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SPECIFICATION

5 TITLE OF THE INVENTION

ESCALATOR APPARATUS

BACKGROUND OF THE INVENTION

Field of the Invention:

10 The present invention relates to an escalator which ordinary users and wheelchair users can commonly use, particularly to an escalator having a footstep suitable to load a wheelchair.

Description of the Related Art:

15 Such a conventional escalator capable of loading a wheelchair as shown, for example, in Japanese Patent Application Laid-Open No.209194/1992, lifts a movable footstep neighboring a lower side of a special footstep to the same height and slopes a movable footstep neighboring an upper side
20 of the special footstep so as to go down to the height of the special footstep, for securing the wheelchair loading step.

In the above conventional technique, since the footstep neighboring the upper side of the special footstep needs to be sloped down by one step height, a riser attached to the
25 sloped footstep also needs to be sloped down. Therefore, the riser has such the constitution that the riser bends at the middle line in order not to interfere with a riser on a returning way side. The above-mentioned conventional



constitution has the following problem that the bend mechanism of an escalator becomes complicated, the motion of the riser also becomes complicated since the riser needs to be lowered as bending it, and the height of a frame body needs to be made
5 larger than the one of a usual escalator since the lower part of the footstep projects by a little length and the height of the frame body needs to be made higher by the projecting length even if it is lowered as bending it.

10 SUMMARY OF THE INVENTION

Objects of the Invention:

The present invention has been achieved in consideration of the above-described problems, and objects of the present invention are as follows.

15 An object of the present invention is to offer an escalator capable of securing a wheelchair loading face without changing the size of a frame body.

Another object of the present invention is to offer an escalator wherein the mechanism and the operations of the
20 sloped footstep are simple.

Further, another object of the present invention is to offer an escalator wherein the slope angle of the sloped footstep is smaller than the angle of a conventional escalator and a wheelchair loading face can be also secured.

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Methods Solving the Problems:

In order to attain the above-mentioned objects, the present invention has the following constitutions. That is,



an escalator, by the present invention, having a plurality of special footsteps inserted between some two of plural usual footsteps endlessly connected each other, the plurality of special footstep operating as usual footstep in usual operations and forming a wheelchair loading face by being extended in transporting the wheelchair, said escalator comprising;

a wheelchair loading footstep formed by lifting the plurality of special footsteps, and

10 a sloped footstep connected to an upper and front end of the wheelchair loading footstep, and sloped so that a lower end of the sloped footstep faces to the upper and front end of the wheelchair loading footstep.

By the above-mentioned constitution of an escalator, the height of an escalator by the present invention can be made the same as that of a conventional escalator, since the sloped footstep is sloped so as to face to the lifted wheelchair loading footstep, which can make the angle of the slope of the sloped footstep small, and the lower part of the riser of the sloped footstep does not project under guide rails even in a down-moving way of the riser. Then, since the angle of the slope of the sloped footstep is small, the lower part of the riser does not project without bending the riser and the constitution and the operations of the sloped footstep are simple.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig.1 is an outline perspective view of a main part of



footsteps showing an embodiment of an escalator by the present invention.

Fig.2 is an outline side view showing the whole of the escalator to which the footsteps shown in Fig.1 is applied.

5 Fig.3 is a side view showing the states of the footsteps shown in Fig.1 at the getting-on or off plate of the lower floor.

Fig.4 is a side view showing the operation states of the footsteps shown in Fig.3.

10 Fig.5 is a perspective view of one of the footsteps shown in Fig.1.

Fig.6 is a cross sectional view of the footstep shown in Fig.5.

15 Fig.7 is a half cross sectional drawing of Fig.4 viewed from the line VII-VII.

Fig.8 is a half cross sectional drawing of Fig.6 viewed from the line VIII-VIII.

Fig.9 is a half cross sectional drawing of Fig.6 viewed from the line IX-IX.

20 Fig.10 is a half cross sectional drawing of Fig.6 viewed from the line X-X.

Fig.11 is a side view showing the states of the footsteps shown in Fig.1 at the slope distance.

25 Fig.12 is a side view showing the states of the footsteps shown in Fig.1 at the getting-on or off plate of the upper floor.

Fig.13 is a perspective view of another embodiment of the footsteps shown in Fig.5.



Fig.14 is a figure, corresponding to Fig.4, showing another example of wheelchair loading footsteps.

DETAILED DESCRIPTION OF THE EMBODIMENTS

5 Hereinafter, details of the present is explained based on embodiments referring to drawings.

An example of an escalator by the present invention is explained referring to figures 1 to 12.

At first, the constitution of an escalator by the present
10 invention is as shown in Fig.2. That is, special footsteps 4 and 5 are inserted between some two of plural usual footsteps 3 endlessly and movably connected each other are supported by a frame body 2 provided between an upper floor 1U and a lower floor 1D. The special footsteps 4 and 5 offer the same
15 function for use of usual users as the usual footsteps in usual operations of the escalator. Handrail panels 6 are provided at the left and right sides of the usual footsteps 3 and the special footsteps 4 and 5 in the moving direction of the escalator, and movable handrails 7 are respectively
20 guided and supported on each periphery of the handrails 7 and move simultaneously with the series of footsteps. Each step of the usual footsteps 3 and the special footsteps 4 and 5, has a pair of wheels 8A and 8B at the right and the left side of the footstep, and moves on guide rails 9A and 9B fixed to
25 the frame body 2.

The special footsteps 4 and 5 are prepared for securing a wheelchair loading face in operations for transporting a wheelchair, and the constitution of the special footsteps 4



has a face extension step 10 as shown in Figs.1, 3 and 4. The face extension step 10 is composed of movable steps 10A and 10B fixed to an upper part of the end part of a lower side, namely, a riser 4R by hinge connection, and a movable step 10C movably connected to the end part of an upper side of the movable step 10A by hinge connection. And the face extension step 10 is constructed so as to rise leaving narrow steps 11 at the both sides of the step 10, and the movable steps 10A and 10C are folded up in piles on the movable step 10B as shown in Fig.4. Then, the surface 10S of the movable steps 10A and 10C is kept at the same height as that of the narrow steps 11 when they are folded up.

Further, the movable step 10B is supported by a base 4B (shown in Figs.1 and 6), and lifted and lowered by a lift mechanism 12 such as a cross-link mechanism. And the movable step 10A is rotated by 180 degrees by using an extension mechanism composed of a extension arm 13, a connection link 14 and a connection pin 15 from the folded up state to such a state as to form the wheelchair loading face together with the movable step 10B, with lift of the movable step 10B.

Then, the lift mechanism 12 is driven by a drive mechanism 16 provided at the base 4B of the footstep 4, and the drive mechanism 16 is fed and operated by a power source (not shown in a figure) provided at the frame body, facing to each position of a lower floor plate and an upper floor plate where the special footstep 4 stops.

Then, the constitution of the special footstep 5 has a step 17 to be sloped as shown in Figs.1 and 4, and 5 to 10.



The step 17 to be sloped is constructed so as to be sloped leaving narrow steps 18 at the both sides of the step 17 and a riser 18R connected to the steps 18. And the step 17 to be sloped is formed together with a riser 17R having the same width as that of the step 17, and the side opposite to the riser 17R of the step 17 is supported by inner wall bodies 18W for connecting the narrow steps 18 to the riser 18R via a support axis 19.

And the step 17 to be sloped has step supporting rods 20 going in and out to the inner wall bodies 18W in the horizontal direction at the backside space of the step 17. The step supporting rods 20 support the step 17 so that, as shown in Fig.7, the face of the step 17 has the same height as those of the narrow steps 18, and pass rod guiding plates 17f, and the top parts 20E of the rods 20 are engaged into engagement holes 18H of the inner wall bodies 18. Then, the rods 20 are to be withdrawn from the engagement holes 18H by a drive mechanism 21 having functions of a electromagnetic plunger and a motor, in order to disconnect the engagement of the top parts 20E of the rods 20 and the holes 18H. The drive mechanism 21 is supported by a support frame 17F provided at the backside space of the step 17, and a power source for the drive mechanism 21 is connected to the power feeding part of the drive mechanism 16 for the special footstep 4 neighboring the special footstep 5 in the lower side, via a cable 23. Further, the rods 20 have small pinions 22 of a shape long in the longitudinal direction, each of which is engaged in a rack 25 of a slope holding arm 24.



The slope holding arms 24 clog holes of the surface of the riser 17R by their tops 24E as shown in Figs.4 and 5 in the usual operations or before the operations for transporting an wheelchair. And, as shown in Figs.6 and 7, each of the arms 5 24 has such a length that the arm passes the riser 17 by using a rod guiding part 17G provided at the backside space of the step 17 to be sloped and engaged with the base 4B positioned after the face extension step 10 (10B) of the special footstep 4 neighboring the footstep 5 in the lower side, in 10 the operations for transporting a wheelchair. Although the angle of the slope of the sloped footstep 17 is set by projection of the step supporting rods 20, in case the rods 20 do not project by any chance, the angle of the slope of the step 17 can not be restricted and the bottom part of the riser 15 17R goes down further beyond the guide rails 9B. Then, in order to avoid such a trouble, stoppers 26 shown in Fig.10 are prepared at the inner wall body 18W so that sloping of the bottom part of the riser 17R stops at the position which does not go down beyond the guide rails 9B.

20 In the usual operations of the escalator having the above-mentioned constitution, the face extension step 10 is folded up so that the surface 10S of the movable steps 10A and 10B of the special footstep 4 is at the same height as that of the narrow steps 11, and the step 17 to be sloped of the 25 special footstep 5 is horizontally held at the same height as that of the narrow steps 18. By operating the series of footsteps including usual footsteps 3 in the above-mentioned states, usual users can utilize the escalator as a general



escalator.

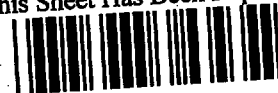
On the contrary, in the operations for transporting a wheelchair from a lower floor 1D to an upper floor 1U, the special footsteps 4 and 5 stop near a getting-on plate 1P of the lower floor 1D as shown by Fig.3 when a command for operations of the wheelchair transportation is generated by operation of a button by a person in charge or a wheelchair user. The spot position corresponds to the horizontal interval a of the guide rails 9A and 9B if the special footstep 4 is used and there is not a difference in level between the footstep 4 and a usual footstep 3 following the footstep 4. However, the special footstep 5 already exists at the concave interval b of the guide rails 9A and 9B and at the level higher than the special footstep 4, and there is a difference in level of H_1 between the footstep 5 and the footstep 4 following the footstep 5. In the time, a usual footstep 3 preceding the footstep 5 exists at the slope interval c and there is a difference in level of H_2 , which is generated in the normal operations, between the usual footstep 3 and the special footstep 5. In the state, the usual footstep 3 following the special footstep 4 projects by the length of L_1 from the top part of the getting-on plate 1P. The length of L_1 is such a length that the movable step 10C of the mentioned-later face extension step 10 covers a part of the getting-on plate 1P when the movable step 10C is rotated and extended, which avoids the generation of a large gap between the face extension step 10 and the getting-on plate 1P. Then, in the state that the movable step 10c is rotated and



extended, the length of the step 10 is extended to one and half of the length of a usual step, following the getting-on plate 1P.

When it is confirmed that the special foot steps 4 and 5 stop at the above-mentioned positions, a power feeding part (not shown in a figure) such as a feeding plug, connected to a power source provided at the frame body 2 facing to the drive mechanism 16 of the special footstep 4, is automatically moved and connected to a terminal of the drive mechanism 16.

By the power connection, the drive mechanism 16 is driven, which operates the lift mechanism 12 and lifts the face extension step 10. And, by the lift of the step 10, the movable step 10A is rotated by 180 degrees by using the extension mechanism composed of the extension arm 13, the connection link 14 and the connection pin 15, and forms a horizontal wheelchair loading face together with the movable step 10B, as shown in Fig.4. Then, as shown in Fig.3, the movable 10c inclines so as to be engaged with the getting-on plate 1P, which makes it smooth that a wheelchair 27 gets on the escalator. And, if front wheels 27F of a wheelchair can easily go over the movable step 10C in getting-on the escalator, it is not always necessary to make the movable step 10c engaged with the getting-on plate 1P. Further, the elevating height H_3 of the face extension step 10 is such a height that the height H_4 by which the rotated and extended movable step 10A is not engaged with the getting-on plate 1P, can be secured, and the height H_4 is almost equal to the difference in level of H_1 between the special footsteps 4 and



5 at the stop positions.

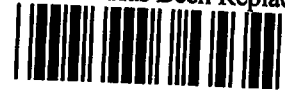
Simultaneously with the formation of the wheelchair loading face by the special footstep 4, the drive mechanism 21 of the special footstep 5 is fed via the cable 23 connected to a power feeding part provided at the special footstep 4 and pulls the step supporting rods 20 as rotating them. By the operations of the step supporting rods, the slope holding arms 24 are moved via the small opinions 22 and the racks 25, and the top parts 24E of the arms are projected and made engaged with the upper face 4P of the base 4B after the face extension step 10 of the special footstep following the footstep 5 is lifted. Then, since the top parts 20E are withdrawn from the engagement holes 18H provided at the inner wall bodies 18W of the narrow steps 18 by the pulling of the step supporting rods 20, the step 17 to be sloped loses the horizontal attitude keeping force and becomes rotatable on the support axis 19. However, the step 17 does not incline and keeps its horizontal attitude since the slope holding arms 24 are engaged with the upper face 4P of the base 4B of the special footstep 4.

In the above-mentioned situation, a wheelchair is operated to get on the escalator. That is, as shown by two-dot chain lines in Fig.3, a wheelchair is conducted to get on the extended steps 10A to 10C from the getting-on plate 1P by pushing it. Then, as shown in Fig.4, the movable step 10c is rotated automatically or manually and set as stoppers for rear wheels 27R of the loaded wheelchair 27.

Then, the restart command is generated by operating a start button specially provided for operating a wheelchair



transportation, and the wheelchair transporting operations are started. And the loaded wheelchair enters the slope interval c via the concave interval b of the guide rails 9A and 9B. In the usual operations, there is the difference in level of H_2 between the footsteps 3 and 4, or the foot steps 4 and 5. On the other hand, in the wheelchair transporting operations, the difference in level between the movable steps 10A and 10B and the narrow steps 18 of the special footstep 5 is H_5 since the movable steps 10A and 10B is lifted by H_3 between the special footsteps 4 and 5, where H_5 is $[H_2 - (H_3 + \text{the thickness of the movable step 10A})]$. Then, in proportion to the enlargement of the difference in level between the special footsteps 4 and 5 on the way from the concave interval b to the slope interval c, the slope supporting arms 24 from the top part of the sloped step 17 goes down on the upper face 4P of the base 4B of the special footstep 4. And the sloped step 17 inclines on the support axis 19 by the lowering of the slope supporting arms, which makes the difference in level of H_5 between the edge at the riser side of the narrow steps 18 of the special footstep 5 and the edge at the riser side of the sloped step 17. Although the bottom part of the riser 17R connected to the sloped step 17 is lowered by H_5 due to the inclining of the sloped step 17, the amount of the lowering can be reduced and the bottom part does not go down beyond the guide rails 9A and 9B since the difference in level of H_5 is decreased by lifting the movable steps 10A and 10B. Then, the height of the edge at the riser side of the sloped step 17 (the lower edge of the sloped step) is kept almost the same



as that of the movable step 10B. Therefore, since a large gap is not generated between the sloped step 17 and the movable step 10B, clothes are prevented from being rolled in. Further, even if the front wheels 27F of the wheelchair on the movable steps 10A and 10B protrude to the special footstep 5 (as shown in Fig.11), the protrusion does not interfere with the motion of the special footstep 5 and the stable operations of the wheelchair transportation can be realized. Then, even if the height of a foot stand 28 of the wheelchair 27 is so low as that of the foot stand 28' shown by two-dot chain lines in Fig.11, the interference between the front wheels and the footstep 5 can be avoided.

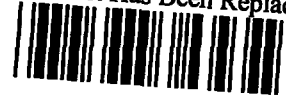
When the special footsteps 4 and 5 enter the convex interval d and the horizontal interval e of the upper floor side via the slope interval c of the guide rails 9A and 9B, the difference in level between the movable step 10 and the special footstep 5, which is H_5 at the slope interval c, is decreased to a very small difference. And the slope supporting arms 24 elevate on the upper face 4P of the base 4B of the special footstep 4 corresponding to the difference decrease and keep the step 17 horizontal. Then, the series of footsteps stops when the difference in level between the special footstep 5 and the usual footstep following the footstep 5 disappears, and the difference in level between the narrow steps 11 of the special footstep 4 and the narrow steps 18 of the special footsteps 5 becomes almost H_1 which is the difference at the getting-on plate in the lower floor.

There is a power feeding part (not shown in a figure)



such as a feeding plug connected to a power source of the frame body 2, facing to the drive mechanism of the stopped special footstep 4. In the situation, the movable steps 10A and 10B are left as lifted and the wheelchair is conducted to get off the escalator to the getting-off plate 1P of the upper floor by pushing it.

After the getting-off of the wheelchair is finished, the command of finishing the wheelchair transporting operations or the command of returning to the usual operations is generated by operating a operation mode button by a person in charge or a wheelchair user. When these commands are generated, the power feeding part is automatically moved and connected to the terminal of the drive mechanism 16. By the connection with the power source, the drive mechanism 21 of the special footstep 5, shown in Fig.7, is driven inversely to the above-mentioned motion, and projects the step supporting rods 20 in the right and the left direction and engages the top parts 20E of the rods 20 into the engagement holes 18H provided at the inner wall body 18W of the narrow steps 18, for keeping the attitude of the step 17 horizontal. Simultaneously, the engagement of the slope holding arms 24 with the special footstep 4 is released by withdrawing the rods 24 from the surface of the base 4B. While or after the slope holding rods 24 are withdrawn from the base 4B, the drive mechanism 16 of the special footstep 4 is inversely driven, and the movable steps 10A and 10C are rotated by 180 degrees and folded up in piles on the movable step 10B. Then, by driving the lift mechanism 12 downward, the folded up face



extension step 10 is stored at the predetermined position.

If it is confirmed that the special footsteps 4 and 5 return to the usual states by a detection mechanism such as a detection switch, the series of footsteps is restarted and returns to the usual operations.

Although the operations for transporting a wheelchair from a lower floor 1D to an upper floor 1U is explained above, the operations inverse to the above-explained operations are executed in transporting a wheelchair from an upper floor 1U to a lower floor 1D.

That is, when the command of operations for the wheelchair transportation is generated, the special steps 4 and 5 stop at the position shown by Fig.12 in the state that the movable steps 10A and 10C are folded up in piles on the movable step 10B. And if the stop of the escalator is confirmed, the face extension step 10 is lifted from the base 4B, and the movable steps 10A and 10C are rotated by 180 degrees to the movable step 10B and the wheelchair loading face is formed. Then, the wheelchair is conducted to get on the formed face and the series of footsteps is restarted.

When the special footsteps 4 and 5 arrive at the predetermined position of the lower floor 1D, the footsteps 4 and 5 stop in the state shown in Fig.4. When the command of returning to the usual operation is generated after the getting-off of the wheelchair, the movable steps 10A, 10B and 10C are folded up. Then, after the step folding up completion, the series of footsteps is driven and returns to the usual operations.



As explained above, the embodiments have the following effects.

(1) Since a wheelchair loading face is formed by extending a step face of one special footstep 4 which stops near a getting-on plate 1P at an entrance of an escalator, the wheelchair loading face can be formed if one and half steps are held horizontal. Therefore, by the embodiments, it is possible to set the needed horizontal length at the getting-on plate so short as that of an usual escalator and to avoid increase of the size of an escalator for transporting a wheelchair.

(2) Since the downward moving distance of the riser of the sloped step can be shortened, the bottom part of the riser does not go down over the footstep guide rails without bending the riser of the sloped step. Therefore, it is possible to suppress increase of the height of the frame body while avoiding interference between the bottom of the riser and the footsteps on the returning way.

(3) Since lowering further more from the preset position or abnormal lowering of the sloped step 17 can be prevented by preparing the stoppers 26 for engaging the step 17 with the stoppers, besides the slope holding arms 24, the reliability of the escalator can be more increased.

(4) Since the gradient of the sloped step 17 changes corresponding to the height of the movable step 10B of the lower side of the special footstep 4, a difference in level between the lower end part of the sloped step 17 and the upper end part of the movable step 10B is not generated, which can



avoid such an accident as rolling-in of clothes.

Although the full length in the moving direction of the sloped step 17 is sloped in the above-explained embodiments, a special footstep 29 having such a structure as shown in Fig.13 can be also used. The special footstep 29 consists of a U-shaped datum step composed of side narrow steps 30 provided at the right and the left side of the footstep 29 and an upper end part narrow step 31, and the step 32 to be sloped which is the rest part obtained by removing the U-shaped datum step from the full footstep 29. Since the angle of the slope of the sloped step 33 can be more enlarged even if the lowering amount of the riser 32R is the same as that in the above-mentioned embodiments, by shortening the length in the moving direction of the step to be sloped, the sloped step 33 can be a more powerful stopper for the front or the rear wheels of a wheelchairs.

Although the wheelchair loading face is formed by the face extension step 10 of one special footstep 4 in the above embodiments, the wheelchair loading face can be also by using each movable step of a plurality of special footsteps, as shown by Fig.14.

In the embodiment shown by Fig.14, the special footsteps 5, 33 and 34 are connected between some two of the usual footsteps endlessly connected each other. And the constitution and the operations of the special footstep 5 are the same as those of the above-mentioned embodiments, but those of the special footsteps 33 and 34 are different from those of the above-mentioned embodiments. The special footsteps 33 and 34



have the respective independent lift mechanism 12. Then, the lower side special footstep 33 has a movable step 35 lifted by the lift mechanism 12 and a movable step 36 rotatably connected to the lower edge part of the movable step 35. And the movable step 36 is rotated and sloped as the movable step 10C in the above-mentioned embodiments, according to the elevating of the movable step 35. And the special footstep 34 has a movable step 37 lifted by the lift mechanism 12. Then, such as an engagement part of the slope holding arms 24 for securing the slope of the sloped step 17 as explained in the above-mentioned embodiments, is formed on the base of the special footstep 34.

In the operations for elevating a wheelchair by an escalator having the above constitution, when the command of the wheelchair transporting operations is generated by operating an operation mode button, the special footsteps 33 and 34 appears in the horizontal state and the series of footsteps stops if the height of the special footstep 5 becomes higher than that of the special footstep 34 by H_1 (the same height difference as that in the above-mentioned embodiments). After confirming that the escalator stops, the wheelchair is conducted to get on the escalator by bestriding the both of the special footsteps 33 and 34. Then, by operations of a start button by a person in charge or a wheelchair user, each of the lift mechanisms 12 is simultaneously driven and lifts each one of the movable steps 35 and 37 by about H_1 . With lifting of the movable steps 35 and 37, the movable step 36 rotates so that the free side of



the step 36 rises from the horizontal state shown by two-dot chain lines in the figure, and serves as a stopper for the rear wheels 27R of the wheelchair 27. Other parts operates so as those in the above-mentioned embodiment, and then the
5 escalator restarts.

After the special footsteps 5, 33 and 34 stop at the upper floor and the wheelchair 27 is conducted to get off the escalator, the special footsteps 5, 33 and 34 return to the usual states, and the series of footsteps is driven for
10 returning to the usual operations, by the command of returning to the usual operations.

Although the horizontal part at the entrance is longer than the one and half steps of horizontal part in the above-mentioned embodiments since the escalator having the above
15 constitution needs two step of horizontal part at the getting-on plate 1P at the entrance, this embodiment has the same merits as the above-mentioned embodiments except the above demerit.

In the embodiment shown by Fig.14, both of the following
20 examples are available: an example wherein the lift mechanism 12 is provided only at the special footstep 34 and lifts the movable step 37 and the movable step 35, connected to the movable step 37, of the special footstep 33 and an example having the constitution inverse to that of the former example.
25 Then, since one lift mechanism needs only to be provided in such an example, the construction cost becomes cheaper.

As mentioned above, by the present invention, the wheelchair loading face can be secured without increasing the



height of the frame body, and the constitution and the
operations of the step to be sloped can be simplified.
Furthermore, the present invention has such a merit that the
wheelchair loading face can be secured by a smaller angle of
5 the slope of the step to be sloped.

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WHAT IS CLAIMED IS;

1. An escalator having a plurality of special footsteps connected between some two of usual footsteps endlessly connected each other functioning in the same way as said usual
5 footsteps in usual operations, and at least one step being provided on each one of said plurality of special footsteps, said at least one step being extended and forming a wheelchair loading face in wheelchair transporting operations, said escalator comprising:

10 a wheelchair loading footstep formed by lifting said at least one step provided on each one of said plurality of special footsteps; and

a sloped footstep having a step to be sloped, facing to an upper part of said wheelchair loading footstep, of which
15 a lower end edge lowered near an upper part of said lifted step.

2. An escalator having a plurality of special footsteps connected between some two of usual footsteps endlessly
20 connected each other, said plurality special footsteps forming a wheelchair loading face by extending a step provide thereon in wheelchair transporting operations, said escalator comprising:

said step lifted from a position of said usual footsteps
25 and forming a wheelchair loading face when said plurality of special footsteps run at a slope interval in said wheelchair transporting operations; and

a sloped footstep having a step to be sloped, of which





a lower end edge is lowered near an upper part of said lifted step.

3. An escalator having a series of usual footsteps endlessly
5 connected each other and moving said usual footsteps, said escalator comprising:

at least one footstep connected between some two of said usual footsteps and forming a wheelchair loading face by lifting a step provided on said at least one footstep; and

- 10 another footstep provided at an upper stage for said at least one footstep, said another footstep being operated to approach near an upper part of said formed wheelchair loading face by sloping said another footstep near an upper part of said footstep.

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4. An escalator having usual footsteps endlessly connected each other, said escalator comprising:

a first footstep having a step thereon, connected to said usual footsteps, said step being lifted and forming a
20 wheelchair loading face; and

a second footstep connected to said first footstep at an upper stage for said first footstep, operated to approach an upper part of said formed wheelchair loading face by sloping said second footstep.

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5. An escalator according to one of claims 1 to 4, wherein said step to be lifted is lifted lower than an upper neighboring footstep at a slope interval in wheelchair





transporting operations.

6. An escalator according to claim 4, wherein a step provided on said first footstep is folded up in piles on a fulcrum in usual operations, and is inversely rotated and extended on said fulcrum in wheelchair transporting operations.

7. An escalator according to claim 4, wherein a step provided on said first footstep further includes two footsteps neighboring each other, and each one of said two footsteps is lifted by each lift mechanism and said lifted two footsteps forms said wheelchair loading face.

8. An escalator according to claim 4, wherein a step provided on said first footstep further includes two footsteps neighboring each other, and one of said two footsteps lifts another one of said two footstep, and said lifted two steps forms said wheelchair loading face.

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9. An escalator having usual footsteps endlessly connected each other, said escalator comprising:

a first footstep having a step thereon, connected to said usual footsteps, said step being lifted and forming a wheelchair loading face; and

a second footstep connected to said first footstep being operated to approach near an upper part of said wheelchair loading face by sloping said second footstep, said second





footstep having a mechanism for keeping a lower edge of a sloped step of said second footstep at a same height as that of said wheelchair loading face connected to a lower side of said second footstep, and said mechanism operating after said
5 first footstep is lifted.

10. An escalator according to claim 9, wherein said mechanism for keeping said lower edge of said sloped step of said second footstep at said height is engaged with said whole
10 first footstep.

11. An escalator comprising:
a first footstep forming a wheelchair loading face by lifting a step on said first footstep, connected between some
15 two of usual footsteps endlessly connected each other; and
a second footstep connected to an upper side of said first footstep, being operated to approach to an upper edge part of said wheelchair loading face,;
wherein said second footstep is set at a position higher
20 than that of said first footstep when said first footstep is positioned at a horizontal interval in a footstep running way at a lower getting-on part.

12. An escalator comprising:
25 a first footstep forming a wheelchair loading face by lifting a step on said first footstep, connected between some two of usual footsteps endlessly connected each other; and
a second footstep connected to an upper side of said





first footstep, being operated to approach near an upper edge part of said wheelchair loading face,;

wherein said second footstep is positioned at a concave part between a horizontal interval and a slope interval, in
5 a footstep running way when said first footstep is positioned at said horizontal interval in said footstep running way.

13. An escalator comprising;

a footstep to be sloped in a lower part of said footstep;
10 a mechanism for keeping said footstep horizontal in usual operations; and

a mechanism for sloping said footstep and holding a lower edge part of said footstep at a same height as that of a wheelchair loading face formed by another footstep facing to
15 a lower side of said above-mentioned footstep, in wheelchair transporting operations;

wherein the other mechanism stops its function while one of said two mechanism executes its function.

20 14. A method of operating an escalator having a first footstep forming a wheelchair loading face by lifting a step on said first footstep connected between some two of usual footsteps endlessly connected each other, and a second footstep connected to an upper side of said first footstep,
25 said second footstep being operated to approach near an upper edge part of said wheelchair loading face, said method comprising the steps of:

stopping said second footstep at a position higher than



said first footstep at a getting-on part by a command of wheelchair transporting operations;

forming said wheelchair loading face by lifting a step on said first footstep to almost a same height as that of a
5 second footstep;

setting said second footstep in a state ready for sloping said second footstep; and

starting a wheelchair transporting operations by a command of restarting said escalator.

10

15. A method of operating an escalator having a first footstep forming a wheelchair loading face by lifting a step on said first footstep, connected between some two of usual footsteps endlessly connected each other, and a second
15 footstep connected to an upper side of said first footstep, being operated to approach an upper edge part of said wheelchair loading face, said method comprising the steps of:

stopping said second footstep at a position higher than said first footstep at a getting-on part by a command of
20 wheelchair transporting operations;

forming said wheelchair loading face by said first footstep;

lifting a step on said first footstep to almost a same height as that of a second footstep by a command of restarting
25 said escalator ;

setting said second footstep in a state ready for sloping; and

restarting wheelchair transporting operations.





ABSTRACT OF DISCLOSURES

An escalator has a plurality of special footsteps and
5 connected between some two of plural usual footsteps endlessly
connected each other and forms the wheelchair loading face by
extending steps provided on the special footsteps in
wheelchair transporting operations. And in the escalator, the
special footsteps has the face extension step and forms the
10 wheelchair loading face by lifting the step, and the special
footstep is connected to the upper side of the special
footstep and has a step to be sloped, of which the lower edge
part is sloped so as to face to the upper part of the face
extension step.

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FIG. 1

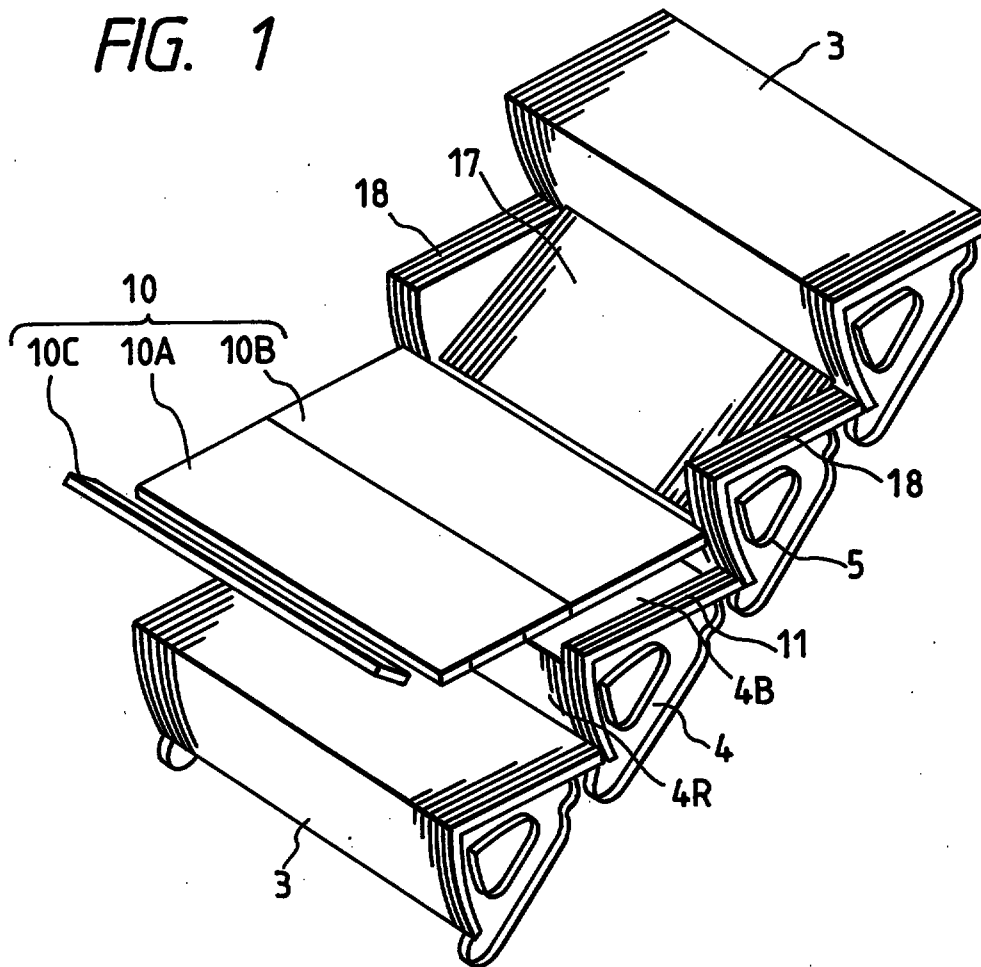


FIG. 2

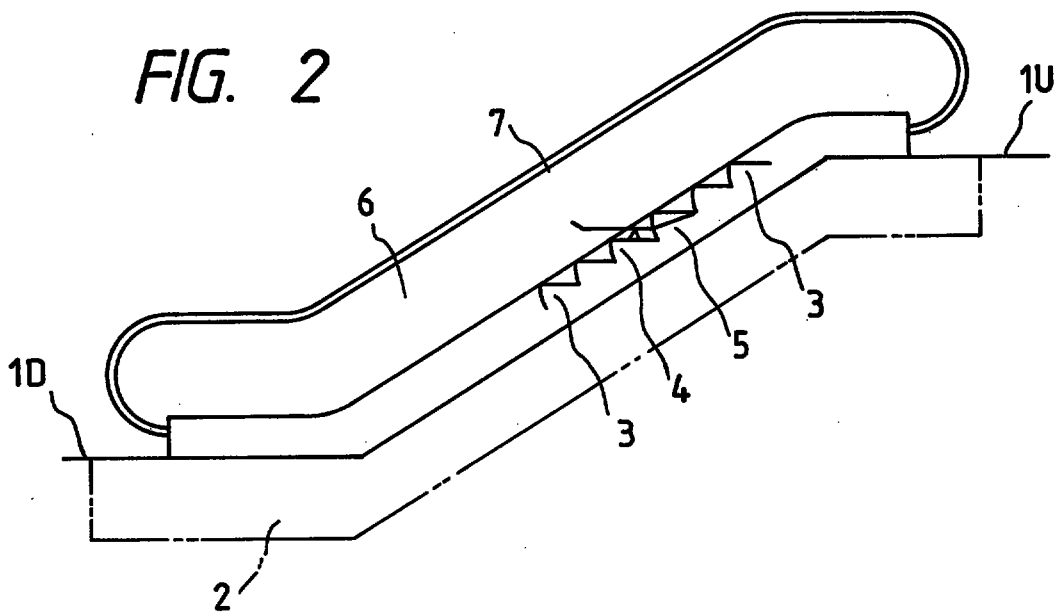




FIG. 3

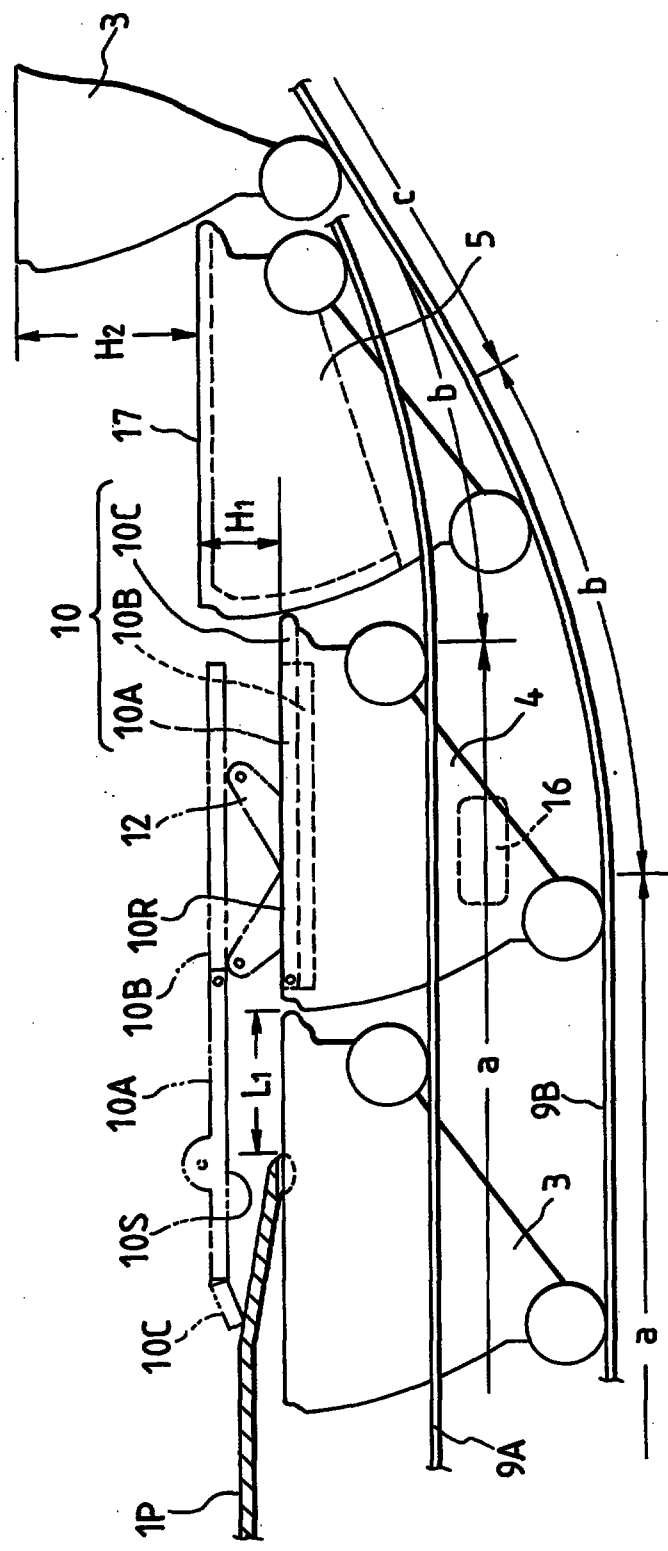




FIG. 4

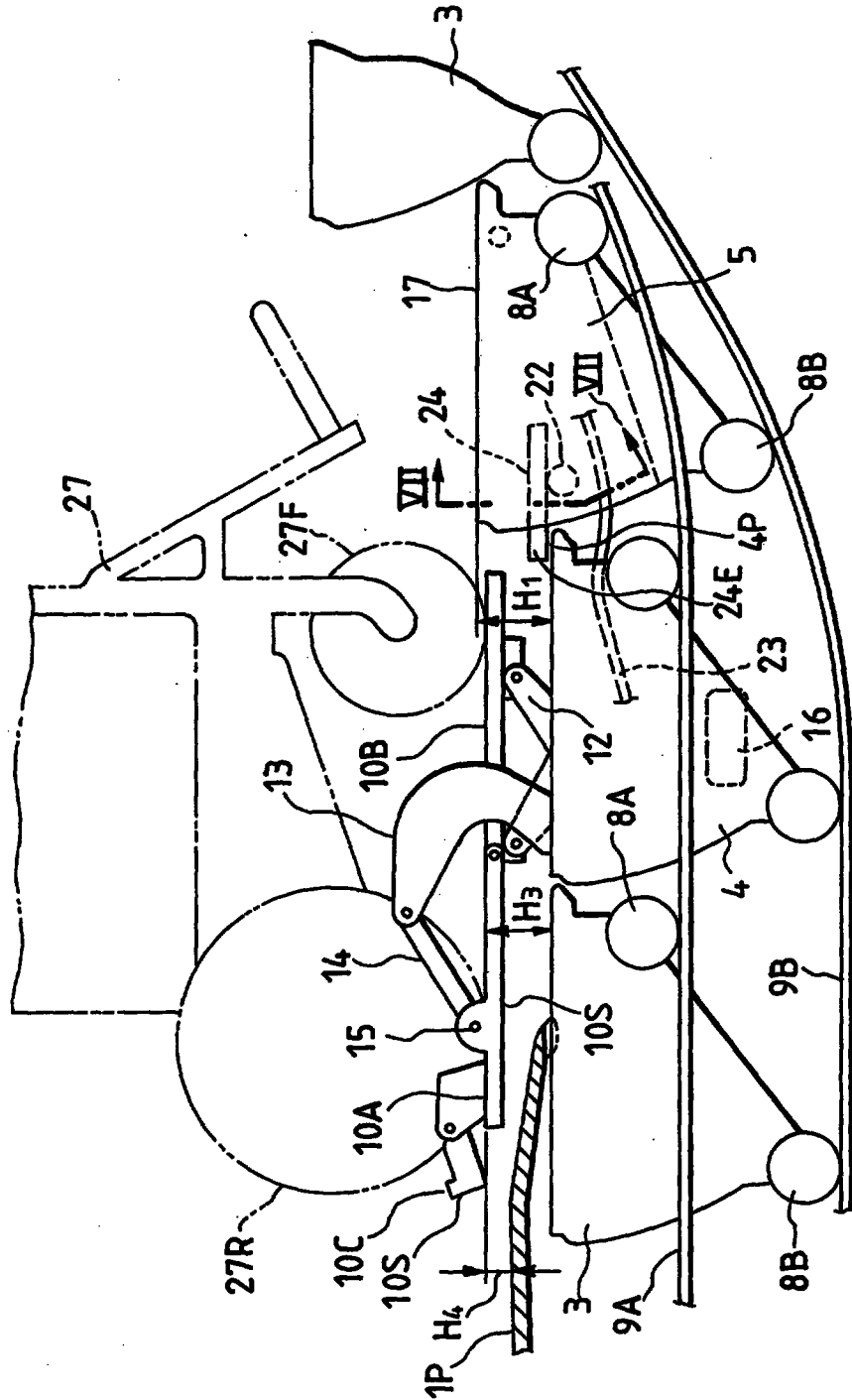




FIG. 5

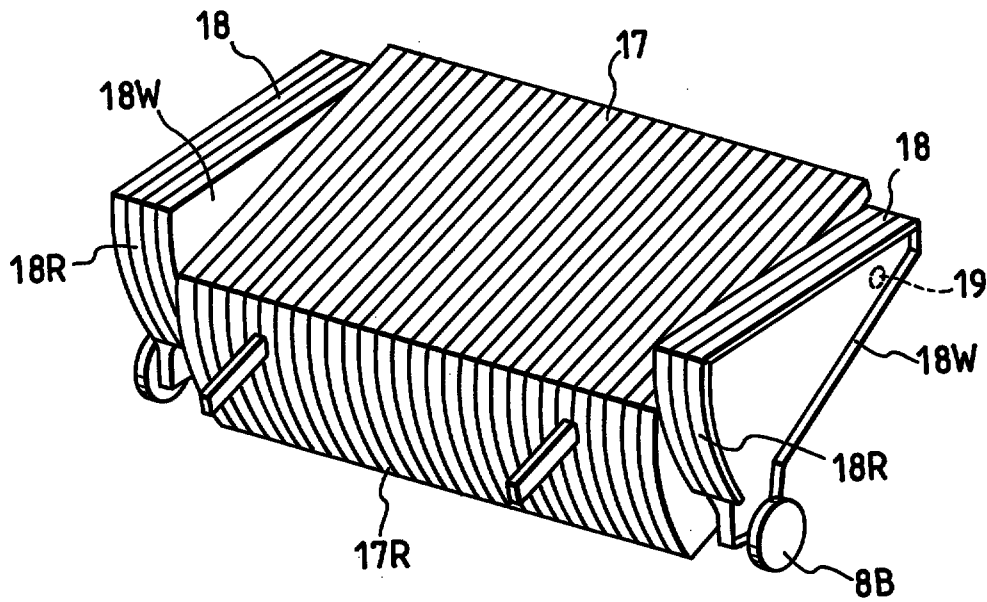


FIG. 6

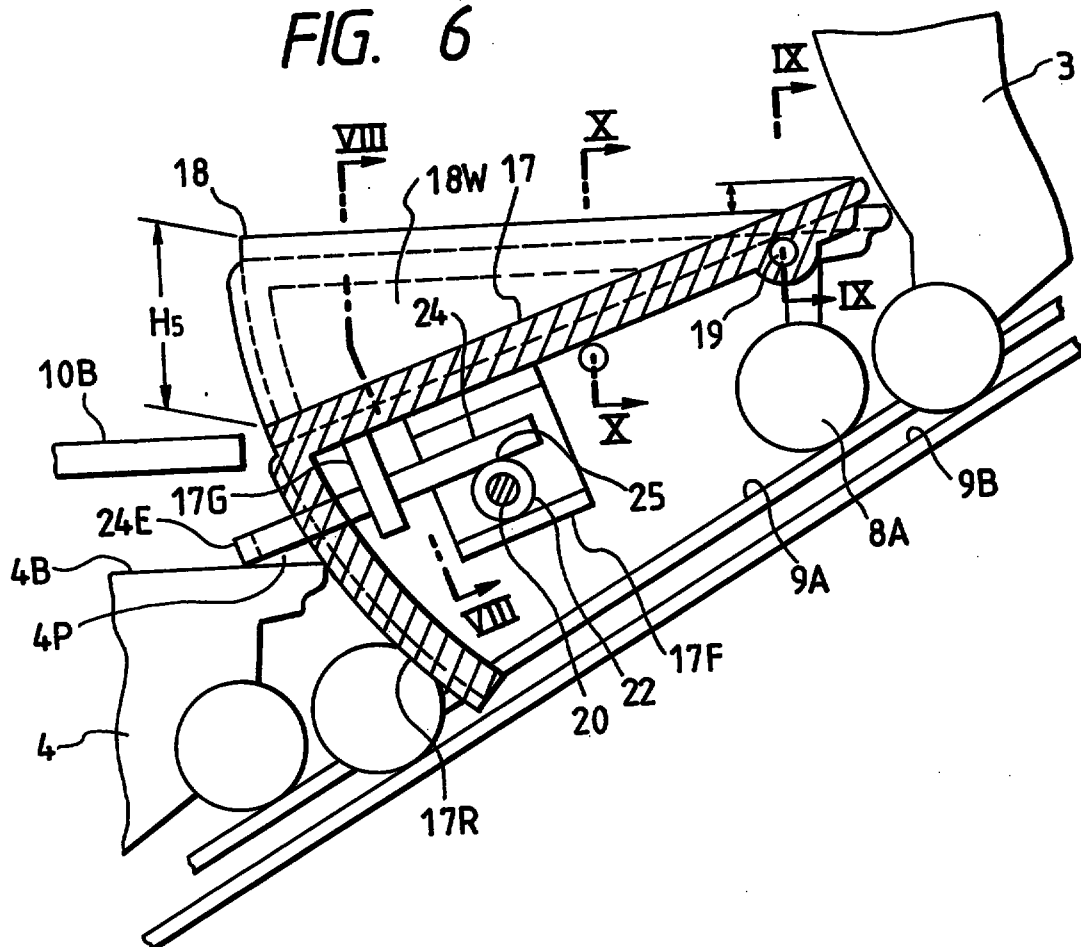




FIG. 7

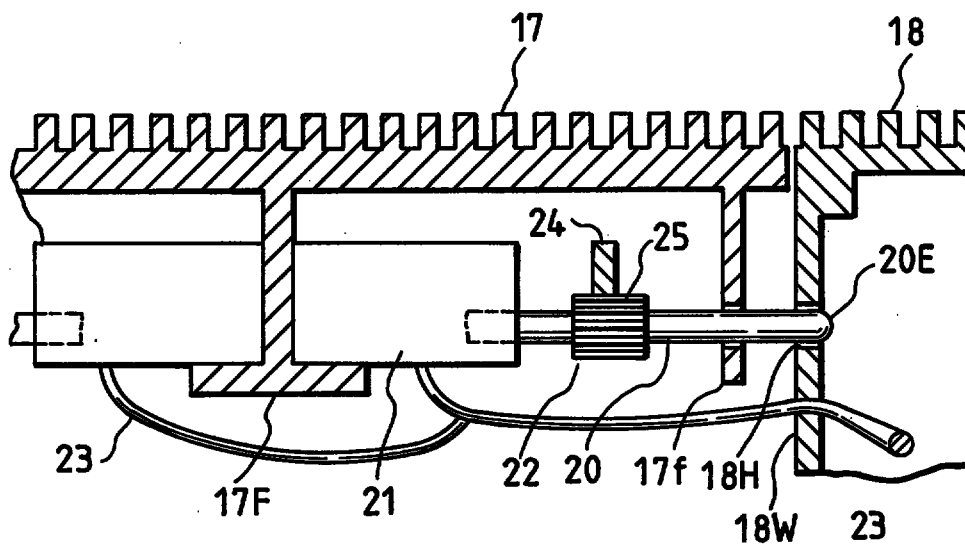


FIG. 8

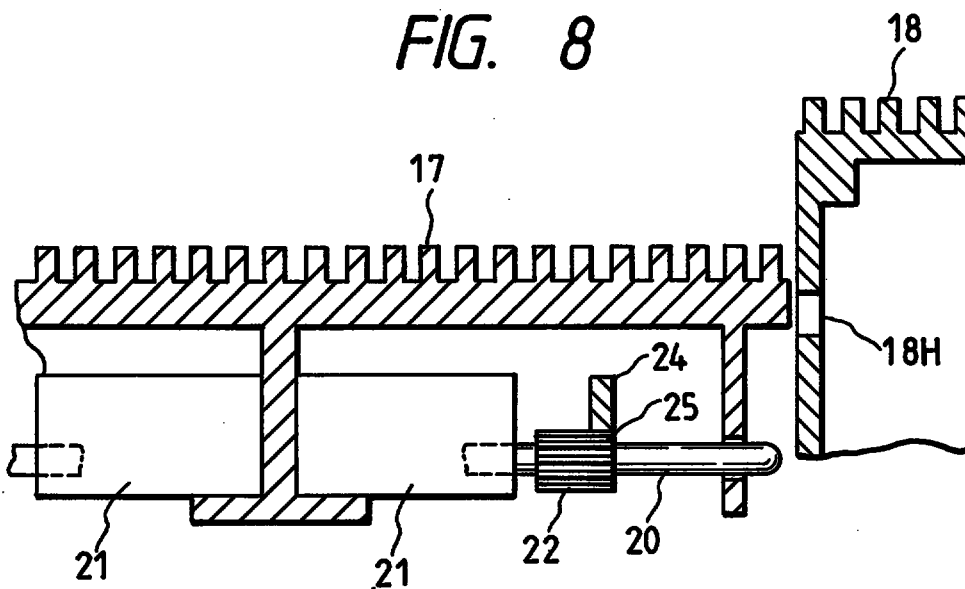




FIG. 9

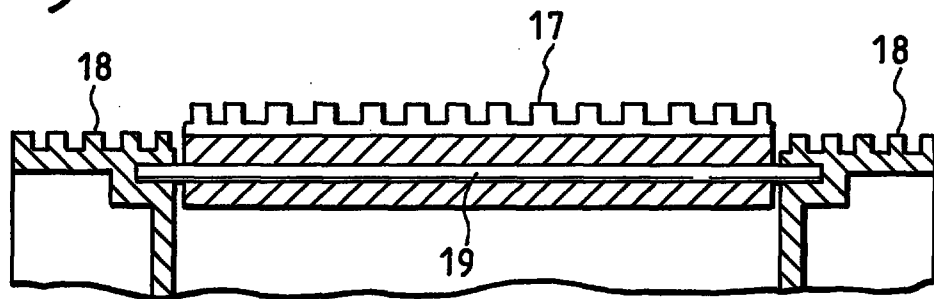


FIG. 10

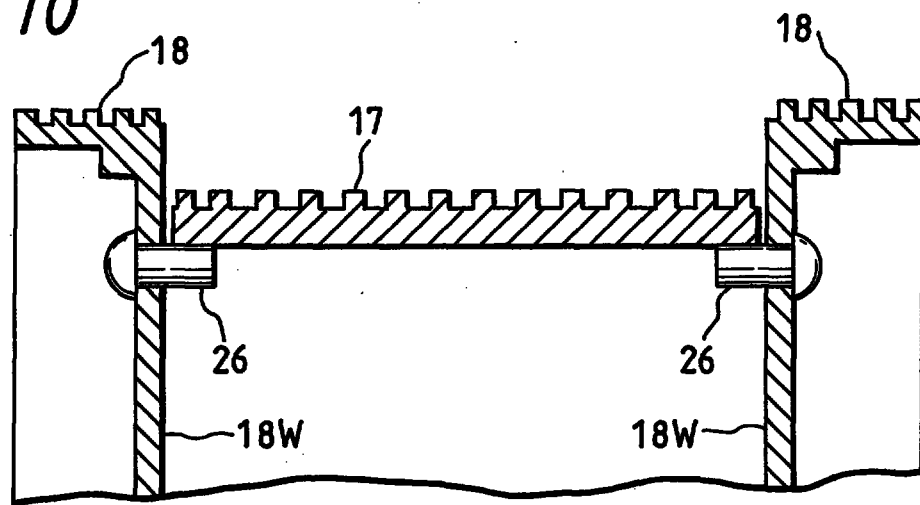


FIG. 13

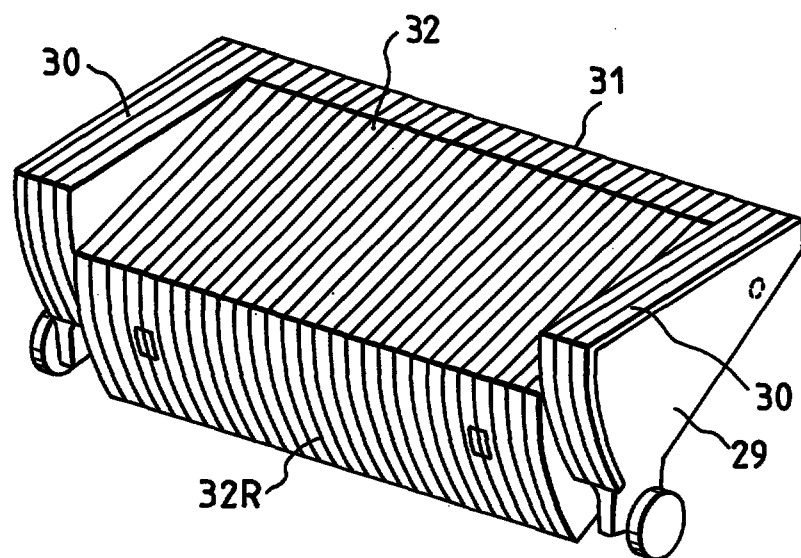
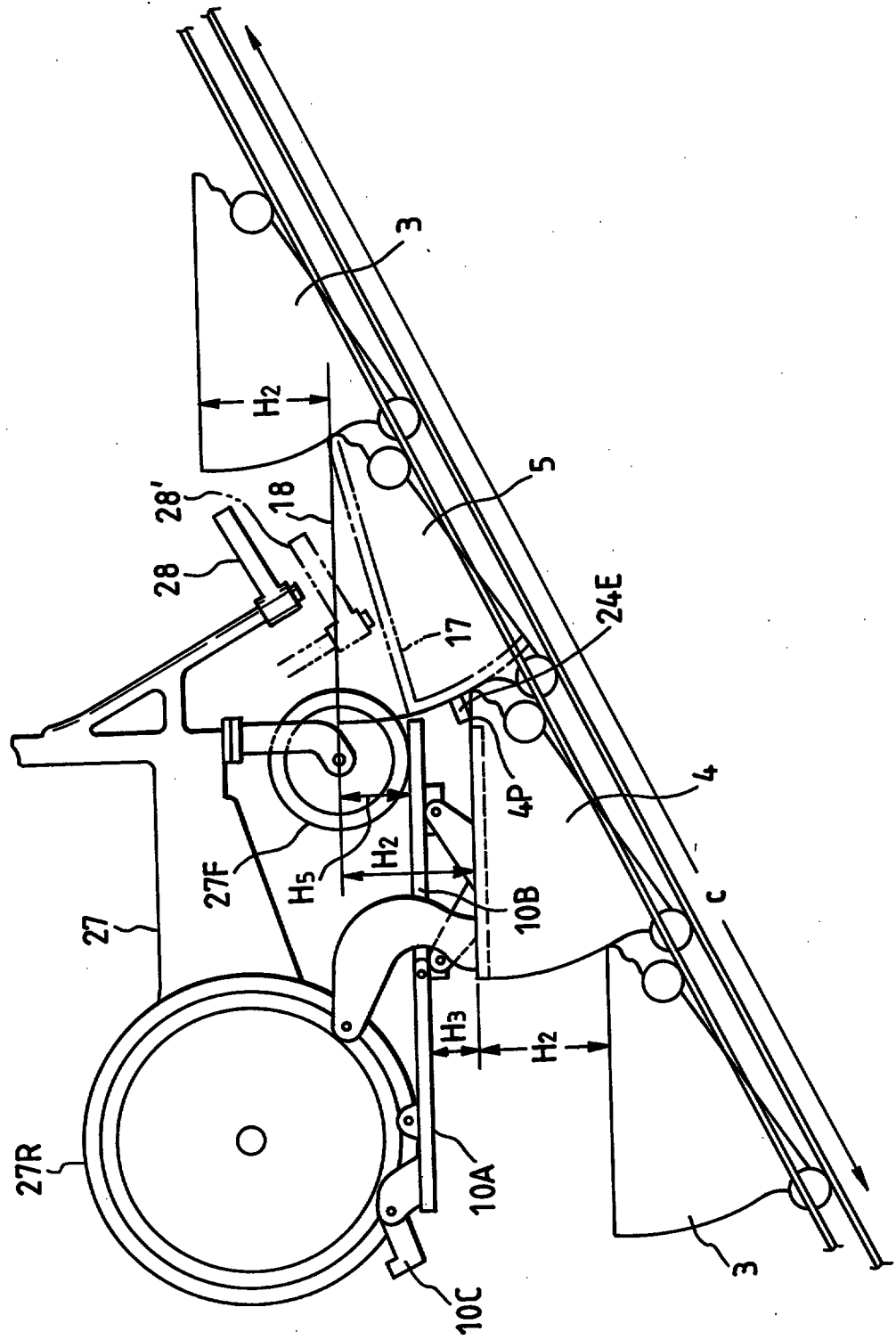




FIG. 11



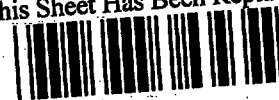


FIG. 12

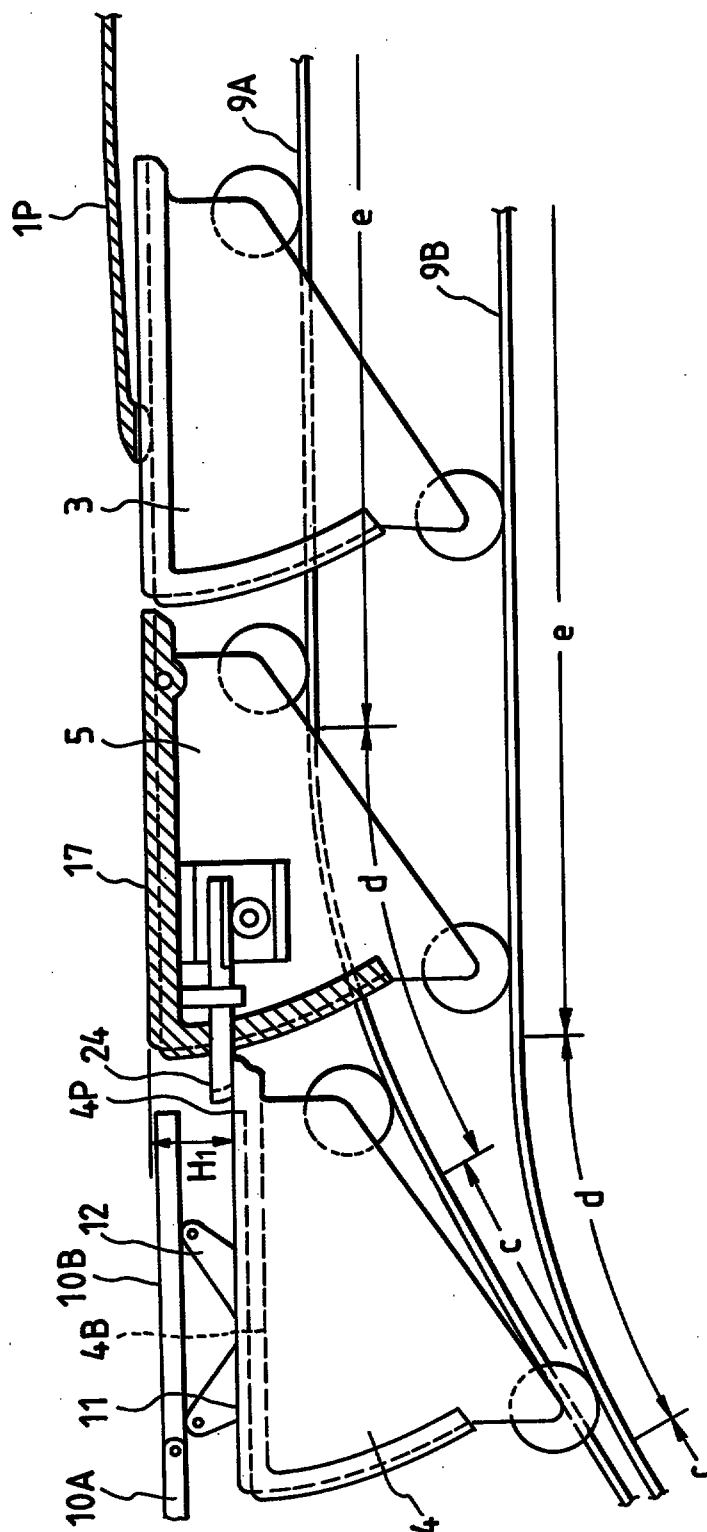
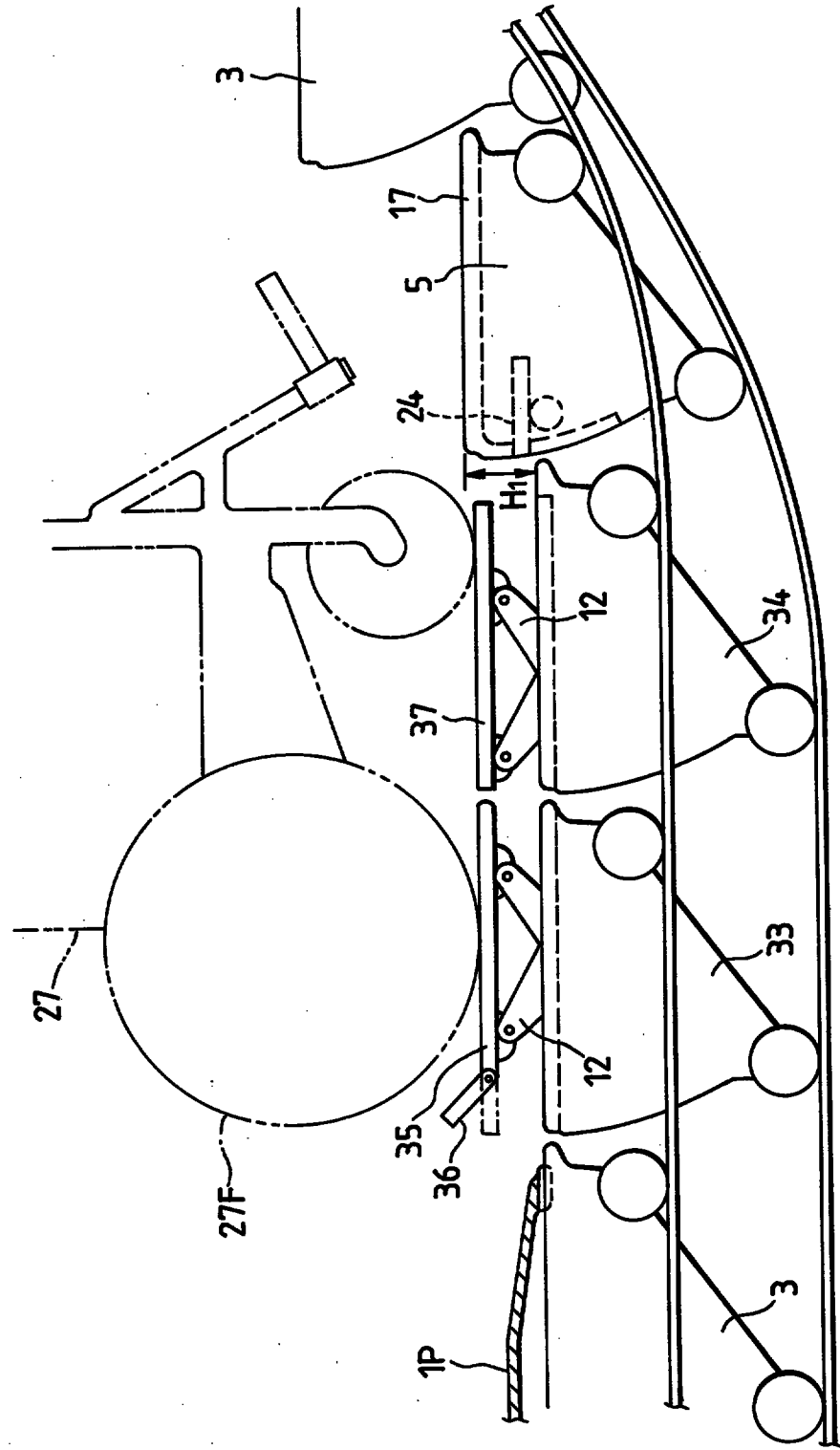




FIG. 14





REPLACEMENT SHEET

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ABSTRACT OF DISCLOSURES

ESCALATOR APPARATUS

An escalator has a plurality of special footsteps and connected between some two of plural usual footsteps endlessly connected each other and forms the wheelchair loading face by extending steps provided on the special footsteps in wheelchair transporting operations. And in the escalator, the special footsteps has the face extension step and forms the wheelchair loading face by lifting the step, and the special footstep is connected to the upper side of the special footstep and has a step to be sloped, of which the lower edge part is sloped so as to face to the upper part of the face extension step.

Figure 1

FIG. 1

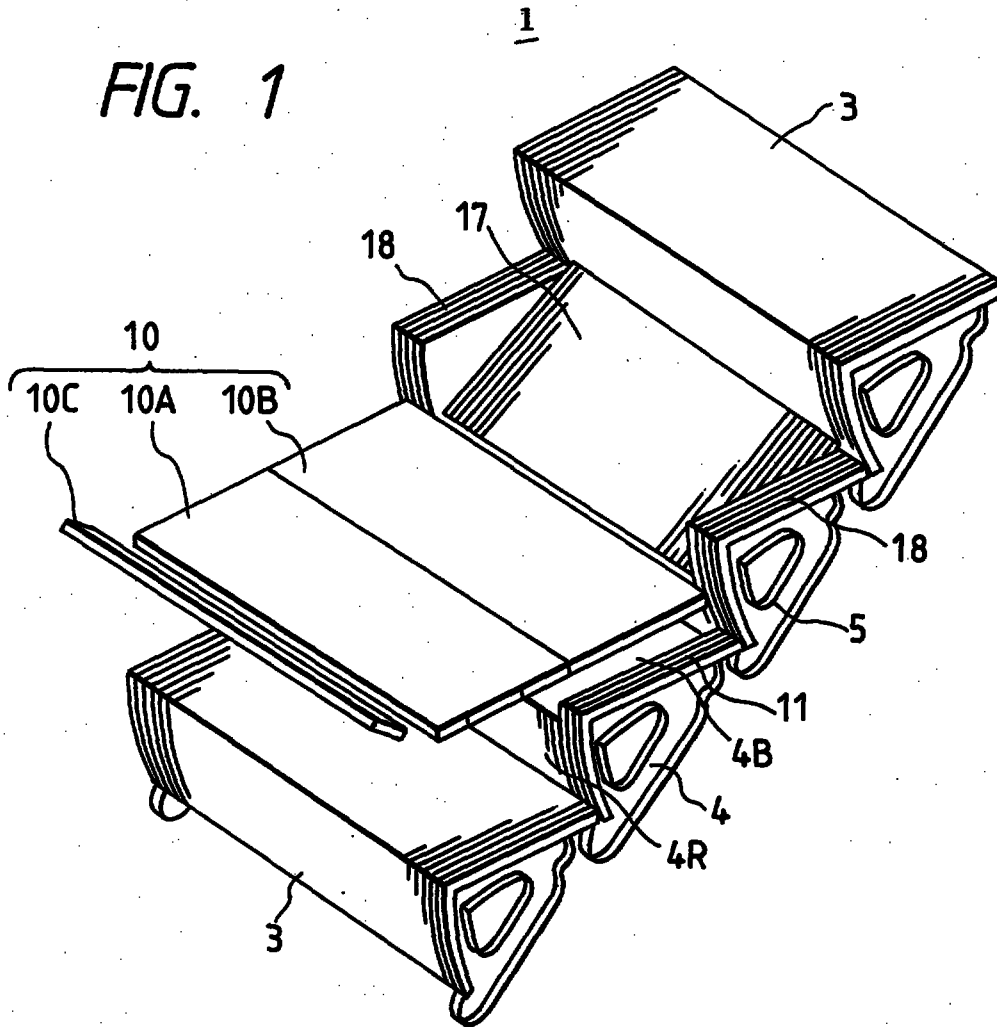


FIG. 2

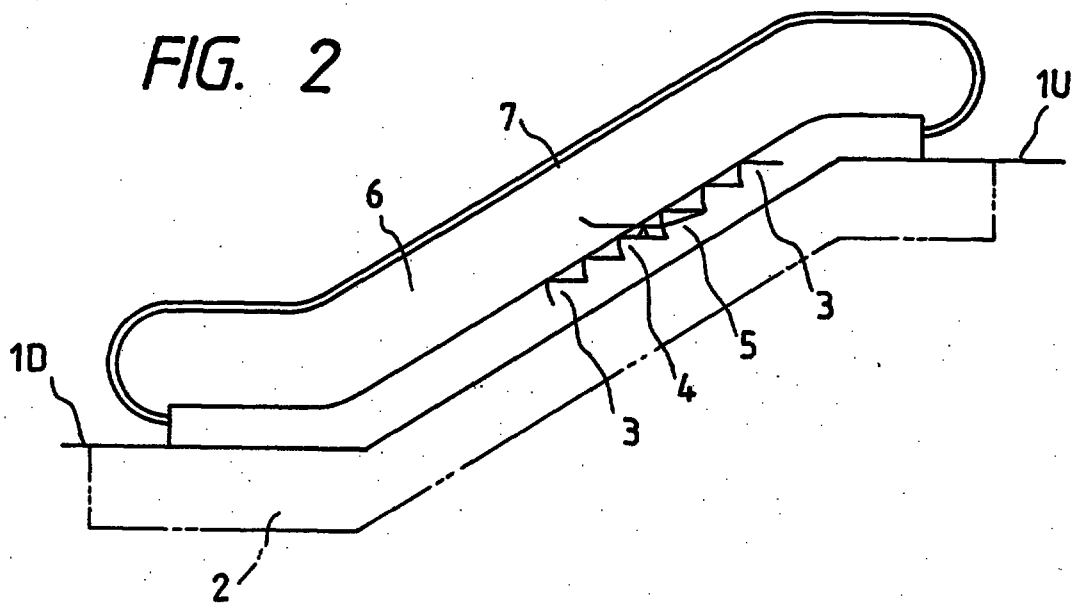
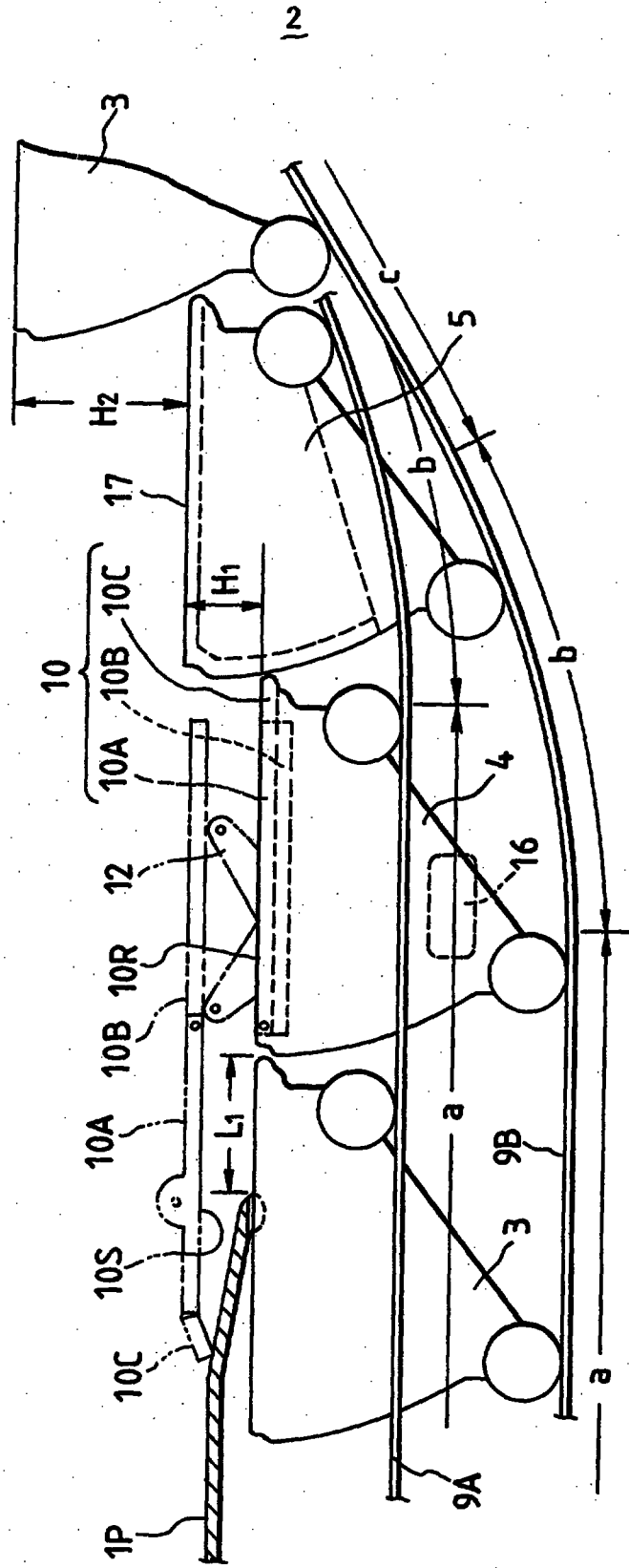
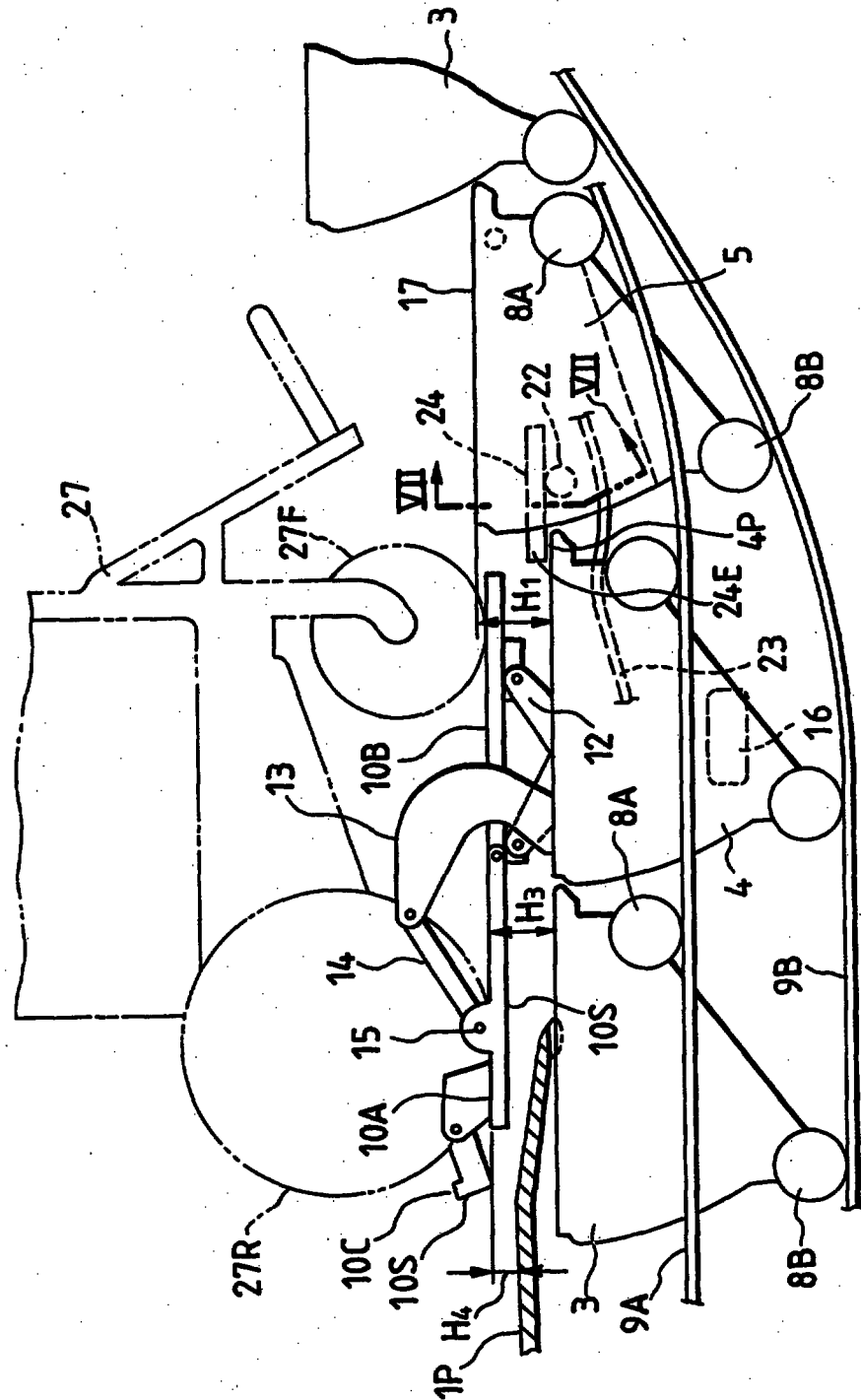


FIG. 3



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FIG. 4



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FIG. 5

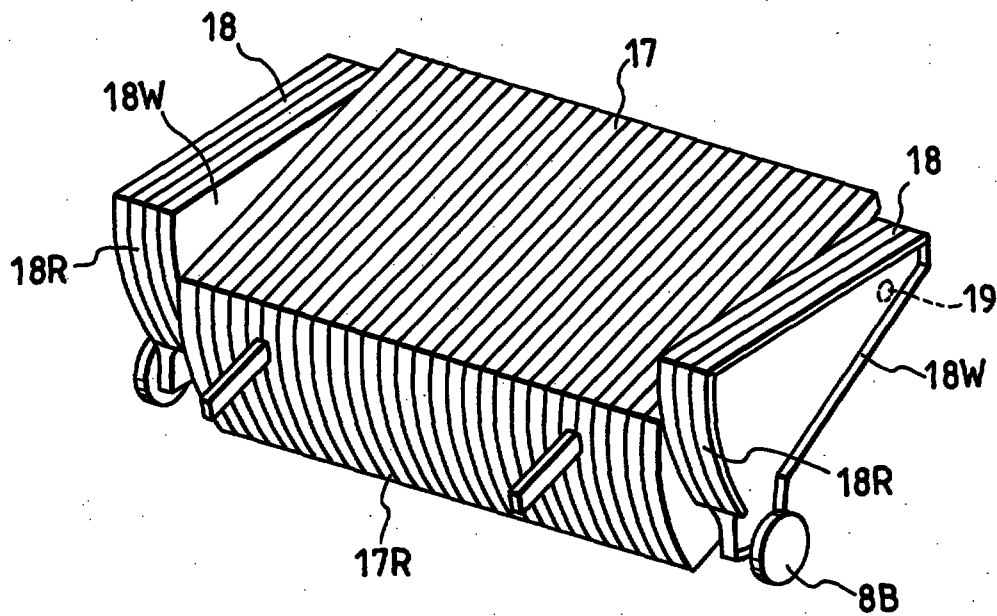
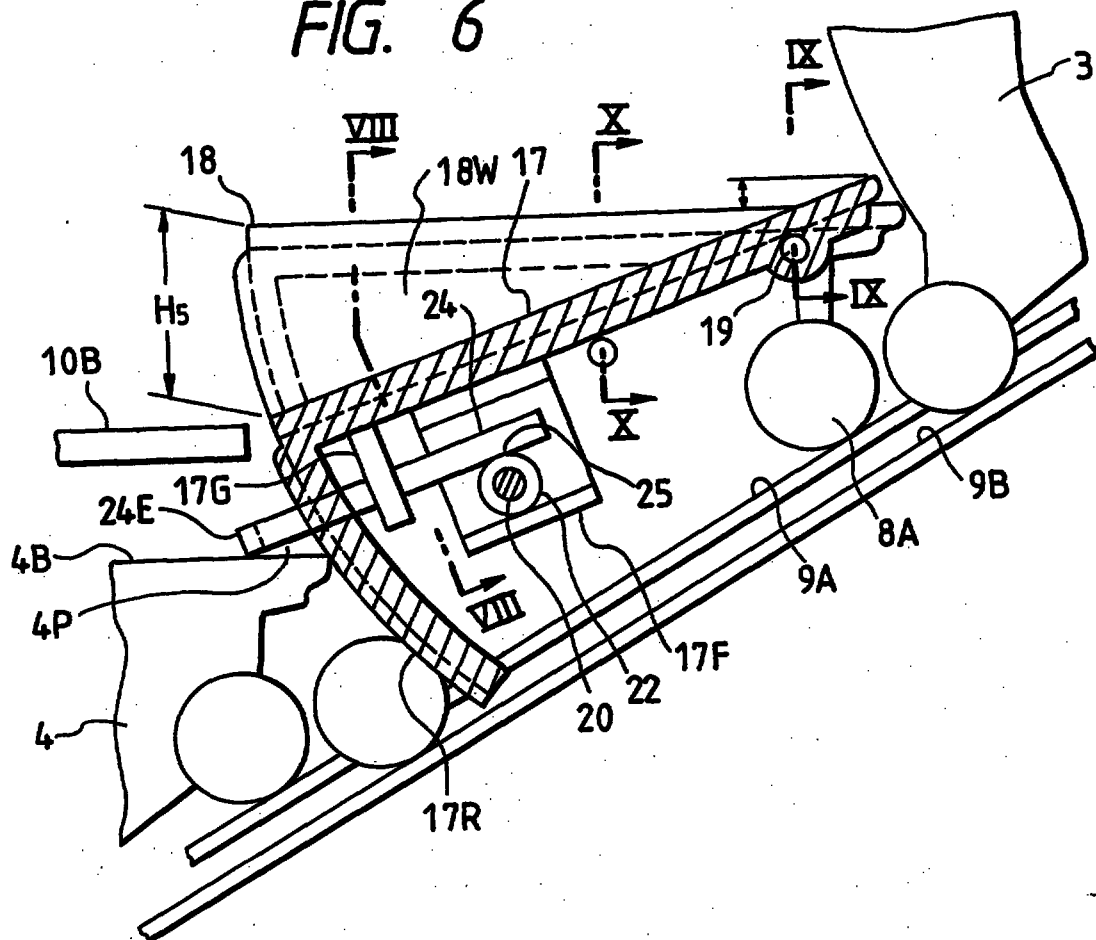


FIG. 6



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FIG. 7

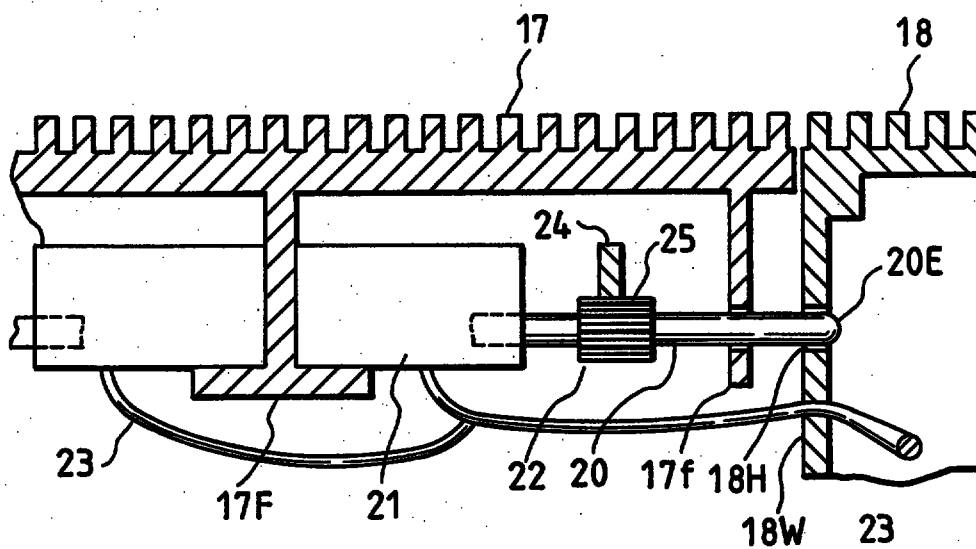


FIG. 8

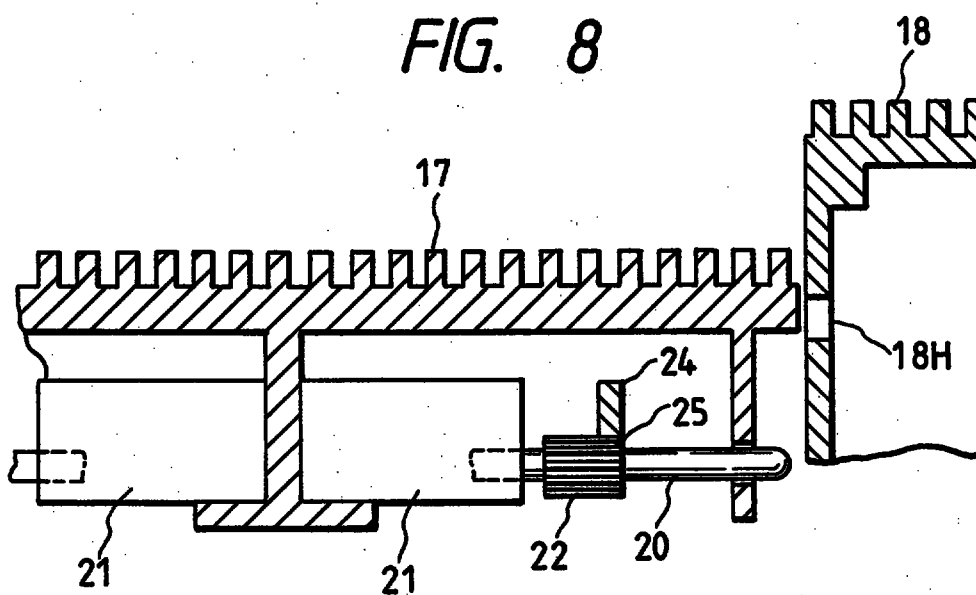


FIG. 9

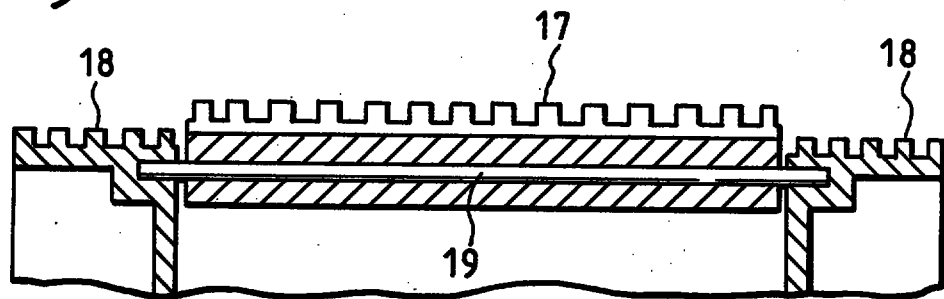


FIG. 10

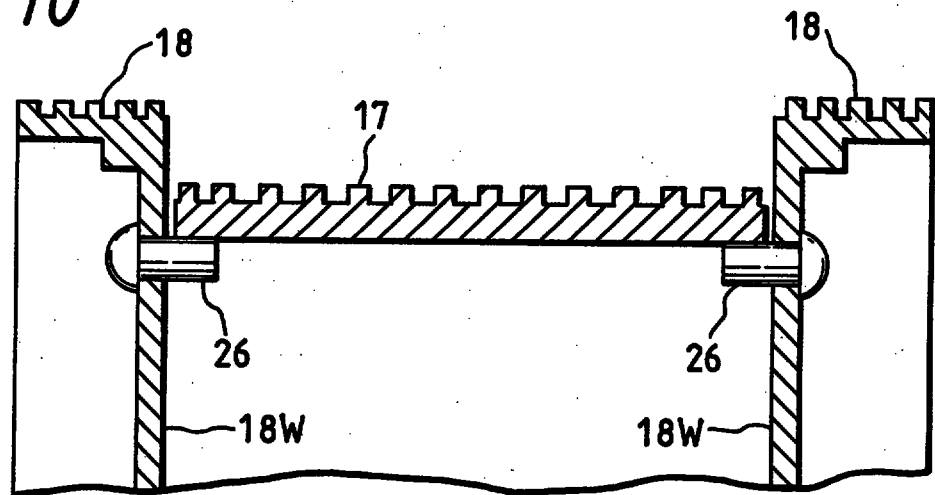


FIG. 11

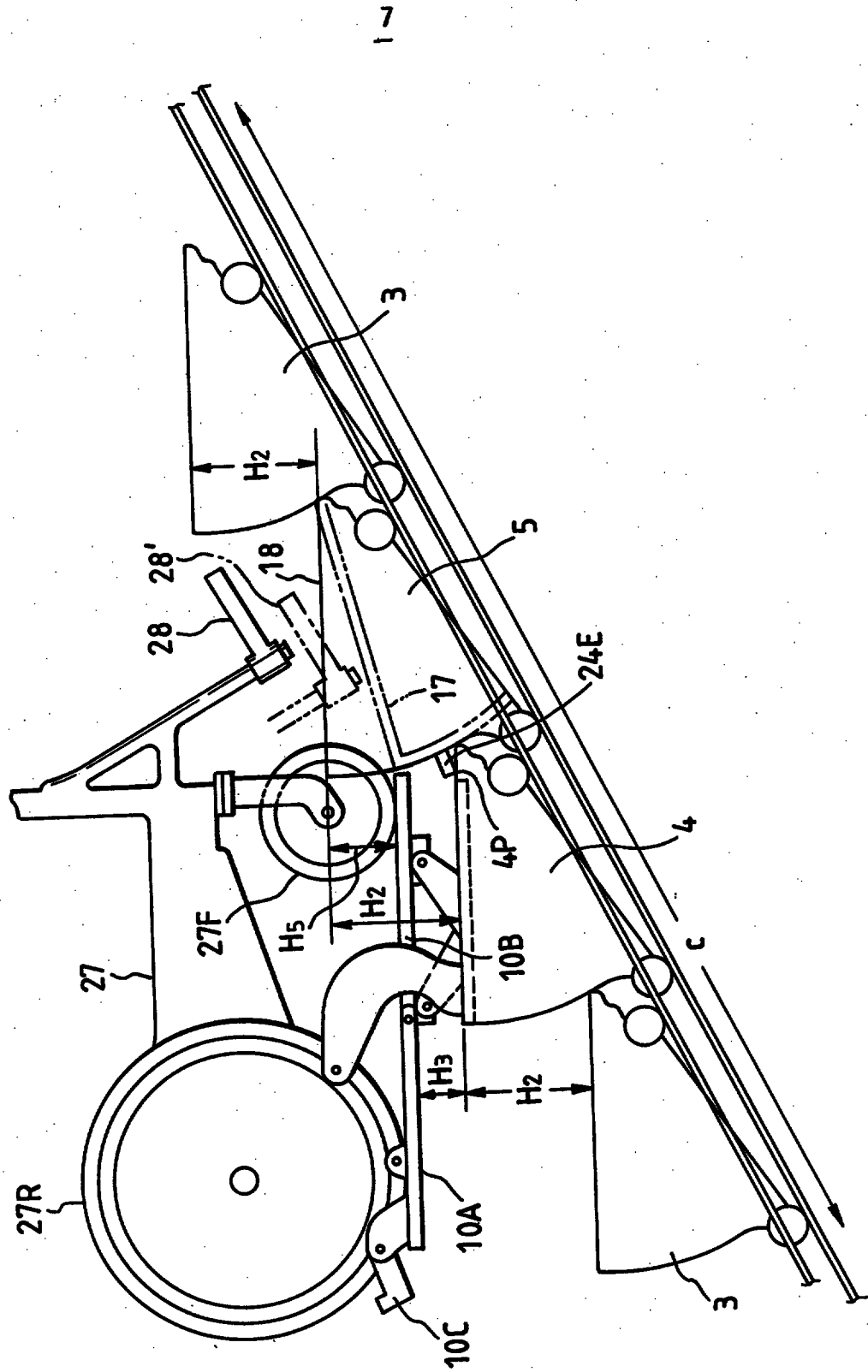


FIG. 12

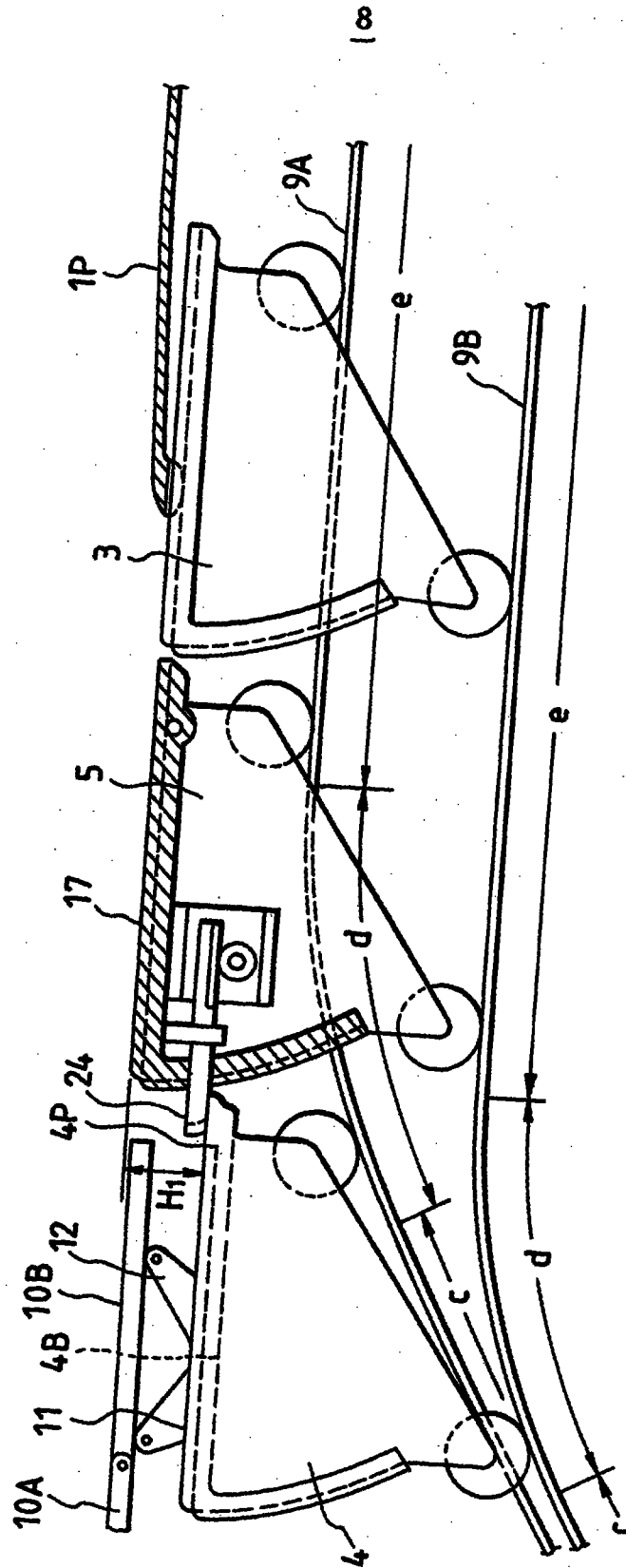


FIG. 13

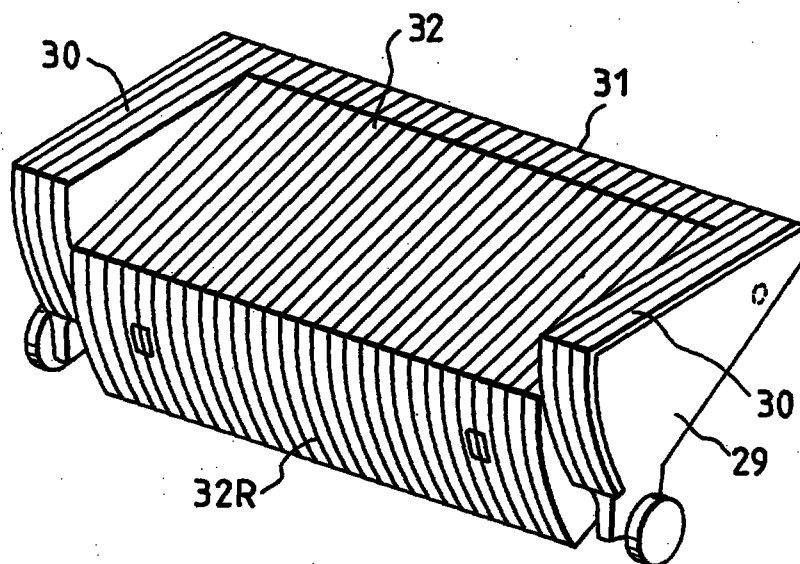
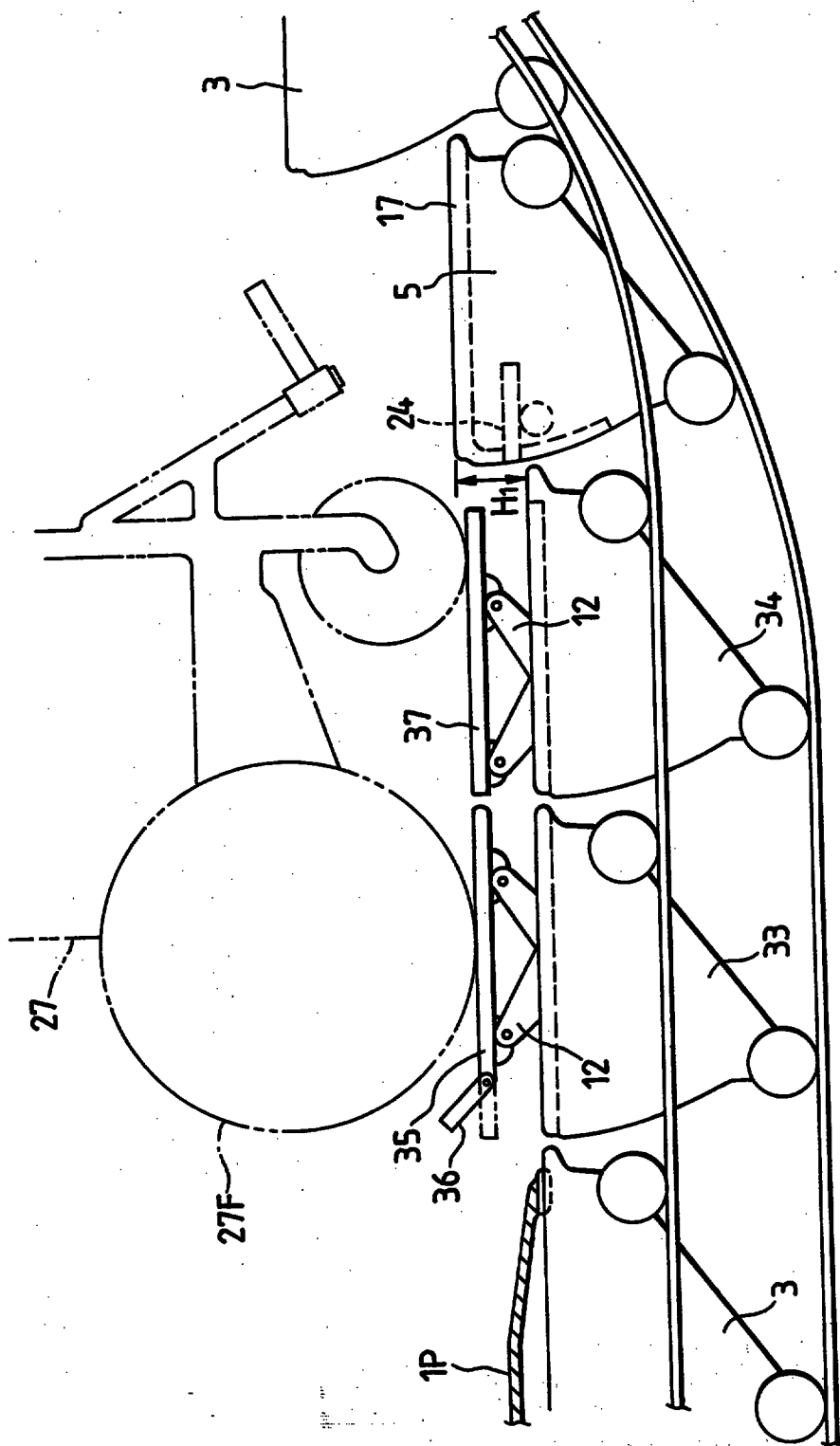


FIG. 14





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WHAT IS CLAIMED IS;



1. An escalator comprising a plurality of successive special footsteps connected between some two of usual footsteps endlessly connected each other functioning in the same way as said usual footsteps in usual operations; at least one step provided on one of said plurality of successive special footsteps, being lifted and extended so as to form a wheelchair loading face in wheelchair transporting operations: and

a sloped footstep of said plurality of successive special footsteps having a step to be sloped, facing to an upper part of said wheelchair loading footstep, of which a lower end edge is lowered near an upper part of said lifted step.

2. An escalator according to claim 1,

wherein said at least one step provided on one of said plurality of successive special footsteps, is lifted from a position of said usual footsteps and forming a wheelchair loading face when said wheelchair face formed by said plurality of successive special footsteps run at a slope interval of said escalator in said wheelchair transporting operations.

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3. An escalator having a series of usual footsteps endlessly connected each other and moving said usual footsteps, said escalator comprising:

at least one footstep connected between some two of said usual footsteps and forming a wheelchair loading face by lifting a step provided on said at least one footstep; and

another footstep provided at an upper stage for said at least one footstep, said another footstep being operated to approach near an upper part of said formed wheelchair loading face by sloping said another footstep near an upper part of said footstep.

4. An escalator having usual footsteps endlessly connected each other, said escalator comprising:

a first footstep having a step thereon, connected to said usual footsteps, said step being lifted and forming a wheelchair loading face; and

a second footstep connected to said first footstep at an upper stage for said first footstep, operated to approach an upper part of said formed wheelchair loading face by sloping said second footstep.

5. An escalator according to one of claims 1 to 4, wherein said step to be lifted is lifted lower than an upper neighboring footstep at a slope interval in wheelchair

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CLAIMS:

1. [CANCELLED]

Claim 2 An escalator having a plurality of special foot steps connected between some two of usual foot steps endlessly connected each other, said plurality special foot steps forming a wheelchair loading face by extending a step plate provide thereon in wheelchair transporting operations, said escalator comprising:

said step plate lifted from a position of said usual foot steps and forming a wheelchair loading face when said plurality of special foot steps run at a slope interval in said wheelchair transporting operations; and

a sloped foot step having a step to be sloped, of which a lower end edge is lowered near an upper part of said lifted step plate.

3. [CANCELLED]



* C L N S *



4. An escalator according to claim 2, wherein a first foot step has a step plate thereon, connected to said usual foot steps, a same step being lifted and forming wheelchair loading face; and a second foot step connected to said first footstep at an upper stage for said first foot step is operated to approach an upper part of said formed wheelchair loading face by sloping said second footstep.

5. An escalator according to claim 2 or claim 4, wherein said step plate to be lifted is lifted lower than an upper neighboring footstep at a slope interval in wheelchair transporting operations.

6. An escalator according to claim 2 or claim 4, wherein said step plate provided on said first foot step is folded up in piles on a fulcrum in usual operations, and is inversely rotated and extended on said fulcrum in wheelchair transporting operations.

7. An escalator according to claim 2 or claim 4, wherein said step plate provided on said first foot step further includes two footsteps neighboring each other, and each one of said two footsteps is lifted by each lift mechanism and said lifted two foot steps form said wheelchair loading face.

8. An escalator according to claim 2 or claim 4, wherein said step plate provided on said first foot step further includes two footsteps neighboring each other, and one of said two footsteps lifts another one of said two footsteps, and said lifted two foot steps form said wheelchair loading face.

9. An escalator according to claim 2, wherein a first foot step has a step plate thereon, connected to said usual foot steps, said step being lifted and forming wheelchair loading face; and a second foot step connected



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to said first foot step is operated to approach an upper part of said wheelchair loading face by sloping said second footstep, said second footstep having a mechanism for keeping a lower edge of a sloped step of said second footstep at a same height as that of said wheelchair loading face connected to a lower side of said second foot step, and said mechanism operating after said first foot step is lifted.

10. An escalator according to claim 9 wherein said mechanism for keeping said lower edge of said sloped step of said second footstep at said height is engaged with said whole first foot step.

11. An escalator according to claim 9, wherein a first foot step forming a wheelchair loading face by lifting a step plate on said first foot step is connected each other, and a second foot step connected to an upper side of said first foot step is operated to approach to an upper edge part of said wheelchair loading face, and said second foot step is set at a position higher than that of said first footstep when said first footstep is positioned at a horizontal interval in a footstep running way at a lower getting-on place.

12. An escalator according to claim 9, wherein said second foot step is positioned at a concave part between a horizontal interval and a slope interval, in a footstep running way when said first footstep is positioned at said horizontal interval in said foot step running way.

13. An escalator according to claim 2, further including a foot step to be sloped in a lower part of said foot step; a mechanism for keeping said foot step horizontal in usual operations; and a mechanism for sloping said foot step and holding a lower edge part of said footstep at a same height as that of a wheelchair loading face formed by another footstep facing to a lower side of said



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above-mentioned footstep, in wheelchair transporting operations; wherein the other mechanism stops its function while one of said two mechanism executes its function.

14. A method of operating an escalator having a first footstep forming a wheelchair loading face by lifting a step on said first footstep connected between some two of usual footsteps endlessly connected each other, and a second footstep connected to an upper side of said first footstep, said second footstep being operated to approach near an upper edge part of said wheelchair loading face, said method comprising the steps of:

stopping said second footstep at a position higher than said first footstep at a getting-on part by a command of wheelchair transporting operations;

forming said wheelchair loading face by lifting a step on said first footstep to almost a same height as that of a second footstep;

setting said second footstep in a state ready for sloping said second footstep; and

starting a wheelchair transporting operations by a command of restarting said escalator.

15. A method of operating an escalator having a first footstep forming a wheelchair loading face by lifting a step on said first footstep, connected between some two of usual footsteps endlessly connected each other, and a second footstep connected to an upper side of said first footstep, being operated to approach an upper edge part of said wheelchair loading face, said method comprising the steps of:

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stopping said second footstep at a position higher than said first footstep at a getting-on part by a command of wheelchair transporting operations;

forming said wheelchair loading face by said first footstep;

lifting a step on said first footstep to almost a same height as that of a second footstep by a command of restarting said escalator ;

setting said second footstep in a state ready for sloping; and

restarting wheelchair transporting operations.



SPECIFICATION

5 TITLE OF THE INVENTION

ESCALATOR APPARATUS

BACKGROUND OF THE INVENTION

Field of the Invention:

The present invention relates to an escalator which
10 ordinary users and wheelchair users can commonly use,
particularly to an escalator having a footstep suitable to
load a wheelchair.

Description of the Related Art:

15 Such a conventional escalator capable of loading a
wheelchair as shown, for example, in Japanese Patent
Application Laid-Open No.209194/1992, raises a movable footstep
neighboring a lower side of a special footstep to the same
height and declines a movable footstep neighboring an upper side
20 of the special footstep so as to go down to the height of the
special footstep, for securing the wheelchair loading step.

In the above conventional technique, since the footstep
neighboring the upper side of the special footstep needs to
be declined down by one step height, a riser attached to the
declined footstep also needs to be declined down. Therefore, the
riser has such the constitution that the riser bends at the
middle line in order not to interfere with a riser on a
returning way side. The above-mentioned conventional

constitution has the following problem that the bend mechanism of an escalator becomes complicated, the motion of the riser also becomes complicated since the riser needs to be lowered as bending it, and the height of a frame body needs to be made larger than the one of a usual escalator since the lower part of the footstep projects by a little length and the height of the frame body needs to be made higher by the projecting length even if it is lowered as bending it.

10 SUMMARY OF THE INVENTION

Objects of the Invention:

The present invention has been achieved in consideration of the above-described problems, and objects of the present invention are as follows.

15 An object of the present invention is to offer an escalator capable of securing a wheelchair loading face without changing the size of a frame body.

Another object of the present invention is to offer an escalator wherein the mechanism and the operations of the declined footstep are simple.

Further, another object of the present invention is to offer an escalator wherein the slope angle of the declined footstep is smaller than the angle of a conventional escalator and a wheelchair loading face can be also secured.

25

Methods Solving the Problems:

In order to attain the above-mentioned objects, the present invention has the following constitutions. That is,

an escalator having an endless loop of steps, in which two neighboring steps have adaptable structures such that said escalator is operable in a wheelchair transporting mode as well as an ordinary operating mode, wherein, a first tread provided a first one of said two neighboring steps, which is lower than the second one thereof when said steps are on the upper side of said escalator, is raisable above its ordinary tread position to provide at least a part of a wheelchair loading face in said wheelchair transporting mode, and

a second tread provided on said second one of said two steps is declinable with respect to its ordinary tread position toward said raised first tread such that the lower edge of said inclined second tread approaches the upper surface of said raised first tread in said wheelchair transporting mode.

By the above-mentioned constitution of an escalator, the height of an escalator by the present invention can be made the same as that of a conventional escalator, since the declined footstep is declined so as to face to the raised wheelchair loading footstep, which can make the angle of the slope of the declined footstep small, and the lower part of the riser of the declined footstep does not project under guide rails even in a down-moving way of the riser. Then, since the angle of the slope of the declined footstep is small, the lower part of the riser does not project without bending the riser and the constitution and the operations of the declined footstep are simple.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig.1 is an outline perspective view of a main part of

footsteps showing an embodiment of an escalator by the present invention.

Fig.2 is an outline side view showing the whole of the escalator to which the footsteps shown in Fig.1 is applied.

5 Fig.3 is a side view showing the states of the footsteps shown in Fig.1 at the getting-on or off plate of the lower floor.

Fig.4 is a side view showing the operation states of the footsteps shown in Fig.3.

10 Fig.5 is a perspective view of one of the footsteps shown in Fig.1.

Fig.6 is a cross sectional view of the footstep shown in Fig.5.

15 Fig.7 is a half cross sectional drawing of Fig.4 viewed from the line VII-VII.

Fig.8 is a half cross sectional drawing of Fig.6 viewed from the line VIII-VIII.

Fig.9 is a half cross sectional drawing of Fig.6 viewed from the line IX-IX.

20 Fig.10 is a half cross sectional drawing of Fig.6 viewed from the line X-X.

Fig.11 is a side view showing the states of the footsteps shown in Fig.1 at the slope distance.

25 Fig.12 is a side view showing the states of the footsteps shown in Fig.1 at the getting-on or off plate of the upper floor.

Fig.13 is a perspective view of another embodiment of the footsteps shown in Fig.5.

Fig.14 is a figure, corresponding to Fig.4, showing another example of wheelchair loading footsteps.

DETAILED DESCRIPTION OF THE EMBODIMENTS

5 Hereinafter, details of the present is explained based on embodiments referring to drawings.

An example of an escalator by the present invention is explained referring to figures 1 to 12.

At first, the constitution of an escalator by the present
10 invention is as shown in Fig.2. That is, special footsteps 4 and 5 are inserted between some two of plural usual footsteps 3 endlessly and movably connected each other are supported by a frame body 2 provided between an upper floor 1U and a lower floor 1D. The special footsteps 4 and 5 offer the same
15 function for use of usual users as the usual footsteps in usual operations of the escalator. Handrail panels 6 are provided at the left and right sides of the usual footsteps 3 and the special footsteps 4 and 5 in the moving direction of the escalator, and movable handrails 7 are respectively
20 guided and supported on each periphery of the handrails 7 and move simultaneously with the series of footsteps. Each step of the usual footsteps 3 and the special footsteps 4 and 5, has a pair of wheels 8A and 8B at the right and the left side of the footstep, and moves on guide rails 9A and 9B fixed to
25 the frame body 2.

The special footsteps 4 and 5 are prepared for securing a wheelchair loading face in operations for transporting a wheelchair, and the constitution of the special footsteps 4

has a face extension tread 10 as shown in Figs.1, 3 and 4. The face extension tread 10 is composed of movable steps 10A and 10B fixed to an upper part of the end part of a lower side, namely, a riser 4R by hinge connection, and a movable step 10C movably connected to the end part of an upper side of the movable step 10A by hinge connection. And the face extension tread 10 is constructed so as to rise leaving narrow steps 11 at the both sides of the step 10, and the movable steps 10A and 10C are folded up in piles on the movable step 10B as shown in Fig.4. Then, the surface 10S of the movable steps 10A and 10C is kept at the same height as that of the narrow steps 11 when they are folded up.

Further, the movable step 10B is supported by a base 4B (shown in Figs.1 and 6), and raised and lowered by a lift mechanism 12 such as a cross-link mechanism. And the movable step 10A is rotated by 180 degrees by using an extension mechanism composed of a extension arm 13, a connection link 14 and a connection pin 15 from the folded up state to such a state as to form the wheelchair loading face together with the movable step 10B, with lift of the movable step 10B.

Then, the lift mechanism 12 is driven by a drive mechanism 16 provided at the base 4B of the footstep 4, and the drive mechanism 16 is fed and operated by a power source (not shown in a figure) provided at the frame body, facing to each position of a lower floor plate and an upper floor plate where the special footstep 4 stops.

Then, the constitution of the special footstep 5 has a step 17 to be declined as shown in Figs.1 and 4, and 5 to 10.

The step 17 to be declined is constructed so as to be declined leaving narrow steps 18 at the both sides of the step 17 and a riser 18R connected to the steps 18. And the step 17 to be declined is formed together with a riser 17R having the same
5 width as that of the step 17, and the side opposite to the riser 17R of the step 17 is supported by inner wall bodies 18W for connecting the narrow steps 18 to the riser 18R via a support axis 19.

And the step 17 to be declined has step supporting rods 20
10 going in and out to the inner wall bodies 18W in the horizontal direction at the backside space of the step 17. The step supporting rods 20 support the step 17 so that, as shown in Fig.7, the face of the step 17 has the same height as those of the narrow steps 18, and pass rod guiding plates 17f, and
15 the top parts 20E of the rods 20 are engaged into engagement holes 18H of the inner wall bodies 18. Then, the rods 20 are to be withdrawn from the engagement holes 18H by a drive mechanism 21 having functions of a electromagnetic plunger and a motor, in order to disconnect the engagement of the top
20 parts 20E of the rods 20 and the holes 18H. The drive mechanism 21 is supported by a support frame 17F provided at the backside space of the step 17, and a power source for the drive mechanism 21 is connected to the power feeding part of the drive mechanism 16 for the special footstep 4 neighboring
25 the special footstep 5 in the lower side, via a cable 23. Further, the rods 20 have small pinions 22 of a shape long in the longitudinal direction, each of which is engaged in a rack 25 of a slope holding arm 24.

The slope holding arms 24 clog holes of the surface of the riser 17R by their tops 24E as shown in Figs.4 and 5 in the usual operations or before the operations for transporting an wheelchair. And, as shown in Figs.6 and 7, each of the arms 5 24 has such a length that the arm passes the riser 17 by using a rod guiding part 17G provided at the backside space of the step 17 to be declined and engaged with the base 4B positioned after the face extension tread 10 (10B) of the special footstep 4 neighboring the footstep 5 in the lower side, in 10 the operations for transporting a wheelchair. Although the angle of the slope of the declined footstep 17 is set by projection of the step supporting rods 20, in case the rods 20 do not project by any chance, the angle of the slope of the step 17 can not be restricted and the bottom part of the riser 15 17R goes down further beyond the guide rails 9B. Then, in order to avoid such a trouble, stoppers 26 shown in Fig.10 are prepared at the inner wall body 18W so that declining of the bottom part of the riser 17R stops at the position which does not go down beyond the guide rails 9B.

20 In the usual operations of the escalator having the above-mentioned constitution, the face extension tread 10 is folded up so that the surface 10S of the movable steps 10A and 10B of the special footstep 4 is at the same height as that of the narrow steps 11, and the step 17 to be declined of the 25 special footstep 5 is horizontally held at the same height as that of the narrow steps 18. By operating the series of footsteps including usual footsteps 3 in the above-mentioned states, usual users can utilize the escalator as a general

escalator.

On the contrary, in the operations for transporting a wheelchair from a lower floor 1D to an upper floor 1U, the special footsteps 4 and 5 stop near a getting-on plate 1P of the lower floor 1D as shown by Fig.3 when a command for operations of the wheelchair transportation is generated by operation of a button by a person in charge or a wheelchair user. The spot position corresponds to the horizontal interval a of the guide rails 9A and 9B if the special footstep 4 is used and there is not a difference in level between the footstep 4 and a usual footstep 3 following the footstep 4. However, the special footstep 5 already exists at the concave interval b of the guide rails 9A and 9B and at the level higher than the special footstep 4, and there is a difference in level of H_1 between the footstep 5 and the footstep 4 following the footstep 5. In the time, a usual footstep 3 preceding the footstep 5 exists at the slope interval c and there is a difference in level of H_2 , which is generated in the normal operations, between the usual footstep 3 and the special footstep 5. In the state, the usual footstep 3 following the special footstep 4 projects by the length of L_1 from the top part of the getting-on plate 1P. The length of L_1 is such a length that the movable step 10C of the mentioned-later face extension tread 10 covers a part of the getting-on plate 1P when the movable step 10C is rotated and extended, which avoids the generation of a large gap between the face extension tread 10 and the getting-on plate 1P. Then, in the state that the movable step 10c is rotated and

extended, the length of the step 10 is extended to one and half of the length of a usual step, following the getting-on plate 1P.

When it is confirmed that the special foot steps 4 and 5 stop at the above-mentioned positions, a power feeding part (not shown in a figure) such as a feeding plug, connected to a power source provided at the frame body 2 facing to the drive mechanism 16 of the special footstep 4, is automatically moved and connected to a terminal of the drive mechanism 16.

10 By the power connection, the drive mechanism 16 is driven, which operates the lift mechanism 12 and raises the face extension tread 10. And, by the lift of the step 10, the movable step 10A is rotated by 180 degrees by using the extension mechanism composed of the extension arm 13, the

15 connection link 14 and the connection pin 15, and forms a horizontal wheelchair loading face together with the movable step 10B, as shown in Fig.4. Then, as shown in Fig.3, the movable 10c inclines so as to be engaged with the getting-on plate 1P, which makes it smooth that a wheelchair 27 gets on

20 the escalator. And, if front wheels 27F of a wheelchair can easily go over the movable step 10C in getting-on the escalator, it is not always necessary to make the movable step 10c engaged with the getting-on plate 1P. Further, the elevating height H_1 of the face extension tread 10 is such a

25 height that the height H_1 by which the rotated and extended movable step 10A is not engaged with the getting-on plate 1P, can be secured, and the height H_1 is almost equal to the difference in level of H_1 between the special footsteps 4 and

5 at the stop positions.

Simultaneously with the formation of the wheelchair loading face by the special footstep 4, the drive mechanism 21 of the special footstep 5 is fed via the cable 23 connected to a power feeding part provided at the special footstep 4 and pulls the step supporting rods 20 as rotating them. By the operations of the step supporting rods, the slope holding arms 24 are moved via the small opinions 22 and the racks 25, and the top parts 24E of the arms are projected and made engaged with the upper face 4P of the base 4B after the face extension tread 10 of the special footstep following the footstep 5 is raised. Then, since the top parts 20E are withdrawn from the engagement holes 18H provided at the inner wall bodies 18W of the narrow steps 18 by the pulling of the step supporting rods 20, the step 17 to be declined loses the horizontal attitude keeping force and becomes rotatable on the support axis 19. However, the step 17 does not incline and keeps its horizontal attitude since the slope holding arms 24 are engaged with the upper face 4P of the base 4B of the special footstep 4.

20 In the above-mentioned situation, a wheelchair is operated to get on the escalator. That is, as shown by two-dot chain lines in Fig.3, a wheelchair is conducted to get on the extended steps 10A to 10C from the getting-on plate 1P by pushing it. Then, as shown in Fig.4, the movable step 10c is
25 rotated automatically or manually and set as stoppers for rear wheels 27R of the loaded wheelchair 27.

Then, the restart command is generated by operating a start button specially provided for operating a wheelchair

transportation, and the wheelchair transporting operations are started. And the loaded wheelchair enters the slope interval c via the concave interval b of the guide rails 9A and 9B. In the usual operations, there is the difference in level of H_2 between the footsteps 3 and 4, or the foot steps 4 and 5. On the other hand, in the wheelchair transporting operations, the difference in level between the movable steps 10A and 10B and the narrow steps 18 of the special footstep 5 is H_3 , since the movable steps 10A and 10B is raised by H_3 between the special footsteps 4 and 5, where H_3 is $[H_2 - (H_2 + \text{the thickness of the movable step 10A})]$. Then, in proportion to the enlargement of the difference in level between the special footsteps 4 and 5 on the way from the concave interval b to the slope interval c, the slope supporting arms 24 from the top part of the declined step 17 goes down on the upper face 4P of the base 4B of the special footstep 4. And the declined step 17 inclines on the support axis 19 by the lowering of the slope supporting arms, which makes the difference in level of H_3 between the edge at the riser side of the narrow steps 18 of the special footstep 5 and the edge at the riser side of the declined step 17. Although the bottom part of the riser 17R connected to the declined step 17 is lowered by H_3 due to the inclining to the declined step 17, the amount of the lowering can be reduced and the bottom part does not go down beyond the guide rails 9A and 9B since the difference in level of H_3 is decreased by raising the movable steps 10A and 10B. Then, the height of the edge at the riser side of the declined step 17 the lower edge of the declined step) is kept almost the same

as that of the movable step 10B. Therefore, since a large gap is not generated between the declined step 17 and the movable step 10B, clothes are prevented from being rolled in. Further, even if the front wheels 27F of the wheelchair on the movable steps 10A and 10B protrude to the special footstep 5 (as shown in Fig.11), the protrusion does not interfere with the motion of the special footstep 5 and the stable operations of the wheelchair transportation can be realized. Then, even if the height of a foot stand 28 of the wheelchair 27 is so low as that of the foot stand 28' shown by two-dot chain lines in Fig.11, the interference between the front wheels and the footstep 5 can be avoided.

When the special footsteps 4 and 5 enter the convex interval d and the horizontal interval e of the upper floor side via the slope interval c of the guide rails 9A and 9B, the difference in level between the movable step 10 and the special footstep 5, which is H_1 at the slope interval c, is decreased to a very small difference. And the slope supporting arms 24 elevate on the upper face 4P of the base 4B of the special footstep 4 corresponding to the difference decrease and keep the step 17 horizontal. Then, the series of footsteps stops when the difference in level between the special footstep 5 and the usual footstep following the footstep 5 disappears, and the difference in level between the narrow steps 11 of the special footstep 4 and the narrow steps 18 of the special footsteps 5 becomes almost H_1 which is the difference at the getting-on plate in the lower floor.

There is a power feeding part (not shown in a figure)

such as a feeding plug connected to a power source of the frame body 2, facing to the drive mechanism of the stopped special footstep 4. In the situation, the movable steps 10A and 10B are left as raised and the wheelchair is conducted to
5 get off the escalator to the getting-off plate 1P of the upper floor by pushing it.

After the getting-off of the wheelchair is finished, the command of finishing the wheelchair transporting operations or the command of returning to the usual operations is
10 generated by operating a operation mode button by a person in charge or a wheelchair user. When these commands are generated, the power feeding part is automatically moved and connected to the terminal of the drive mechanism 16. By the connection with the power source, the drive mechanism 21 of
15 the special footstep 5, shown in Fig.7, is driven inversely to the above-mentioned motion, and projects the step supporting rods 20 in the right and the left direction and engages the top parts 20E of the rods 20 into the engagement holes 18H provided at the inner wall body 18W of the narrow
20 steps 18, for keeping the attitude of the step 17 horizontal. Simultaneously, the engagement of the slope holding arms 24 with the special footstep 4 is released by withdrawing the rods 24 from the surface of the base 4B. While or after the slope holding rods 24 are withdrawn from the base 4B, the
25 drive mechanism 16 of the special footstep 4 is inversely driven, and the movable steps 10A and 10C are rotated by 180 degrees and folded up in piles on the movable step 10B. Then, by driving the lift mechanism 12 downward, the folded up face

extension tread 10 is stored at the predetermined position.

If it is confirmed that the special footsteps 4 and 5 return to the usual states by a detection mechanism such as a detection switch, the series of footsteps is restarted and
5 returns to the usual operations.

Although the operations for transporting a wheelchair from a lower floor 1D to an upper floor 1U is explained above, the operations inverse to the above-explained operations are executed in transporting a wheelchair from an upper floor 1U
10 to a lower floor 1D.

That is, when the command of operations for the wheelchair transportation is generated, the special steps 4 and 5 stop at the position shown by Fig.12 in the state that the movable steps 10A and 10C are folded up in piles on the
15 movable step 10B. And if the stop of the escalator is confirmed, the face extension tread 10 is raised from the base 4B, and the movable steps 10A and 10C are rotated by 180 degrees to the movable step 10B and the wheelchair loading face is formed. Then, the wheelchair is conducted to get on
20 the formed face and the series of footsteps is restarted.

When the special footsteps 4 and 5 arrive at the predetermined position of the lower floor 1D, the footsteps 4 and 5 stop in the state shown in Fig.4. When the command of returning to the usual operation is generated after the
25 getting-off of the wheelchair, the movable treads 10A, 10B and 10C are folded up. Then, after the step folding up completion, the series of footsteps is driven and returns to the usual operations.

As explained above, the embodiments have the following effects.

(1) Since a wheelchair loading face is formed by extending a step face of one special footstep 4 which stops near a getting-on plate 1P at an entrance of an escalator, the wheelchair loading face can be formed if one and half steps are held horizontal. Therefore, by the embodiments, it is possible to set the needed horizontal length at the getting-on plate so short as that of an usual escalator and to avoid increase of the size of an escalator for transporting a wheelchair.

(2) Since the downward moving distance of the riser of the declined step can be shortened, the bottom part of the riser does not go down over the footstep guide rails without bending the riser of the declined step. Therefore, it is possible to suppress increase of the height of the frame body while avoiding interference between the bottom of the riser and the footsteps on the returning way.

(3) Since lowering further more from the preset position or abnormal lowering of the declined step 17 can be prevented by preparing the stoppers 26 for engaging the step 17 with the stoppers, besides the slope holding arms 24, the reliability of the escalator can be more increased.

(4) Since the gradient of the declined step 17 changes corresponding to the height of the movable step 10B of the lower side of the special footstep 4, a difference in level between the lower end part of the declined step 17 and the upper end part of the movable step 10B is not generated, which can

avoid such an accident as rolling-in of clothes.

Although the full length in the moving direction of the declined step 17 is declined in the above-explained embodiments,

a special footstep 29 having such a structure as shown in
5 Fig.13 can be also used. The special footstep 29 consists of
a U-shaped datum step composed of side narrow steps 30
provided at the right and the left side of the footstep 29 and
an upper end part narrow step 31, and the step 32 to be declined
which is the rest part obtained by removing the U-shaped datum
10 step from the full footstep 29. Since the angle of the slope
of the declined step 33 can be more enlarged even if the
lowering amount of the riser 32R is the same as that in the
above-mentioned embodiments, by shortening the length in the
moving direction of the step to be declined, the declined step 33
15 can be a more powerful stopper for the front or the rear
wheels of a wheelchairs.

Although the wheelchair loading face is formed by the
face extension tread 10 of one special footstep 4 in the above
embodiments, the wheelchair loading face can be also by using
20 each movable step of a plurality of special footsteps, as
shown by Fig.14.

In the embodiment shown by Fig.14, the special footsteps
5, 33 and 34 are connected between some two of the usual
footsteps endlessly connected each other. And the constitution
25 and the operations of the special footstep 5 are the same as
those of the above-mentioned embodiments, but those of the
special footsteps 33 and 34 are different from those of the
above-mentioned embodiments. The special footsteps 33 and 34

have the respective independent lift mechanism 12. Then, the lower side special footstep 33 has a movable step 35 lifted by the lift mechanism 12 and a movable step 36 rotatably connected to the lower edge part of the movable step 35. And the movable step 36 is rotated and declined as the movable step 10C in the above-mentioned embodiments, according to the elevating of the movable step 35. And the special footstep 34 has a movable step 37 raised by the lift mechanism 12. Then, such as an engagement part of the slope holding arms 24 for securing the slope of the declined step 17 as explained in the above-mentioned embodiments, is formed on the base of the special footstep 34.

In the operations for elevating a wheelchair by an escalator having the above constitution, when the command of the wheelchair transporting operations is generated by operating an operation mode button, the special footsteps 33 and 34 appears in the horizontal state and the series of footsteps stops if the height of the special footstep 5 becomes higher than that of the special footstep 34 by H_1 (the same height difference as that in the above-mentioned embodiments). After confirming that the escalator stops, the wheelchair is conducted to get on the escalator by bestriding the both of the special footsteps 33 and 34. Then, by operations of a start button by a person in charge or a wheelchair user, each of the lift mechanisms 12 is simultaneously driven and raises each one of the movable steps 35 and 37 by about H_1 . With raising of the movable steps 35 and 37, the movable step 36 rotates so that the free side of

the step 36 rises from the horizontal state shown by two-dot chain lines in the figure, and serves as a stopper for the rear wheels 27R of the wheelchair 27. Other parts operates so as those in the above-mentioned embodiment, and then the
5 escalator restarts.

After the special footsteps 5, 33 and 34 stop at the upper floor and the wheelchair 27 is conducted to get off the escalator, the special footsteps 5, 33 and 34 return to the usual states, and the series of footsteps is driven for
10 returning to the usual operations, by the command of returning to the usual operations.

Although the horizontal part at the entrance is longer than the one and half steps of horizontal part in the above-mentioned embodiments since the escalator having the above
15 constitution needs two step of horizontal part at the getting-on plate 1P at the entrance, this embodiment has the same merits as the above-mentioned embodiments except the above demerit.

In the embodiment shown by Fig.14, both of the following
20 examples are available: an example wherein the lift mechanism 12 is provided only at the special footstep 34 and raises the movable step 37 and the movable step 35, connected to the movable step 37, of the special footstep 33 and an example having the constitution inverse to that of the former example.
25 Then, since one lift mechanism needs only to be provided in such an example, the construction cost becomes cheaper.

As mentioned above, by the present invention, the wheelchair loading face can be secured without increasing the

height of the frame body, and the constitution and the operations of the step to be declined can be simplified.

Furthermore, the present invention has such a merit that the wheelchair loading face can be secured by a smaller angle of

5 the slope of the step to be declined.

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CLAIMS

1. An escalator having an endless loop of steps, in which two neighboring steps have adaptable structures such that said escalator is operable in a wheelchair transporting mode as well as an ordinary operating mode, wherein, a first tread provided a first one of said two neighboring steps, which is lower than the second one thereof when said steps are on the upper side of said escalator, is raisable above its ordinary tread position to provide at least a part of a wheelchair loading face in said wheelchair transporting mode, and

a second tread provided on said second one of said two steps is declinable with respect to its ordinary tread position toward said raised first tread such that the lower edge of said inclined second tread approaches the upper surface of said raised first tread in said wheelchair transporting mode.

2. An escalator according to claim 1, in which said second step has means for keeping the lower edge of said declined second tread at the same height as said raised first tread during movement of said escalator.

3. An escalator according to claim 1 or 2, in which in the wheelchair transporting mode, said raisable first tread is raised less than the difference the tread heights of said first and second steps in said ordinary operating mode, said difference being determined from the maximum relative vertical displacement of said first and second steps on the upper side of said escalator.



4. An escalator according to any one of claims 1 to 3, in which said first tread of said first step is extendible to above the next lower step.
5. An escalator according to claim 4, in which said first tread is formed from at least two plates which are folded one on top to another in ordinary operating mode, and are unfolded to form an extended cantilevered wheelchair loading face in wheelchair transporting mode.
6. An escalator according to any one of claims 1 to 3, in which a third step has an adaptable structure and is the next lower step to said first step, wherein, in said wheelchair transporting mode, a third tread provided on said third step is raised such that said first and third treads together form said wheelchair loading face.
7. An escalator according to claim 6, in which each one of said first and third treads is raised by a respective lift mechanism provided at the corresponding one of said first and third steps.
8. An escalator according to claim 6, in which said first and third treads are raised together by a lift mechanism provided at one of said first and third steps.
9. A method of providing, in an escalator according to any one of claims 1 to 8, said wheelchair transporting mode, including performing the steps of:



Date : 05 AUG 1997

(i) stopping movement of said escalator such that said second step is positioned higher than said first step and said first step is positioned at a boarding part of said escalator,

(ii) forming at least part of said wheelchair loading face by raising said first tread,

(iii) declining said second tread toward said raised first tread,
and

(iv) restarting said escalator,
in which steps (iii) and (iv) may be performed in the order (iii) followed by (iv), or the order (iv) followed by (iii).



ABSTRACT OF DISCLOSURES

ESCALATOR APPARATUS

An escalator has a plurality of special footsteps and
5 connected between some two of plural usual footsteps endlessly
connected each other and forms the wheelchair loading face by
extending steps provided on the special footsteps in
wheelchair transporting operations. And in the escalator, the
special footsteps has the face extension step and forms the
10 wheelchair loading face by raising the step, and the special
footstep is connected to the upper side of the special
footstep and has a step to be declined, of which the lower edge
part is declined so as to face to the upper part of the face
extension step.

FIG. 1

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