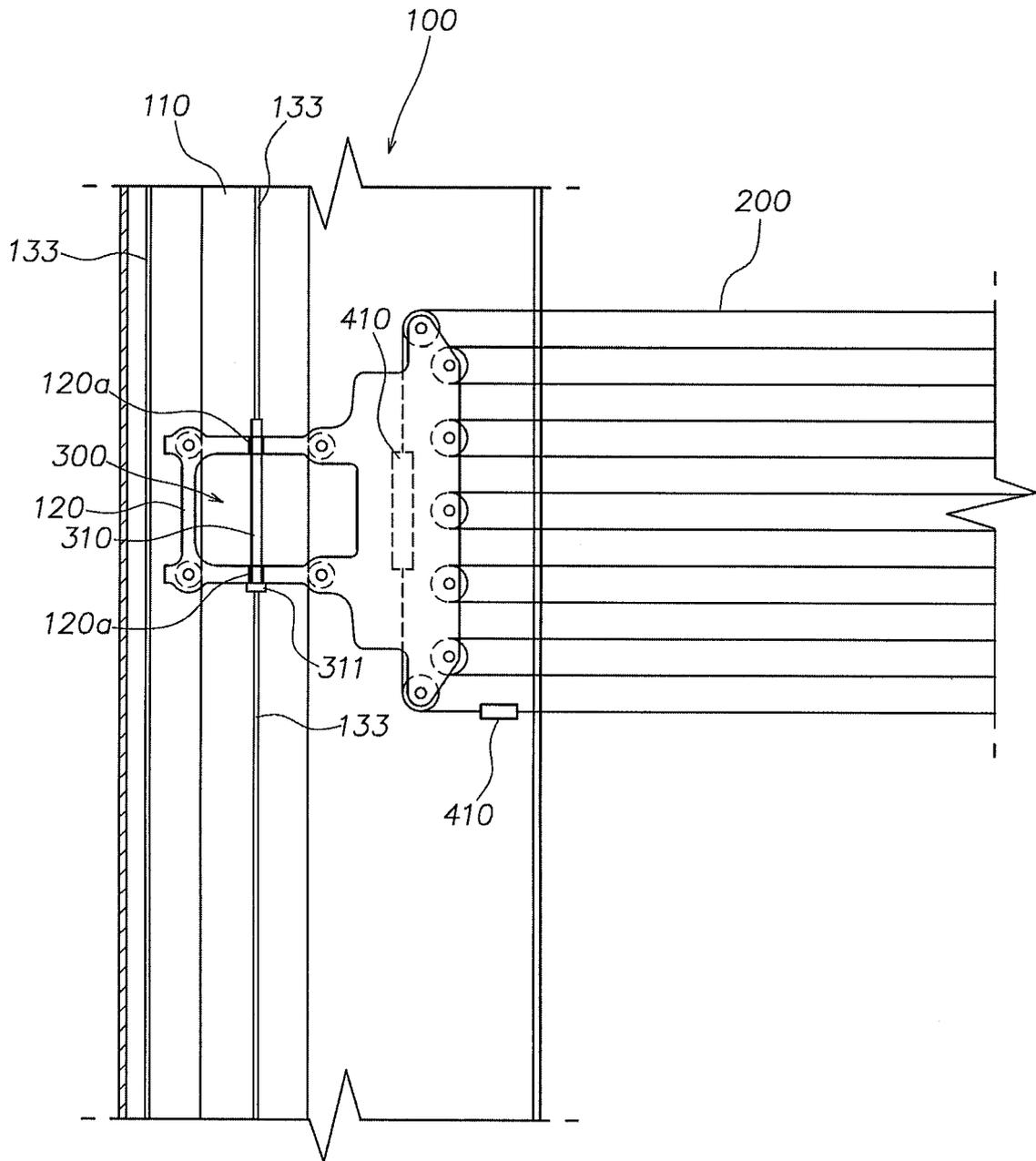
**FIG. 2**



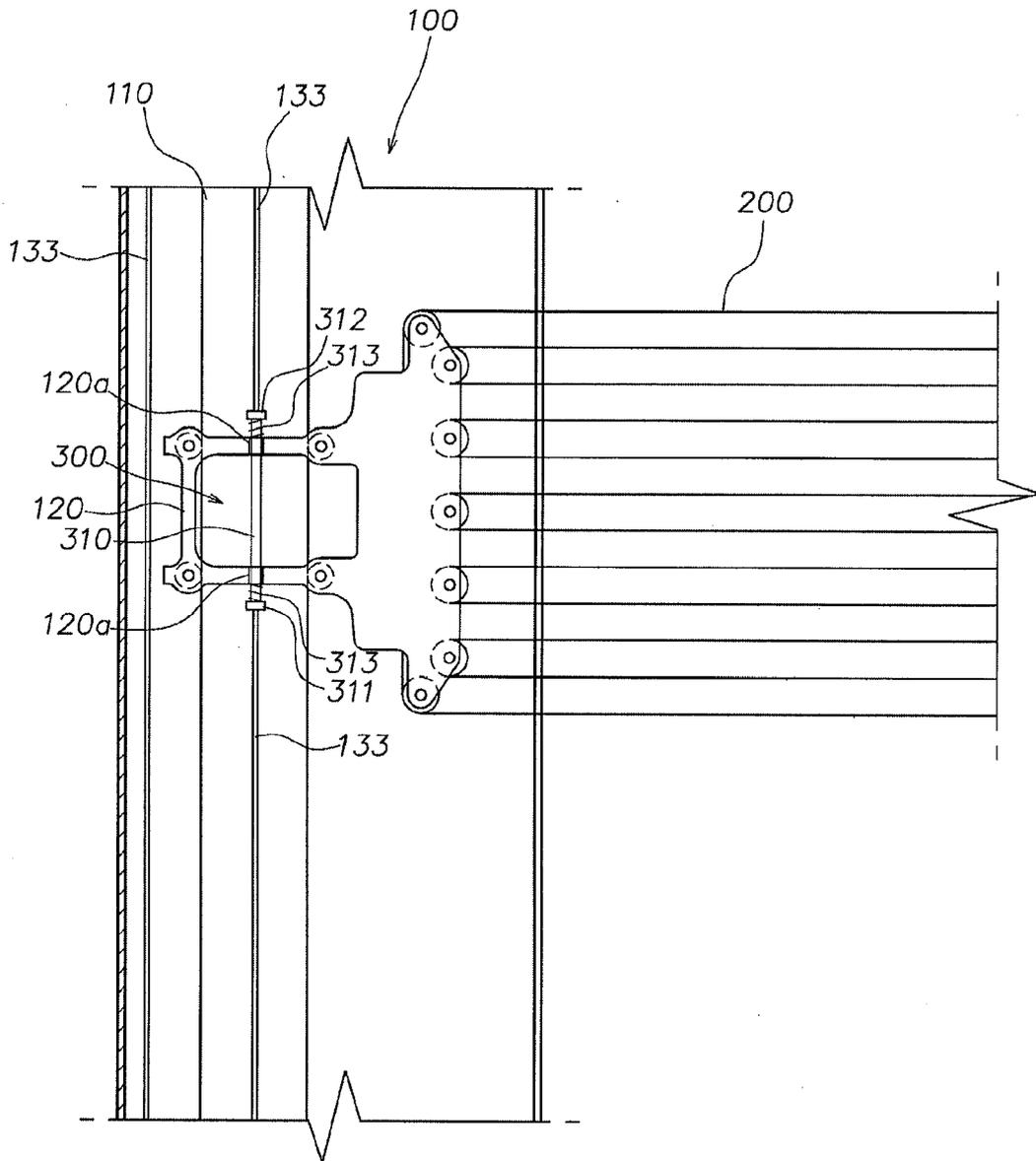
**FIG. 3**



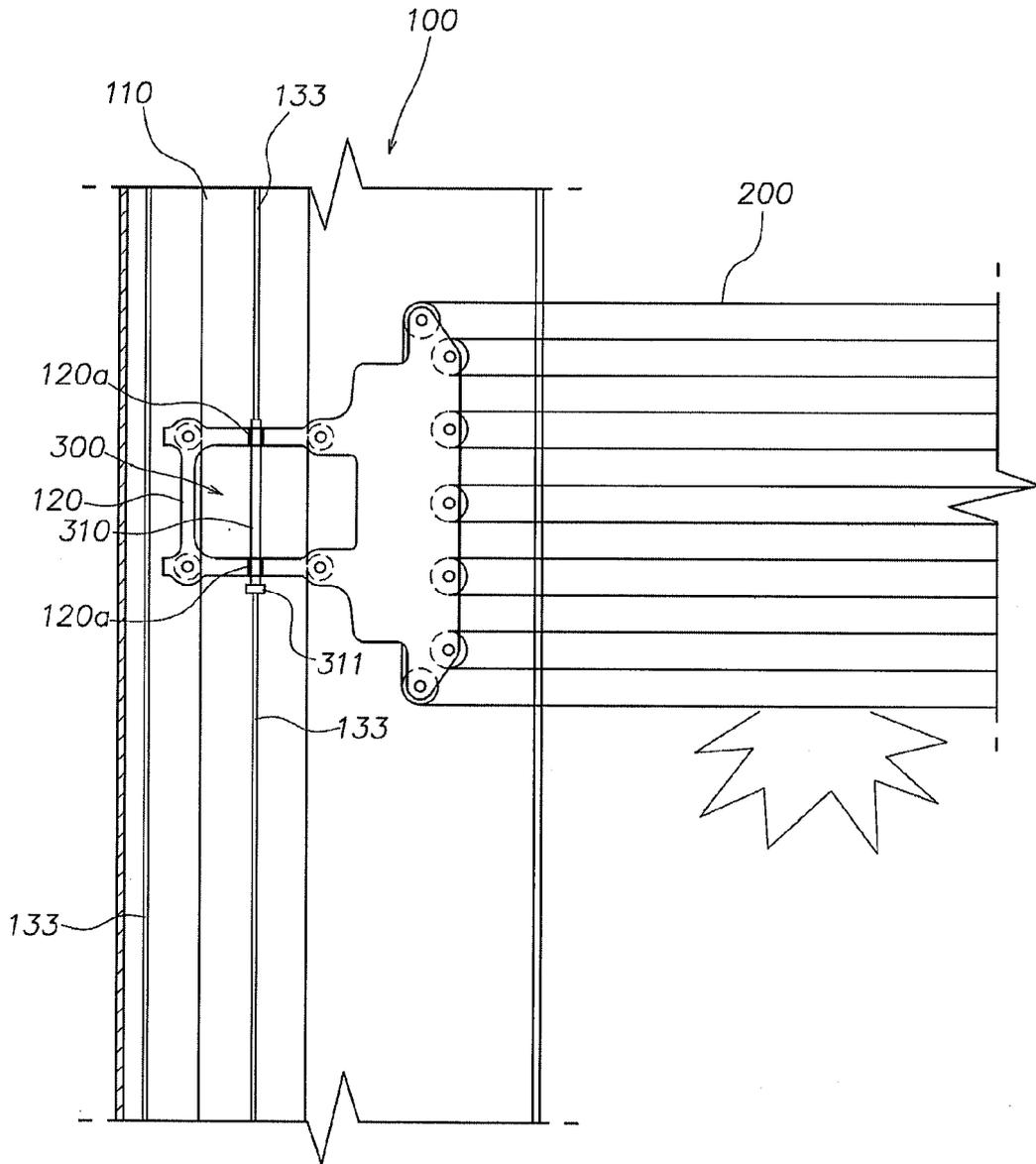
**FIG. 4**



**FIG. 5**



**FIG. 6**





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Application Number  
EP 18 21 0083

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Place of search		Date of completion of the search	Examiner
Munich		26 April 2019	Awad, Philippe
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