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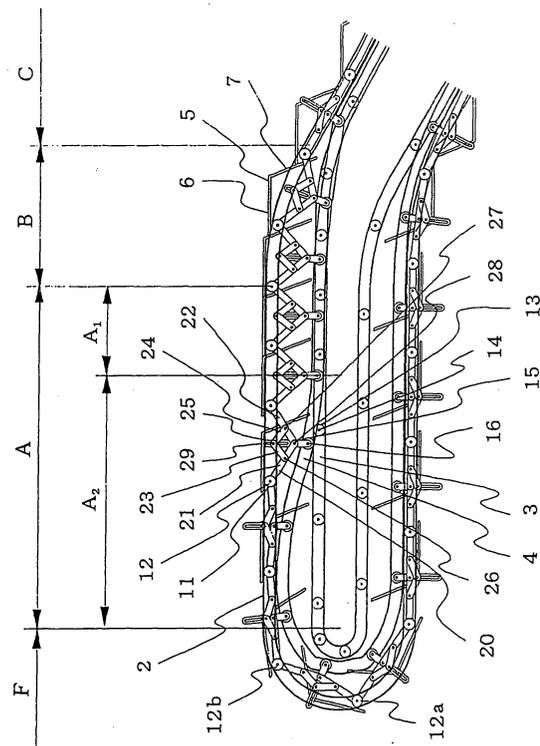
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(54) **HIGH-SPEED ESCALATOR FOR SLOPED PART**

(57) When a step (5) passes through the reversing section F, it moves with a first link (21) and a second link (22) being folded and extended, whereby even if a driving-roller guide track is a simple circular arc, the movement trajectory of a driving roller (11) can be kept within the bounds of the driving-roller guide track, and smooth reversing operation can be achieved.

Fig. 2



EP 1 571 114 A1

Description

TECHNICAL FIELD

[0001] The present invention relates to high-speed-incline escalators in which the steps move faster in the escalator intermediate inclined section than in the upper and lower horizontal sections.

BACKGROUND ART

[0002] Recently, a large number of large height-differential escalators have been installed in subway stations and the like. In such kinds of escalators, passengers often feel uncomfortable because they are obliged to stand still on the steps for a long time. Therefore, high-speed escalators have been developed. However, the operating speed of such escalators has an upper limit in order that the passengers can get on and off safely.

[0003] Accordingly, an escalator with a high-speed inclined section is proposed, which can reduce escalator riding time by moving the steps in the intermediate inclined section at a relatively higher speed than the movement speed of the steps in the upper and lower horizontal sections where the passengers get on and off (see Patent document 1).

[0004] Patent document 1: Japanese Patent Laid-Open No. S51-116586

[0005] However, a conventional escalator with a high-speed inclined section as described in Patent document 1 has a configuration in which the steps run on an approximately arcuate track in the reversing section with foldable links (folding links) for connecting the steps being extended, wherein there has been a problem in that because the trajectory along which the driving rollers should travel does not match the shape of the reversing-section track, enormous travel resistance or the like arises between the driving rollers and the track, whereby smooth reversing operation of the steps cannot be achieved.

[0006] The invention has been made to resolve such a problem, and aims to provide an escalator with a high-speed inclined section in which a smooth reversing movement can be achieved by passing the folding links through the reversing section while folding and extending them.

DISCLOSURE OF THE INVENTION

[0007] An escalator with a high-speed inclined section relevant to the invention includes: a plurality of steps, each step having a driving roller and a trailing roller, and being connected together in an endless fashion for circulation;

a driving-roller guide track for guiding movement of the driving roller, being configured to be substantially arcuate in its reversing sections;

a trailing-roller guide track for guiding movement of the trailing roller;

link mechanisms, each link mechanism being configured with a plurality of links, a first link among the links being connected to a step and rotatable around a driving-roller shaft for supporting the driving roller, a second link among the links being connected to an adjacent step and rotatable around a driving-roller shaft of the adjacent step, remaining ends of the first link and the second link being rotatably connected together, and the link mechanism having an auxiliary roller rotatably mounted on one of the plurality of links; and

an auxiliary-roller guide track for guiding movement of the auxiliary roller;

wherein the link mechanism travels while the distance between adjacent steps is varied by the first link and the second link being folded and extended in the reversing sections.

[0008] Moreover, in the escalator with the high-speed inclined section of the invention, when the step passes through its forward path horizontal sections, the link mechanism moves with the first link and the second link being folded, and when the step passes through the reversing sections, the link mechanism moves with the first link and the second link that have been folded gradually being extended.

BRIEF DESCRIPTION OF DRAWINGS

[0009]

Fig. 1 is an overall side view illustrating an escalator with a high-speed inclined section according to Embodiment 1 of the invention;

Fig. 2 is an explanatory diagram illustrating the portion around a horizontal section A and a reversing section F at the upstairs end of the escalator with a high-speed inclined section according to Embodiment 1 of the invention;

Fig. 3 is an explanatory diagram illustrating the portion around a horizontal section A and a reversing section F at the upstairs end of an escalator with a high-speed inclined section according to Embodiment 2 of the invention; and

Fig. 4 is an explanatory diagram illustrating the portion around a horizontal section A and a reversing section F at the upstairs end of an escalator with a high-speed inclined section according to Embodiment 3 of the invention.

BEST MODE FOR CARRYING OUT THE INVENTION

[0010] Hereinafter, embodiments of the invention will be described in reference to attached drawings.

Embodiment 1.

[0011] Fig. 1 is an overall side view illustrating an escalator with a high-speed inclined section according to Embodiment 1 of the invention, and Fig. 2 is an explanatory diagram illustrating the portion around a horizontal section and a reversing section at the upstairs end of the escalator.

[0012] Firstly, the makeup will be described in reference to Fig. 1 and Fig. 2.

[0013] A main frame 1 is provided with a driving-roller track 2, a trailing-roller track 3, and an auxiliary-roller track 4. Steps 5 are connected together in an endless fashion, and circulated along the tracks 2 through 4.

[0014] Each of the steps 5 has a driving roller 11 that rolls along the driving-roller track 2, a driving-roller shaft 12 that supports the driving roller 11, a trailing roller 13 that rolls along the trailing-roller track 3, and a trailing-roller shaft 14 that supports the trailing roller 13; and is configured with a tread 6 for carrying a passenger and a riser 7 extending downwards from the underside of the tread 6.

[0015] The speed of the steps 5 varies by the distance between adjacent steps 5—in other words, the distance between the driving-roller shafts 12 (distance between the centers of the shafts)—being changed. More specifically, in an upper landing section A_1 where passengers get on or off, the distance between the centers of the adjacent driving-roller shafts 12 is decreased, and the steps 5 move at low speed.

[0016] Then, as the steps move from the upstairs curved section B toward the constantly inclined section C, the distance between the centers of the adjacent driving-roller shafts 12 is gradually increased, and the steps 5 turn into a high-speed movement.

[0017] Between the adjacent steps 5, a link mechanism 20 for varying the distance between the centers of the adjacent driving-roller shafts 12 is interlinked. The link mechanism 20 includes first through fifth links 21 through 25, and an auxiliary roller 15 that rolls along the auxiliary-roller track 4.

[0018] One end portion of the first link 21 is rotatably connected to the driving-roller shaft 12. The other end portion of the first link 21 is rotatably connected to the middle portion of the fifth link 25 via a rotational shaft 28. One end portion of a second link 22 is rotatably connected to the driving-roller shaft 12 of the adjacent step 5. The other end portion of the second link 22 is rotatably connected to the middle portion of the fifth link 25 via the rotational shaft 28. A third link 23 is rotatably connected to the middle portion of the first link 21. A fourth link 24 is rotatably connected to the middle portion of the second link 22. The other end portions of the third link 23 and the fourth link 24 are connected to one end portion of the fifth link 25 via a sliding shaft 29. A guide groove for guiding the sliding of the sliding shaft 29 in the fifth link 25 is provided in the one end portion of the fifth link 25. The rotatable auxiliary roller 15 is provided

at the other end portion of the fifth link 25.

[0019] Next, the operation will be described. The first, second, third, and fourth links 21, 22, 23, and 24 form a so-called pantograph type quadruple link mechanism, in which the angle made by the first and the second links 21 and 22 can be increased or decreased with the fifth link 25 serving as the axis of symmetry.

[0020] This makes it possible to vary the distance between the driving-roller shafts 12 connected to the first and the second links 21 and 22.

[0021] As the steps move from the upstairs curved section B toward the constantly inclined section C, the distance between the driving-roller track 2 and the auxiliary-roller track 4 gradually decreases. At this time, the link mechanism operates like the framework of an umbrella when being opened out, and the distance between the driving-roller shafts 12 of the adjacent steps, which has been minimum at the upper landing section A_1 , gradually increases. In the constantly inclined section C, the distance between the driving-roller track 2 and the auxiliary-roller track 4 becomes minimum, and the distance between the driving-roller shafts 12 of the adjacent steps 5 becomes maximum. Therefore, the speed of the steps 5 reaches maximum, and the first and the second links 21 and 22 become approximately linear in this state.

[0022] As described above, the first link 21 and the second link 22 in the link mechanism 20 connecting the driving-roller shafts 12 of the adjacent steps are folded in the upstairs landing section A_1 where the steps move at low speed, and within the upstairs expanding section A_2 from the landing section up to the reversing section F, the first link 21 and the second link 22 in the link mechanism are gradually extended linear. Then the links move to the reversing section F.

[0023] However, the driving-roller track 2 of the upstairs reversing section F has no moving parts and is arcuate in shape, and if the first link 21 and the second link 22 move along the reversing section F in an extended state, because the movement trajectory of the driving roller 11 and the shape of the fixed arcuate driving-roller track 2 do not match in shape, enormous travel resistance or the like arises between the driving roller 11 and the driving-roller track 2, whereby smooth reversing operation of the steps 5 cannot be achieved.

[0024] Given such circumstances, in the invention, the first link 21 and the second link 22 in the link mechanism 20 that connect the respective driving-roller shafts 12a and 12b are folded in the reversing section when the adjacent steps 5 move along the reversing section.

[0025] Here, assuming an equilateral polygon whose vertices are all positioned on an arcuate trajectory, if one side is shortened, a vertex at an end of the side can be displaced toward the inside of the circle, in other words, toward the center of the circle. Expressing this as a relationship between the driving roller 11 moving along the reversing section F and the link mechanism 20 in the

escalator with a high-speed inclined section, the centers of the adjacent driving-roller shafts 12a and 12b disposed on the arcuate trajectory correspond to the vertices of the equilateral polygon, and the first link 21 and the second link 22 that are linear correspond to the sides of the equilateral polygon. Here, when the first link 21 and the second link 22 that connect the adjacent driving-roller shafts 12a and 12b are folded, the distance between the centers of the driving-roller shafts 12a and 12b is decreased, and the centers of the driving-roller shafts 12a and 12b are displaced toward the inside of the circular arc.

[0026] If the link mechanism 20 and the driving-roller track 2 are established so that their positional relationship is one in which the centers of the driving-roller shafts 12a and 12b would pass outside of the driving-roller track 2 in the reversing section when the first link 21 and the second link 22 pass through the reversing section while being extended linear, by decreasing the distance between the center of the driving-roller shaft 12a and the center of the driving-roller shaft 12b, the center of the driving-roller shaft 12a and the center of the driving-roller shaft 12b that would be positioned outside of the circular arc can be displaced conversely toward the inside of the circular arc, and the center of the driving-roller shaft 12a and the center of the driving-roller shaft 12b can be kept within the track range of the circular driving-roller track 2 in the reversing section F.

[0027] In order to vary the distance between the center of the driving-roller shaft 12a and the center of the driving-roller shaft 12b, the first link 21 and the second link 22 in the link mechanism 20 should be folded or extended. This can be achieved also in the reversing section F by appropriately varying the distance between the auxiliary-roller track 4 and the arcuate driving-roller track 2 as well as in the upstairs curved section B or in the upstairs expanding section in the escalator with a high-speed inclined section when controlling the folding and extending of the first link 21 and the second link 22 in the link mechanism 20.

[0028] Only the upstairs reversing section has been described above; however, it is all the same with the downstairs side.

[0029] Thus, in the upstairs and in the downstairs step reversing sections, the movement trajectory of the driving roller and the shape of the driving-roller guide track can be matched, whereby the smooth reversing operation of the steps can be achieved.

Embodiment 2.

[0030] Fig. 3 is an explanatory diagram illustrating the portion around a horizontal section A and a reversing section F at the upstairs end of an escalator with a high-speed inclined section according to Embodiment 2 of the invention. Redundant descriptions of components and their operations illustrated in Fig. 3 that are identical to those in Fig. 2 will be omitted by attaching identical

numerals.

[0031] In Embodiment 1, the link mechanism 20 is configured with the first through fifth links as illustrated in Fig. 2. In this Embodiment 2, however, the link mechanism 20 is configured only with a first link 21 and a second link 22 as illustrated in Fig. 3. Operations and benefits are the same as in Embodiment 1.

Embodiment 3.

[0032] Next, an escalator with a high-speed inclined section according to Embodiment 3 will be described.

[0033] Fig. 4 is an explanatory diagram illustrating the portion around a horizontal section A and a reversing section F at the upstairs end, of the escalator with a high-speed inclined section according to Embodiment 3 of the invention. Redundant descriptions of components and their operations illustrated in Fig. 4 that are identical to those in Fig. 2 will be omitted by attaching identical numerals.

[0034] A driving-roller track 2 of the upstairs reversing section F in Fig. 4 has no moving parts, and is arcuate in shape.

[0035] In this Embodiment 3, the distance between adjacent steps 5 is minimum in the horizontal section A forward path, and the distance between the adjacent steps 5 is maximum in the horizontal section A return path. When the steps 5 move along the reversing section F, the distance between the steps 5 is gradually increased from the horizontal section forward path toward the horizontal section return path.

[0036] Specifically, the distance between the driving-roller track 2 and the auxiliary roller 4 is maximum in the horizontal section forward path with the first link 21 and the second link 22 in the link mechanism 20 being folded; the distance between the driving-roller track 2 and the auxiliary-roller track 4 is minimum in the horizontal section return path with the first link 21 and the second link 22 being linear; and the distance between the driving-roller track 2 and the auxiliary roller 4 is gradually decreased from the horizontal section forward path to the horizontal section return path in the reversing section F; whereby the folding and extending of the first link and the second link is controlled in the same way as in the upstairs curved section B or in the upstairs extending section in the escalator with a high-speed inclined section.

[0037] Only the upstairs reversing section has been described above; however, it is all the same with the downstairs side.

[0038] Thus, in the step reversing sections at the upstairs end and at the downstairs end, smooth reversing operation of the steps can be achieved.

[0039] Moreover, because the length of the horizontal section in the escalator with a high-speed inclined section can be reduced, the escalator with a high-speed inclined section can be produced at low cost, and the construction cost can be reduced.

INDUSTRIAL APPLICABILITY

[0040] Because the first link and the second link are extended or folded in the reversing section in the escalator with a high-speed inclined section according to the invention as above, even if the driving-roller guide track in the reversing section is simply arcuate in shape, smooth reversing operation of the steps can be achieved so that energy saving and ride quality are enhanced.

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Claims

1. An escalator with a high-speed inclined section including:

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a plurality of steps, each step having a driving roller and a trailing roller, and being connected together in an endless fashion for circulation;

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a driving-roller guide track for guiding movement of the driving roller, being configured to be substantially circular in its reversing sections;

a trailing-roller guide track for guiding movement of the trailing roller;

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link mechanisms, each link mechanism being configured with a plurality of links, a first link among the links being connected to a step and rotatable around a driving-roller shaft for supporting the driving roller,

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a second link among the links being connected to an adjacent step and rotatable around a driving-roller shaft of the adjacent step, remaining ends of the first link and the second link being rotatably connected together, and the link mechanism having an auxiliary roller rotatably mounted on one of the plurality of links; and

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an auxiliary-roller guide track for guiding movement of the auxiliary roller;

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characterized in that the link mechanism travels while the distance between adjacent steps is varied by the first link and the second link being folded and extended in the reversing sections.

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2. An escalator with a high-speed inclined section according to claim 1, **characterized in that** when the step passes through its forward path horizontal sections, the link mechanism moves with the first link and the second link being folded, and that when the step passes through the reversing sections, the link mechanism moves with the first link and the second link that have been folded gradually being extended.

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Fig. 1

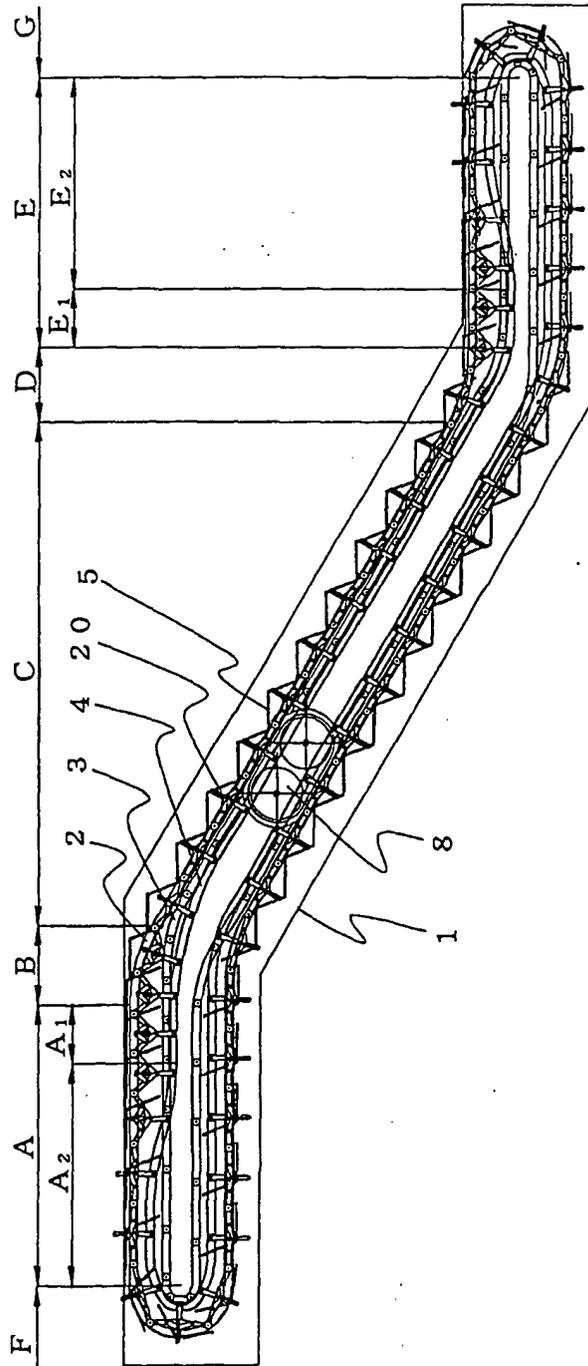


Fig. 2

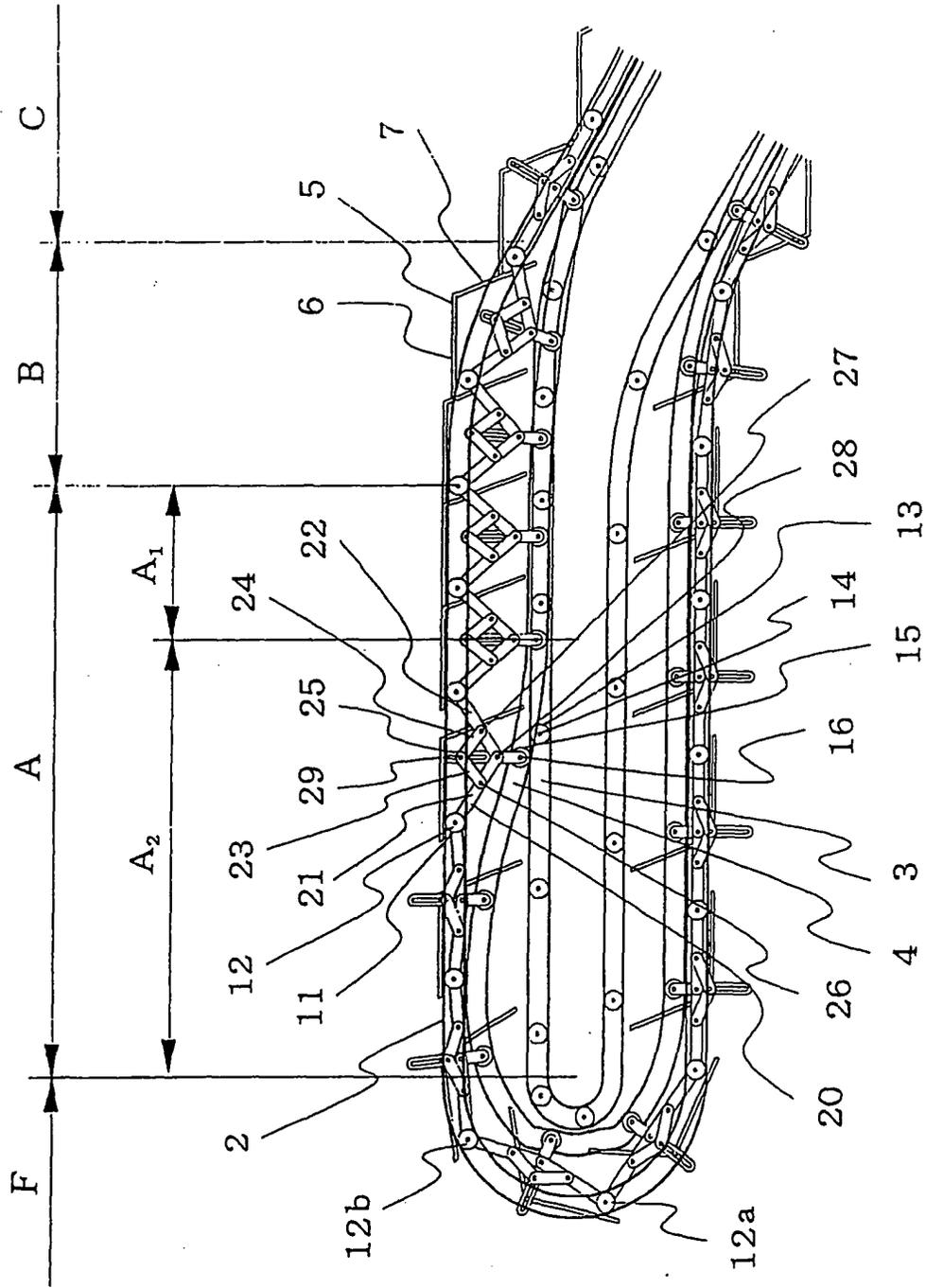


Fig. 3

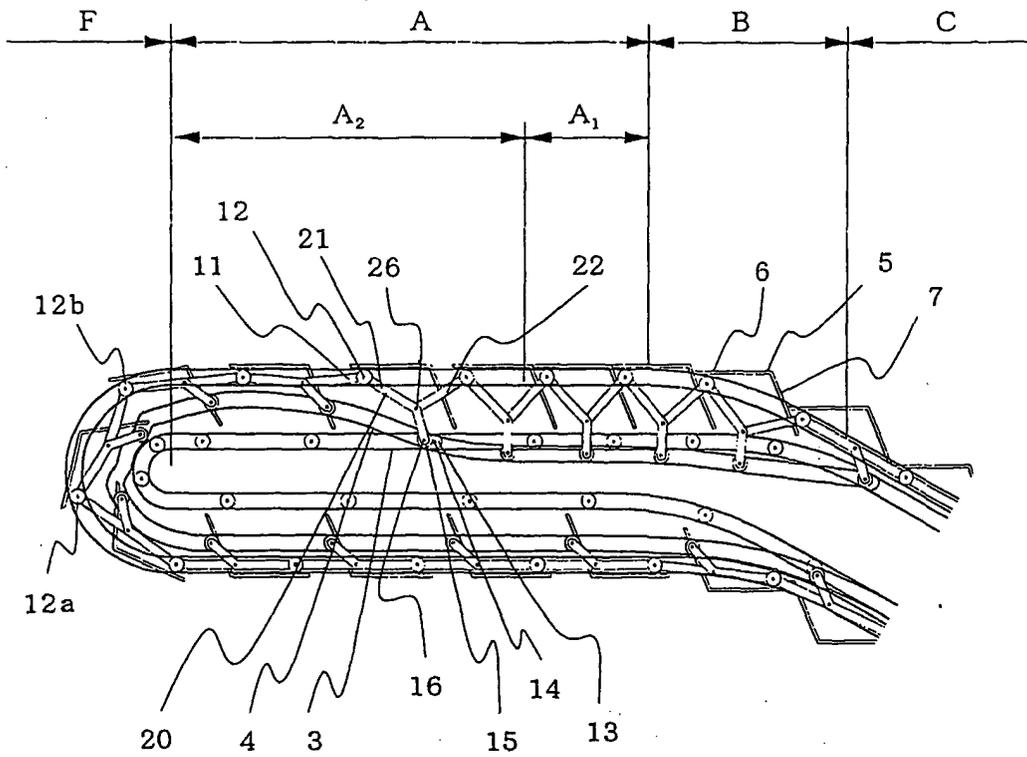
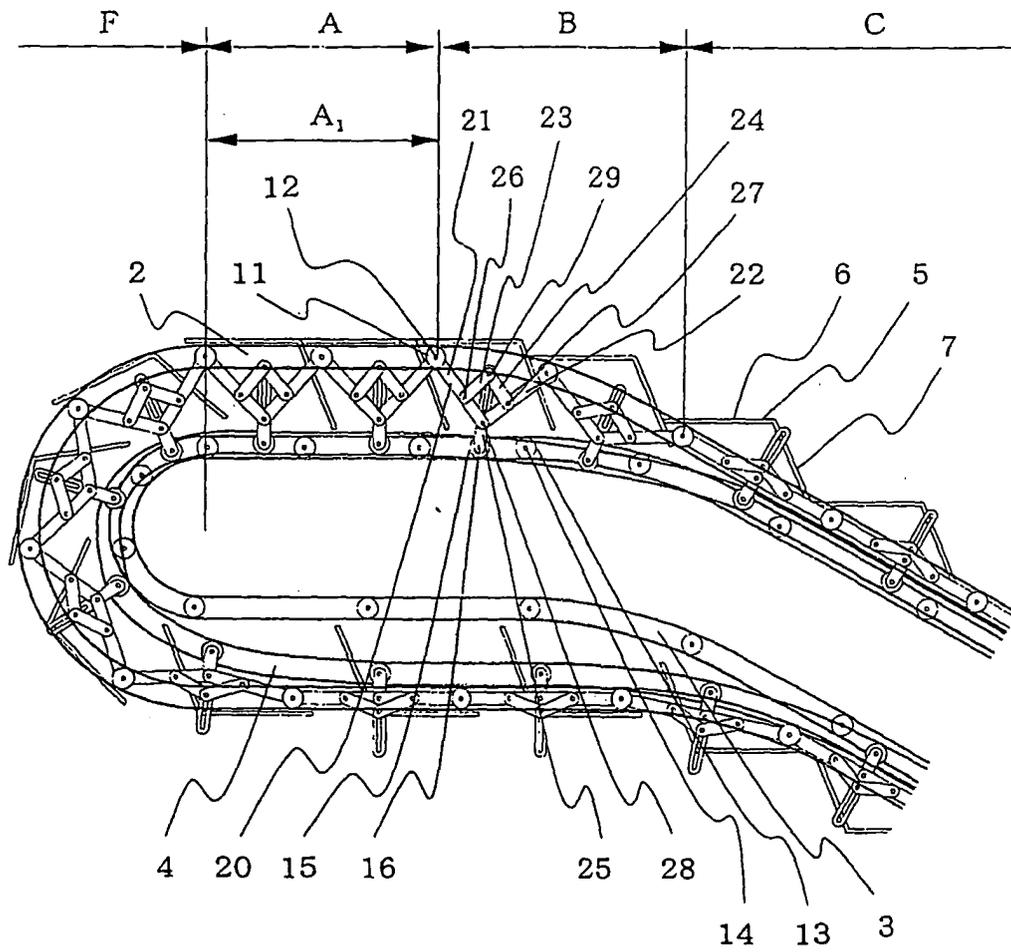


Fig. 4



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP02/12972

<p>A. CLASSIFICATION OF SUBJECT MATTER Int.Cl⁷ B66B21/02, B66B23/14</p> <p>According to International Patent Classification (IPC) or to both national classification and IPC</p>																																			
<p>B. FIELDS SEARCHED</p> <p>Minimum documentation searched (classification system followed by classification symbols) Int.Cl⁷ B66B21/00-B66B31/02</p> <p>Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched</p> <table border="0"> <tr> <td>Jitsuyo Shinan Koho</td> <td>1922-1996</td> <td>Jitsuyo Shinan Toroku Koho</td> <td>1996-2003</td> </tr> <tr> <td>Kokai Jitsuyo Shinan Koho</td> <td>1971-2003</td> <td>Toroku Jitsuyo Shinan Koho</td> <td>1994-2003</td> </tr> </table> <p>Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)</p>			Jitsuyo Shinan Koho	1922-1996	Jitsuyo Shinan Toroku Koho	1996-2003	Kokai Jitsuyo Shinan Koho	1971-2003	Toroku Jitsuyo Shinan Koho	1994-2003																									
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<p>C. DOCUMENTS CONSIDERED TO BE RELEVANT</p> <table border="1"> <thead> <tr> <th>Category*</th> <th>Citation of document, with indication, where appropriate, of the relevant passages</th> <th>Relevant to claim No.</th> </tr> </thead> <tbody> <tr> <td>E, X</td> <td>JP 2003-212464 A (Mitsubishi Electric Corp.), 30 July, 2003 (30.07.03), (Family: none)</td> <td>1-2</td> </tr> <tr> <td>E, X</td> <td>JP 2003-212463 A (Mitsubishi Electric Corp.), 30 July, 2003 (30.07.03), (Family: none)</td> <td>1-2</td> </tr> <tr> <td>A</td> <td>JP 2002-326780 A (Mitsubishi Electric Corp.), 12 November, 2002 (12.11.02), (Family: none)</td> <td>1-2</td> </tr> <tr> <td>A</td> <td>JP 51-116586 A (Hitachi, Ltd.), 14 October, 1976 (14.10.76), (Family: none)</td> <td>1-2</td> </tr> </tbody> </table> <p><input type="checkbox"/> Further documents are listed in the continuation of Box C. <input type="checkbox"/> See patent family annex.</p> <table border="0"> <tr> <td>* Special categories of cited documents:</td> <td>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</td> </tr> <tr> <td>"A" document defining the general state of the art which is not considered to be of particular relevance</td> <td>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone</td> </tr> <tr> <td>"E" earlier document but published on or after the international filing date</td> <td>"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art</td> </tr> <tr> <td>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</td> <td>"&" document member of the same patent family</td> </tr> <tr> <td>"O" document referring to an oral disclosure, use, exhibition or other means</td> <td></td> </tr> <tr> <td>"P" document published prior to the international filing date but later than the priority date claimed</td> <td></td> </tr> </table> <table border="1"> <tr> <td>Date of the actual completion of the international search 10 September, 2003 (10.09.03)</td> <td>Date of mailing of the international search report 07 October, 2003 (07.10.03)</td> </tr> <tr> <td>Name and mailing address of the ISA/ Japanese Patent Office</td> <td>Authorized officer</td> </tr> <tr> <td>Facsimile No.</td> <td>Telephone No.</td> </tr> </table>			Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.	E, X	JP 2003-212464 A (Mitsubishi Electric Corp.), 30 July, 2003 (30.07.03), (Family: none)	1-2	E, X	JP 2003-212463 A (Mitsubishi Electric Corp.), 30 July, 2003 (30.07.03), (Family: none)	1-2	A	JP 2002-326780 A (Mitsubishi Electric Corp.), 12 November, 2002 (12.11.02), (Family: none)	1-2	A	JP 51-116586 A (Hitachi, Ltd.), 14 October, 1976 (14.10.76), (Family: none)	1-2	* Special categories of cited documents:	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention	"A" document defining the general state of the art which is not considered to be of particular relevance	"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone	"E" earlier document but published on or after the international filing date	"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art	"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"&" document member of the same patent family	"O" document referring to an oral disclosure, use, exhibition or other means		"P" document published prior to the international filing date but later than the priority date claimed		Date of the actual completion of the international search 10 September, 2003 (10.09.03)	Date of mailing of the international search report 07 October, 2003 (07.10.03)	Name and mailing address of the ISA/ Japanese Patent Office	Authorized officer	Facsimile No.	Telephone No.
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