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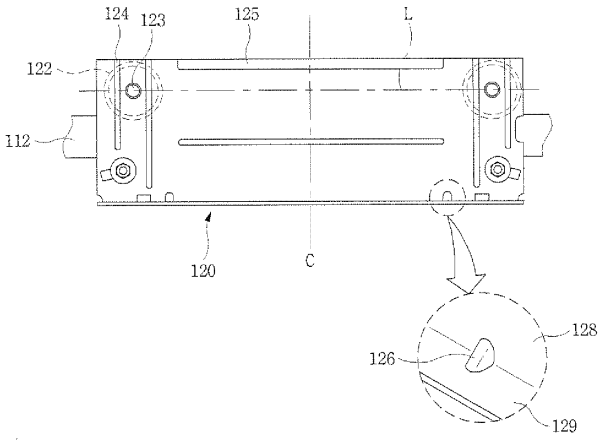
# (54) HANGER PLATE FOR ELEVATOR AND ELEVATOR DOOR DEVICE COMPRISING THE SAME

(57) An elevator door device is provided, which includes a hanger case installed on an upper part of an elevator doorway and having a hanger rail formed in a width direction of the elevator doorway; a hanger plate connected to a roller rotating on the hanger rail to move in the width direction of the elevator doorway in response to the rotation of the roller on the hanger rail; and an elevator door engaged with the hanger plate to open/close the elevator doorway according to the left/right movement of the hanger plate. Here, the hanger plate has a first embossing portion, which is forwardly projected or backwardly recessed, formed thereon in a vertical direction, and the first embossing portion is formed to pass through a line extended in the width direction from a point that corresponds to the center of the roller. Accordingly, the rigidity of a part or the whole of the hanger plate can be easily and inexpensively increased to meet the desired level without changing the material of the hanger plate or increasing the thickness thereof, and thus the secession of the elevator door due to the deformation of the hanger plate can be prevented even if a force is applied to the elevator door.

**FIG. 3**

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## Description

### CROSS-REFERENCE TO RELATED APPLICATION

**[0001]** This application is based on and claims priority from Korean Patent Application No. 10-2008-0039364, filed on April 28, 2008 in the Korean Intellectual Property Office, the disclosure of which is incorporated herein in its entirety by reference.

### BACKGROUND OF THE INVENTION

#### Field of the invention

**[0002]** The present invention relates to a hanger plate for an elevator and an elevator door device including the same, and more particularly to a hanger plate for an elevator and an elevator door device including the same, which can prevent separation of en elevator door due to deformation of the hanger plate by increasing the rigidity of the hanger plate.

#### Description of the Prior Art

**[0003]** In the related art, the safety standard related to the separation of an elevator door due to an external impact is not quite satisfactory. For example, in the EN (European Nations) standards, a method of applying a weight of 30 kg to an elevator door and confirming the existence/nonexistence of deformation of the door has been used. However, this method has the problem that the method cannot appropriately reflect the actual collision situation, and thus the safety of the elevator door cannot be sufficiently secured.

**[0004]** Accordingly, in the International Standards Organization (ISO/TC178) for Elevator Safety recently held, it was agreed to simultaneously use a method of applying kinetic energy of a moving object to the elevator door, which is most similar to the actual collision situation in relation to "Separation Strength and Test Method" of the elevator door.

**[0005]** Accordingly, in order to confirm the safety of the elevator door, it is required that the elevator door is not separated even though energy of 450[J] (energy in the case where two middle school boys (120 kg) dash and collide with an elevator door) is applied to the elevator door.

**[0006]** However, in the case of the elevator door device in the related art, if energy is applied to the elevator door, the elevator door is easily separated due to the deformation of the hanger plate.

**[0007]** FIG. 9 is a side view of an elevator door device in the related art explaining the separation of an elevator door due to bending of a hanger plate that may occur when a certain force is applied to the elevator door.

**[0008]** Referring to FIG. 9, the elevator door device in the related art will be described. On an upper part of an elevator doorway, a hanger case 10 in which a driving device for driving an elevator door 30 is installed is provided. In addition to the driving device, a hanger rail 12 for guiding the movement of the elevator door 30 is provided in the hanger case 10. On the hanger rail 12, a roller 22 which rotates along the hanger rail 12 and moves left and right, i.e. in a width direction of the elevator doorway, is provided. This roller 22 is connected to a hanger plate 20 that is engaged with the elevator door 30. Through the above-describe structure, the elevator door 30 is movably connected to the hanger rail 12 of the hanger case 10 in the left/right direction by the hanger plate 20.

**[0009]** The upper part of the elevator door 30 is supported by the hanger case 10 via the hanger plate 20, and the lower part of the elevator door 30 is supported by the guide rail 40 via a door shoe 32, so that the elevator door 30 can stably move left and right, i.e. in the width direction of the elevator doorway.

**[0010]** However, since the hanger plate 20 in the related art is manufactured by simply bending a flat metal plate having a thin thickness, the rigidity of the hanger plate 20 is very weak. Accordingly, if a force F is vertically applied to the elevator door 30 as illustrated in FIG. 9, parts of the hanger plate 20 get bent (see "A" and "B" in FIG. 9), and the elevator door 30 may be separated from the guide rail 40.

### SUMMARY OF THE INVENTION

**[0011]** Accordingly, the present invention has been made to solve the above-mentioned problems occurring in the related art while advantages achieved by the related art are maintained intact.

**[0012]** One subject to be achieved by the present invention is to provide a hanger plate for an elevator and an elevator door device, which can prevent the separation of en elevator door by suppressing the occurrence of deformation of a hanger plate even if a force is applied to the elevator door.

**[0013]** In one aspect of the present invention, there is provided an elevator door device, which includes a hanger case installed on an upper part of an elevator doorway and having a hanger rail formed in a width direction of the elevator doorway; a hanger plate connected to a roller rotating on the hanger rail to move in the width direction of the elevator doorway in response to the rotation of the roller on the hanger rail; and an elevator door engaged with the hanger plate to open/close the elevator doorway according to the left/right movement of the hanger plate. Here, the hanger plate has a first embossing portion, which is forwardly projected or backwardly recessed, formed thereon in a vertical direction, and the first embossing portion is formed to pass through a line extended in the width direction from a point that corresponds to the center of the roller.

**[0014]** In the elevator door device according to an embodiment of the present invention, the hanger plate has the first embossing portion formed thereon, and thus the bending of the hanger plate in the upward direction can

be maximally suppressed even if a force is applied to the elevator door in the vertical direction. That is, since the first embossing portion is formed on the hanger plate in the vertical direction, the rigidity of the hanger plate for suppressing the bending of the hanger plate can be secured. Accordingly, even if a vertical force is applied to the elevator door, the hanger plate is not bent in the upward direction and thus the secession of the elevator door can be prevented.

**[0015]** Also, such secession prevention becomes more effective since the first embossing portion is formed to pass through the line extended in the width direction from the point that corresponds to the center of the roller. Specifically, if a force is applied to the hanger plate, the bending may first occur at a point where the hanger plate is connected to the roller, that is, a point that corresponds to the center of the roller. However, according to the hanger plate according to en embodiment of the present invention, the first embossing portion is formed to pass through the line extended in the width direction from the point that corresponds to the center of the roller, the weakness in rigidity of the hanger plate can be reinforced. A pair of embossing portions may be formed around a connection axis for connecting the hanger plate and the roller.

**[0016]** On the other hand, in the elevator door device according to an embodiment of the present invention, the twist of the hanger plate can be prevented by a second embossing portion even though a force is applied to the elevator door at points that are apart in left and right directions from the center line that halves a distance between both ends of the elevator door in the width direction. That is, on the hanger plate according to the present invention, the second embossing portion, which is forwardly projected or backwardly recessed, may be formed thereon in a horizontal direction to prevent the occurrence of twist of the hanger plate. In this case, it is preferable that the second embossing portion is formed to pass through a center line that halves a distance between both ends of the hanger plate in the width direction.

**[0017]** Also, the hanger plate may include a base plate and a connection plate formed to be vertically bent from one end of the base plate, and a third embossing portion, which is inwardly projected, may be formed on a connection portion that connects the base plate and the connection plate to prevent the bending of the connection plate toward the base plate. Accordingly, even if a force is applied to the elevator door, the bending of the connection portion in an upward direction can be prevented.

**[0018]** In another aspect of the present invention, there is provided an elevator door device, which includes a hanger case installed on an upper part of an elevator doorway and having a hanger rail formed in a width direction of the elevator doorway; a hanger plate connected to a roller rotating on the hanger rail to move in the width direction of the elevator doorway in response to the rotation of the roller on the hanger rail; and an elevator door engaged with the hanger plate to open/close the elevator doorway according to the left/right movement of the hanger plate. Here, bent portions, which are formed to be bent from the hanger plate in the forward or backward direction, are provided at both ends of the hanger plate in the width direction, and the bent portions are formed to pass through a line extended in the width direction from a point that corresponds to the center of the roller.

**[0019]** In still another aspect of the present invention, there is provided a hanger plate for an elevator, which connects a hanger case installed on an upper part of an elevator doorway and having a hanger rail formed in a width direction of the elevator doorway, with an elevator door which is guided by the hanger rail to move in the width direction of the elevator doorway, through a roller rotating on the hanger rail; comprising a first embossing portion which is forwardly projected or backwardly recessed, and is formed in a vertical direction so as to pass through a line extended in the width direction from a point that corresponds to the center of the roller.

**[0020]** With the above-described construction, since the hanger plate for an elevator and the elevator door device according to the present invention are constructed so as to include the hanger plate having first to third embossing portions formed thereon, the rigidity of the hanger plate is increased, and thus the secession of the elevator door due to the deformation of the hanger plate can be prevented even if a force is applied to the elevator door.

**[0021]** Also, in the hanger plate for an elevator and the elevator door device according to the present invention, it is not necessary to change the material of the hanger plate, to increase the thickness thereof, or to engage a separate plate with the hanger plate by a welding process or the like to increase the rigidity, and the rigidity of a part or the whole of the hanger plate can be easily and inexpensively increased to meet the desired level.

## BRIEF DESCRIPTION OF THE DRAWINGS

**[0022]** The above and other objects, features and advantages of the present invention will be more apparent from the following detailed description taken in conjunction with the accompanying drawings, in which:

FIG. 1 is a front view illustrating an elevator door device according to embodiment 1 of the present invention;

FIG. 2 is a side view of FIG. 1;

FIG. 3 is a front view illustrating a hanger plate according to embodiment 1 of the present invention;

FIG. 4 is a plan view of FIG. 3;

FIG. 5 is a side view of FIG. 3;

FIG. 6 is a front view illustrating a hanger plate according to embodiment 2 of the present invention;

FIG. 7 is a plan view of FIG. 6;

FIG. 8 is a side view of FIG. 6; and

FIG. 9 is a side view of an elevator door device in the related art explaining the separation of an eleva-

tor door due to bending of a hanger plate that may occur when a certain force is applied to the elevator door.

## DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

**[0023]** Hereinafter, preferred embodiments of the present invention will be described in detail with reference to the accompanying drawings. However, the present invention is not limited to the embodiments thereof. For reference, the same reference numerals are used for the same elements across various figures. Under the above-described rules, explanation may be made referring to the contents described in the drawings or the contents which are determined to be apparent to those skilled in the art or which are duplicated may be omitted.

Embodiment 1

**[0024]** FIG. 1 is a front view illustrating an elevator door device according to embodiment 1 of the present invention, and FIG. 2 is a side view of FIG. 1.

**[0025]** As illustrated in FIGS. 1 and 2, an elevator door device according to a first embodiment of the present invention includes a hanger case 110, a hanger plate 120, and an elevator door 130.

**[0026]** On an upper portion of an elevator hoistway-side or partition-side doorway (hereinafter referred to as an "elevator doorway" in all), the hanger case 110 is installed. In the hanger case 110, a driving device 160 for providing a driving force for opening/closing an elevator hoistway-side or partition-side door (hereinafter referred to as an "elevator door" in all) and a hanger rail 112 for guiding left and right movement of the elevator door 130 in a width direction are provided.

**[0027]** The driving device 160 generally includes a driving device main body including a motor, a rotating shaft rotating by the driving force of the driving device main body, a driving pulley fixed to the rotating shaft to rotate in association with the rotating shaft, and an endless belt wound on the driving pulley to perform an orbital movement by the rotation of the driving pulley. The hanger plate 120 connected to the belt moves in the width direction, i.e. in the left/right direction, of the elevator doorway 150 in response to an orbital movement of the belt, and thus the elevator door 130 engaged with the hanger plate 120 can open/close the doorway.

**[0028]** The hanger rail 112 is formed in the width direction of the elevator doorway 150 to guide the movement of a roller 122 connected to the hanger plate 120 and to support the hanger plate engaged with the elevator door 130 via the roller 122. Such a hanger rail may be manufactured separately from the hanger case and may be engaged with the hanger case or may be manufactured integrally with the hanger case. In this embodiment of the present invention, the hanger rail 112 integrally manufactured with the hanger case 110 is illustrated.

**[0029]** On the other hand, the hanger plate 120 not only connects the elevator door 130 and the hanger rail 112 of the hanger case 110 via the roller but also serves to transfer the driving force of the driving device to the elevator door 130. That is, the driving force generated by the driving device main body moves the hanger plate 120 in the left/right direction through the belt that performs the orbital movement, and the elevator door 130 engaged with the hanger plate can open/close the elevator doorway 150 according to the left/right movement of the hanger plate 120.

**[0030]** Also, the hanger plate 120 may be connected to the roller 122 rotating on the hanger rail 112 to make the hanger plate 120 move smoothly, and stably move the hanger plate 120 on a predetermined path. It is general that two rollers 122 are provided on upper both sides of the hanger plate 120 around the center line that halves the center line of the hanger plate 120 in the width direction.

**[0031]** As described above, the upper part of the elevator door 130 is supported by the hanger case 110 via the hanger plate 120, and the lower part of the elevator door 130 is supported by the guide rail 140 via the door shoe 132, so that the elevator door 130 can stably move in the left/right direction, i.e. in the width direction of the elevator doorway 150.

**[0032]** Referring to FIGS. 3 to 5, the structure of the hanger plate according to an embodiment of the present invention will be described in detail. FIG. 3 is a front view illustrating the hanger plate according to embodiment 1 of the present invention, FIG. 4 is a plan view of FIG. 3, and FIG. 5 is a side view of FIG. 3.

**[0033]** As illustrated in FIGS. 3 to 5, on the hanger plate 120 according to the first embodiment of the present invention, a first embossing portion 124 which is backwardly recessed may be formed in the vertical direction. In this case, it is preferable that the first embossing portion 124 is formed to pass through the line L that is extended in the width direction from the point that corresponds to the center of the roller. For reference, in the description, the term "vertical direction" means a length direction of the hanger plate 120, that is, the vertical direction in the hanger plate of FIG. 3, and "horizontal direction" or "width direction" means a horizontal direction in the with direction of the hanger plate 120, i.e. the horizontal direction in the hanger plate of FIG. 3.

**[0034]** If a force is applied to the elevator door 130 in the forward or rearward direction, a force that is applied to the lower end thereof in the forward or backward direction acts on the hanger plate 120 engaged with the upper end of the door 130. In this case, since the upper part of the hanger plate 120 is supported by the connection shaft 123 provided in the center of the roller 122, the bending of the hanger plate 120 typically occurs in the neighborhood of the connection shaft 123 when such a force is applied thereto. Accordingly, if a force is applied to the elevator door 130 due to a passenger's carelessness or accident, the bending of the hanger plate 120

typically occurs according to the line that connects the center of the roller 122 connected to both sides of the upper part of the hanger plate 120.

**[0035]** However, in this embodiment of the present invention, since the first embossing portion 124 is formed on the hanger plate 120, the above-described bending can be maximally suppressed. That is, since the first embossing unit 124 is formed to pass the line L extended in the width direction from the point that corresponds to the portion that can be bent most easily, i.e. the center of the roller 122, the rigidity of the hanger plate 120 that can prevent the bending of the hanger plate 120 as described above can be secured. Accordingly, even if a force is applied to the elevator door 130, the separation of the elevator door 130 due to the bending of the hanger plate 120 can be maximally prevented.

**[0036]** The first embossing portion 124 may be formed by pressing a part of the hanger plate 120 by press or the like, and may be formed to be forwardly projected or to be backwardly recessed according to the manufacturing method. In this embodiment, the first embossing portion 124 that is backwardly recessed is exemplified.

**[0037]** On the other hand, since the bending of the hanger plate 120 typically starts at both ends of the hanger plate 120 in the width direction, the bending of the hanger plate 120 can be prevented more effectively when the first embossing portion 124 is formed in the neighborhood of the both ends of the hanger plate 120 rather than when the first embossing portion 124 is formed in the neighborhood of the center of the width direction. Accordingly, it is preferable that a pair of first embossing portions 124 is formed around the connection shaft 123 of the rollers 122 connected in the neighborhood of the both ends of the hanger plate 120.

**[0038]** Generally, the deformation of the hanger plate 120 causes a problem when the hanger plate 120 is bent in the upward direction as described above. However, if a force is applied to the door 130 at points that are apart in left and right directions from the center line that halves a distance between both ends of the elevator door 130 in the width direction, the twist of the hanger plate 120 may cause a problem in addition to the bending as described above.

**[0039]** In order to prevent the twist of the hanger plate, a second embossing portion 125 according to this embodiment may be formed on the hanger plate 120. In the same manner as the first embossing portion 124, the second embossing portion 125 may be formed by pressing a part of the hanger plate 120 by press or the like, and may be formed to be forwardly projected or to be backwardly recessed according to the manufacturing method. In this embodiment, the second embossing portion 125 that is backwardly recessed is exemplified.

**[0040]** On the other hand, the both ends of the hanger plate 120 in the width direction are connected to the connection shaft 123 or the like of the roller 122, and if a force is applied to the hanger plate 120 at the positions that are apart in the width direction from the center line, it is general that the twist occurs in the neighborhood of the center line L that halves a distance between both ends of the hanger plate 120 in the width direction. Accordingly, it is preferable that the second embossing portion 125 is formed to pass through the center line that halves the distance between the both ends of the hanger plate 120 in the width direction.

**[0041]** Also, since the bending of the hanger plate 120 typically starts at both ends of the hanger plate 120 in the upward/downward direction, the twist of the hanger plate 120 can be prevented more effectively when the second embossing portion 125 is formed in the neighborhood of the both ends of the hanger plate 120 in the upward/downward direction rather than when the second embossing portion 125 is formed in the neighborhood of the center in the upward/downward direction. Accordingly, it is preferable that the second embossing portions 125 are formed in the neighborhood of the both ends of the hanger plate in the upward/downward direction.

**[0042]** On the other hand, as illustrated in FIG. 5, the hanger plate 120 may include a base plate 128 on which the first and second embossing portions 124 and 125 are formed, and a connection plate 129 formed to be vertically bent from one end of the base plate 128. Accordingly, the hanger plate 120 may have an "L"-shaped section as seen from the side.

**[0043]** In the case where the hanger plate 120 is formed as described above, the connection portion of the base plate 128 and the connection plate 129 is very weak and is easily bent. Accordingly, in order to supplement the weakness as described above, a third embossing portion 126 may be further formed on the hanger plate 120 according to this embodiment of the present invention.

**[0044]** The third embossing portion 126, which is inwardly projected, may be formed on the connection portion that connects the base plate 128 and the connection plate 129. In the hanger plate 120 according to this embodiment of the present invention, the bending of the connection portion in the upward direction can be prevented by the third embossing unit 126.

**[0045]** As described above, since the elevator door device according to this embodiment is constructed so as to include the hanger plate having the first to third embossing portions formed thereon, the secession of the elevator door due to the deformation of the hanger plate can be prevented even if a force is applied to the elevator door.

**[0046]** Also, in the elevator door device according to this embodiment, it is not necessary to change the material of the hanger plate, to increase the thickness thereof, or to engage a separate plate with the hanger plate by a welding process or the like to increase the rigidity, and the rigidity of a part or the whole of the hanger plate can be easily and inexpensively increased to meet the desired level.

Embodiment 2

**[0047]** FIG. 6 is a front view illustrating a hanger plate according to embodiment 2 of the present invention, FIG. 7 is a plan view of FIG. 6, and FIG. 8 is a side view of FIG. 6. For reference, the same or proper reference numerals are given to the same or proper constituent elements across the figures, and the detailed description thereof will be omitted.

**[0048]** An elevator door device according to a second embodiment of the present invention includes a hanger case 110, a hanger plate 120, and an elevator door 130. The main difference between the elevator door device according to this embodiment and the elevator door device according to the first embodiment is on the point that the construction of the hanger plate according to this embodiment is different from that of the hanger plate according to the first embodiment, and the elevator door device according to this embodiment will be described centering around the hanger plate with reference to FIGS. 6 to 8.

**[0049]** In this embodiment, the hanger plate 220 is provided with bent portions 224 which are provided at both ends of the hanger plate 220 in the width direction. The bent portions 224 are formed to be bent from the hanger plate 220 in the forward or backward direction. Also, the bent portions 224 are formed to pass through the line L extended in the width direction from the point that corresponds to the center of the roller 122.

**[0050]** As described above, if a force is applied to the elevator door 130, the bending of the hanger plate 120 occurs along the line L that connects the center of the roller 122 connected to both sides of the upper part of the hanger plate 120. Accordingly, in the same manner as the first embossing portion 124 according to the first embodiment, it is preferable that the bent portion 224 is formed to pass the line L extended in the width direction from the point that corresponds to the portion that can be bent most easily, i.e. the center of the roller 122. In this embodiment, the bent portion 224 is formed from the upper end to the lower end of the hanger plate 220.

**[0051]** Although the deformation is prevented more effectively in the case where the thickness or the length of the bent portion 224 is increased, it is preferable that the thickness or the length is properly selected in consideration of the space or cost thereof.

**[0052]** Although preferred embodiments of the present invention have been described for illustrative purposes, those skilled in the art will appreciate that various modifications, additions and substitutions are possible, without departing from the scope and spirit of the invention as disclosed in the accompanying claims.

## Claims

**1.** An elevator door device comprising:

a hanger case installed on an upper part of an elevator doorway and having a hanger rail formed in a width direction of the elevator doorway;

a hanger plate connected to a roller rotating on the hanger rail to move in the width direction of the elevator doorway in response to the rotation of the roller on the hanger rail; and

an elevator door engaged with the hanger plate to open/clnse the elevator doorway according to the left/right movement of the hanger plate;

wherein the hanger plate has a first embossing portion, which is forwardly projected or backwardly recessed, formed thereon in a vertical direction, and the first embossing portion is formed to pass through a line extended in the width direction from a point that corresponds to the center of the roller.

**2.** The elevator door device according to claim 1, wherein on the hanger plate, a second embossing portion, which is forwardly projected or backwardly recessed, is formed in a horizontal direction, and the second embossing portion is formed to pass through a center line that halves a distance between both ends of the hanger plate in the width direction.

**3.** The elevator door device according to claim 1 or 2, wherein the hanger plate includes a base plate and a connection plate formed to be vertically bent from one end of the base plate, and a third embossing portion, which is inwardly projected, is formed on a connection portion that connects the base plate and the connection plate to prevent the bending of the connection plate toward the base plate.

**4.** The elevator door device according to claim 1, wherein a pair of first embossing portions is formed around a connection shaft that connects the hanger plate and the roller.

**5.** An elevator door device comprising:

a hanger case installed on an upper part of an elevator doorway and having a hanger rail formed in a width direction of the elevator doorway;

a hanger plate connected to a roller rotating on the hanger rail to move in the width direction of the elevator doorway in response to the rotation of the roller on the hanger rail; and

an elevator door engaged with the hanger plate to open/close the elevator doorway according to the left/right movement of the hanger plate;

wherein bent portions, which are formed to be bent from the hanger plate in the forward or backward direction, are provided at both ends of the hanger plate in the width direction, and

the bent portions are formed to pass through a line extended in the width direction from a point that corresponds to the center of the roller.

**6.** A hanger plate for an elevator connecting a hanger case installed on an upper part of an elevator doorway and having a hanger rail formed in a width direction of the elevator doorway, with an elevator door which is guided by the hanger rail to move in the width direction of the elevator doorway, through a roller rotating on the hanger rail, comprising:

a first embossing portion which is forwardly projected or backwardly recessed, and is formed in a vertical direction so as to pass through a line extended in the width direction from a point that corresponds to the center of the roller.

**7.** The hanger plate according to claim 6, further comprising a second embossing portion which is forwardly projected or backwardly recessed, and is formed in a horizontal direction, and the second embossing portion is formed to pass through a center line that halves a distance between both ends of the hanger plate in the width direction.

**8.** The hanger plate according to claim 6 or 7, further comprising a base plate and a connection plate formed to be vertically bent from one end of the base plate;
wherein a third embossing portion, which is inwardly projected, is formed on a connection portion that connects the base plate and the connection plate to prevent the bending of the connection plate toward the base plate.

**9.** The hanger plate according to claim 6 or 7, further comprising bent portions which are formed to be bent from the hanger plate in a forward or backward direction, and are extended in a vertical direction so as to pass through a line extended in the width direction from a point that corresponds to the center of the roller.

FIG. 1

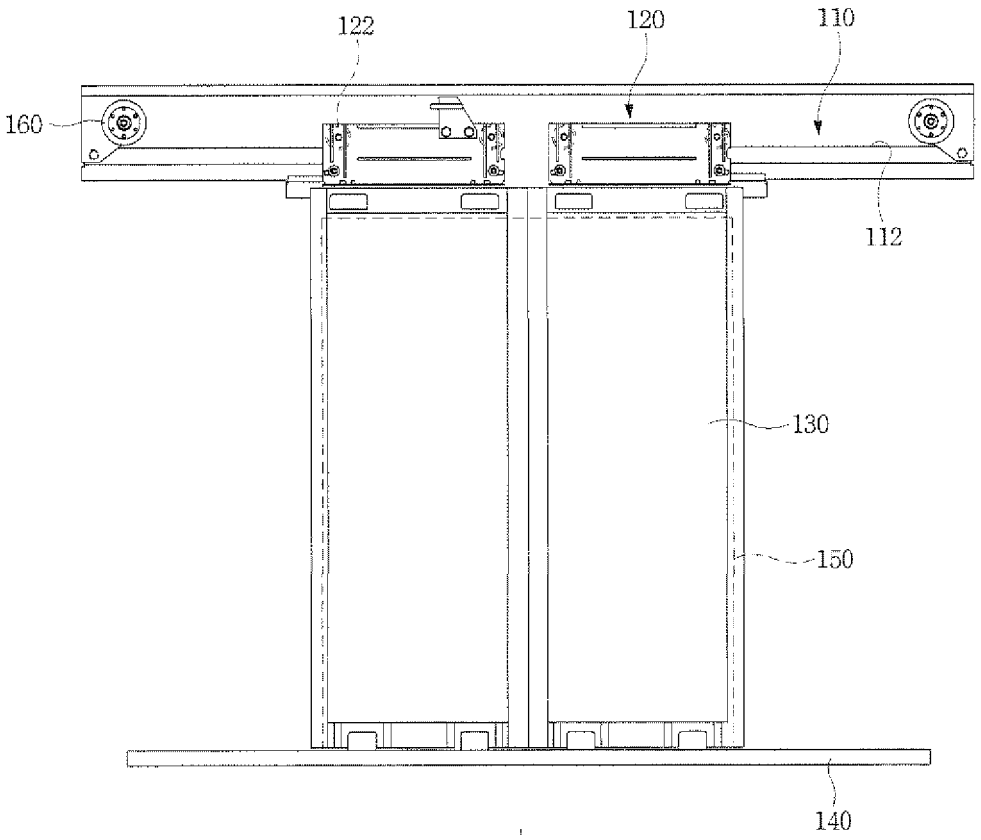


FIG. 2

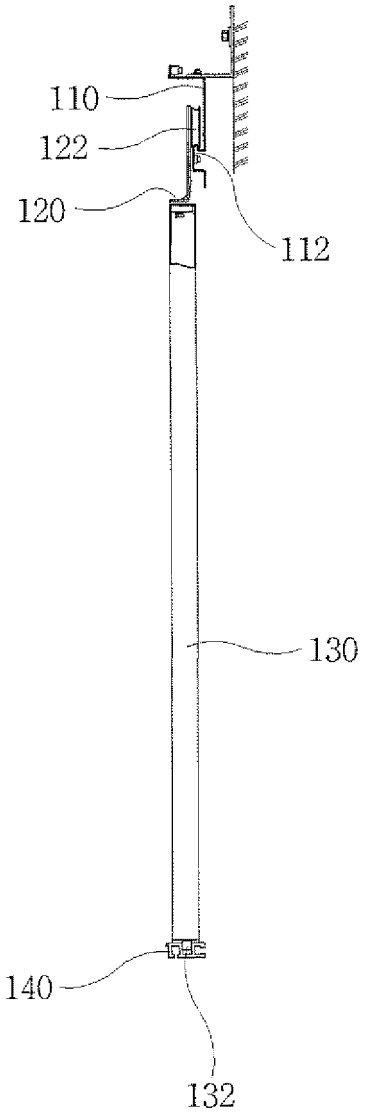


FIG. 3

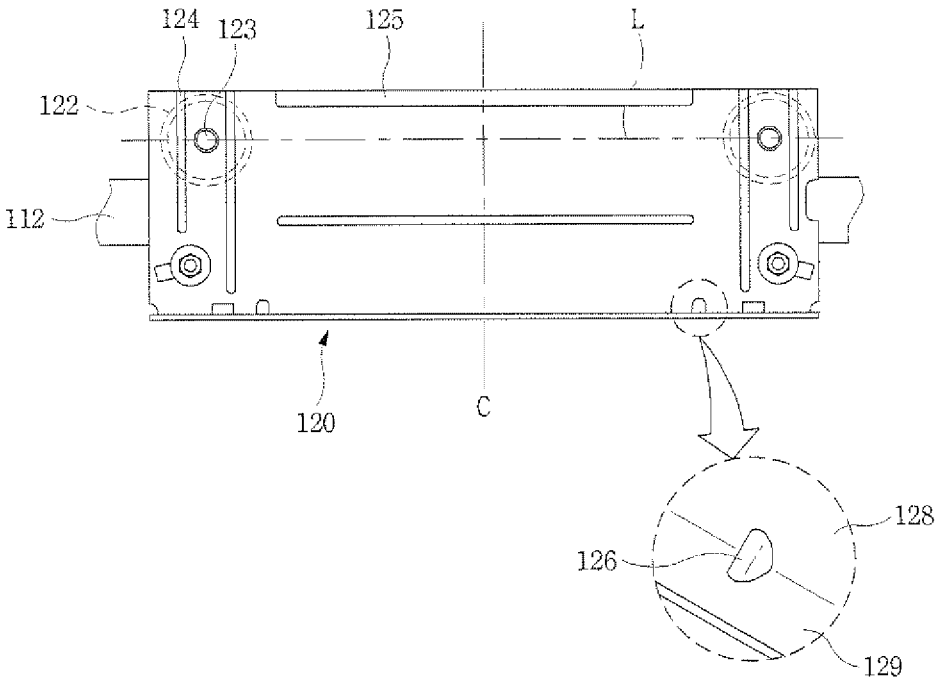


FIG. 4

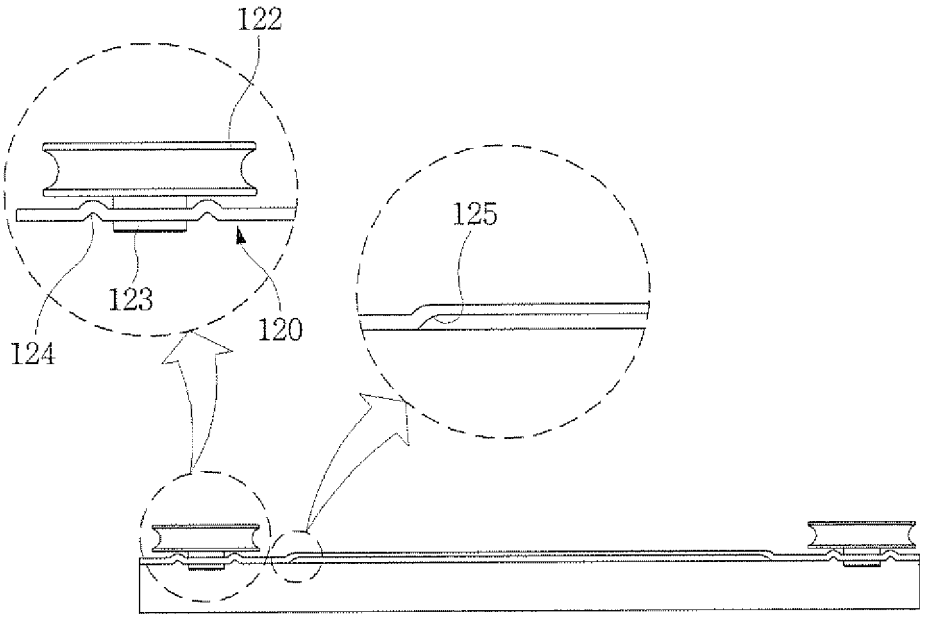


FIG. 5

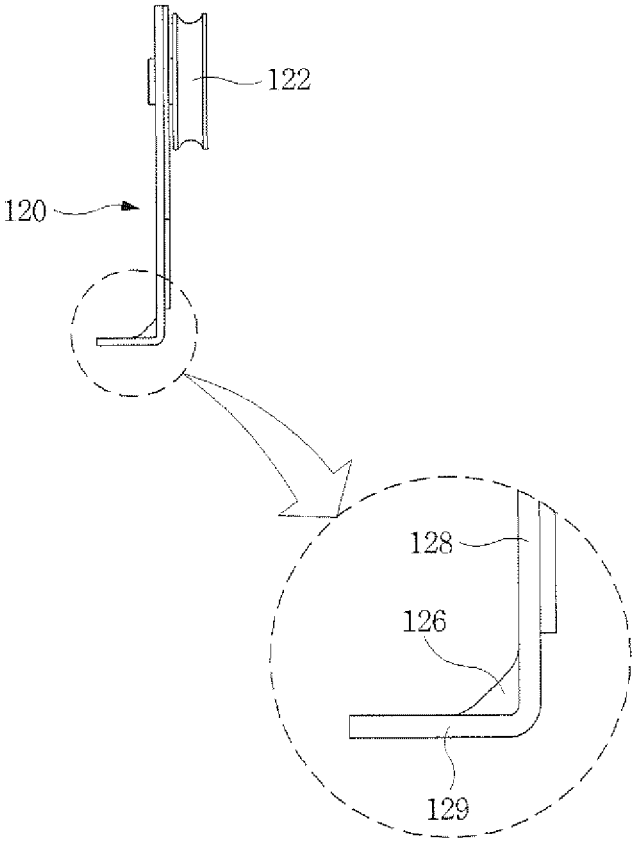


FIG. 6

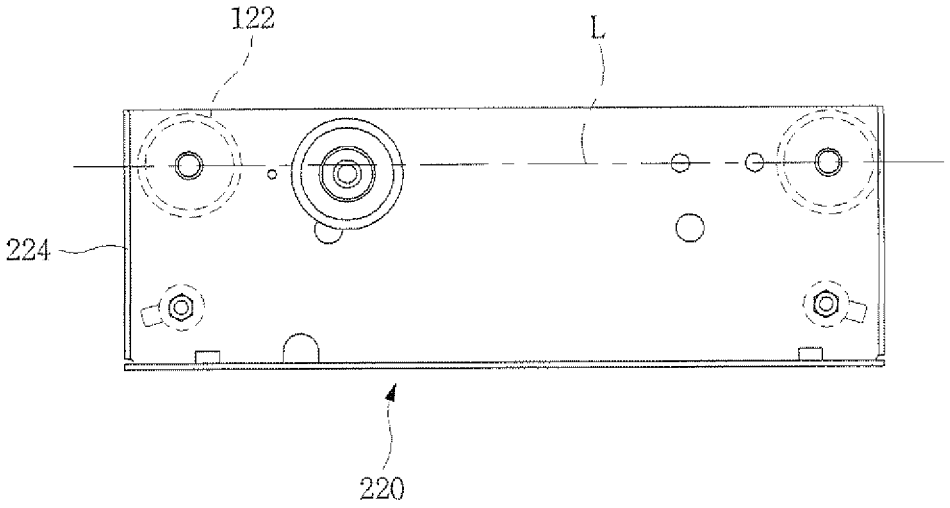



FIG. 7

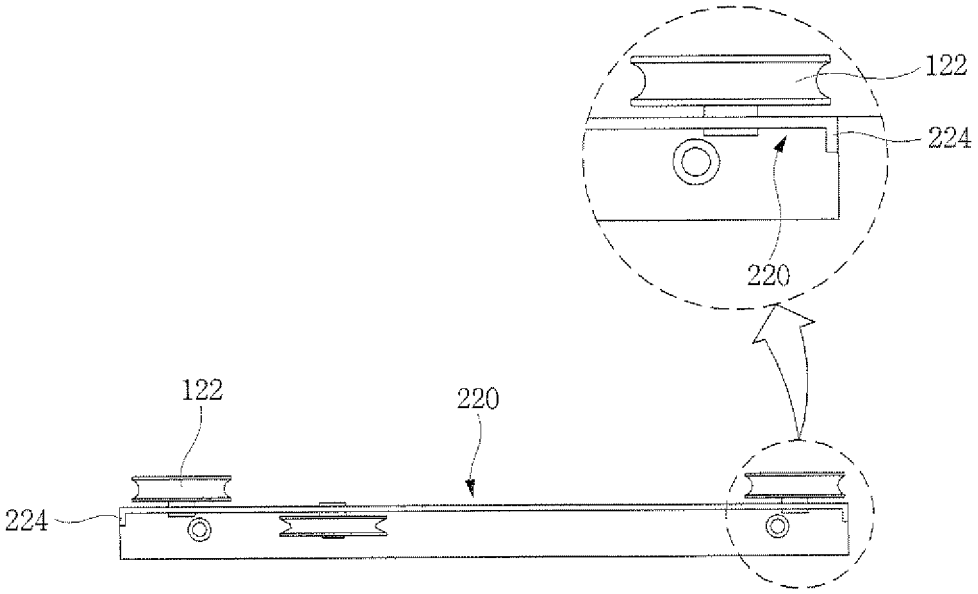


FIG. 8

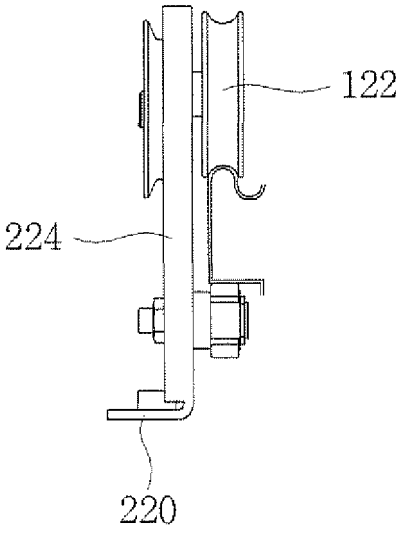
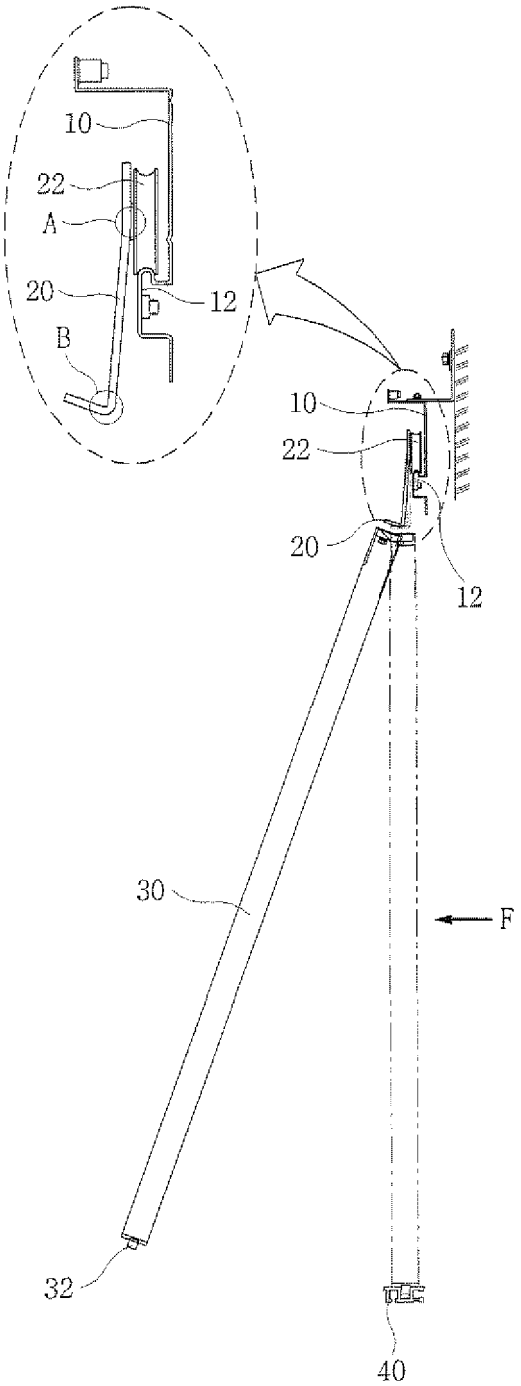


FIG. 9



## REFERENCES CITED IN THE DESCRIPTION

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### Patent documents cited in the description


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