(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 1 306 342 A1

(12) **EUROPEAN PATENT APPLICATION**
published in accordance with Art. 158(3) EPC

(43) Date of publication:
02.05.2003 Bulletin 2003/18

(21) Application number: **00942362.5**

(22) Date of filing: **28.06.2000**

(51) Int Cl.[7]: **B66B 23/02**

(86) International application number:
PCT/JP00/04243

(87) International publication number:
WO 02/000542 (03.01.2002 Gazette 2002/01)

(84) Designated Contracting States:
AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU MC NL PT SE
Designated Extension States:
AL LT LV MK RO SI

(71) Applicants:
- **Hitachi, Ltd.**
  Chiyoda-ku, Tokyo 101-8010 (JP)
- **Hitachi Building Systems Co., Ltd.**
  Chiyoda-ku, Tokyo 101-0054 (JP)

(72) Inventors:
- **MATSUMOTO, Tatsuya, Elevators & Escalators**
  Hitachinaka-shi, Ibaraki 312-0033 (JP)
- **YAMAGUCHI, Yukihiro, Elevators & Escalators**
  Hitachinaka-shi, Ibaraki 312-0033 (JP)
- **SAITOH, Chuichi, Hitachi, Ltd.**
  Tokyo 101-8010 (JP)
- **OJIMA, Kazuhira, Elevators & Escalators**
  Hitachinaka-shi, Ibaraki 312-0033 (JP)
- **TERAMOTO, Takashi,**
  Mechanical Eng. Research Lab.
  Tsuchiura-shi, Ibaraki 300-0013 (JP)
- **YAMAKI, Masamitsu,**
  Hitachi Building Syst. Co., Ltd
  Tokyo 101-0054 (JP)
- **ABE, Yoshio, Elevators & Escalators**
  Hitachinaka-shi, Ibaraki 312-0033 (JP)

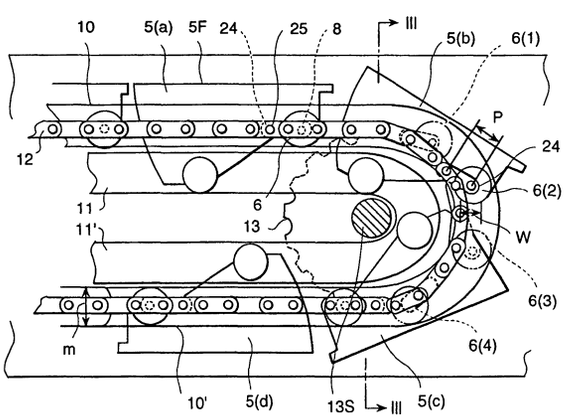
(74) Representative: **Strehl Schübel-Hopf & Partner**
Maximilianstrasse 54
80538 München (DE)

(54) PASSENGER CONVEYOR

(57) An object of the present invention is to provide a novel passenger conveyer in which the volume of the direction turning space between the forward path and the returning path of the steps is reduced, and the direction turning operation of the steps between the forward path and the returning path can be smoothly performed.

In a passenger conveyer comprising a plurality of steps 5 moved and circulated so that a tread faces upward on a forward path and faces downward on a returning path; a step chain 12 for endlessly coupling the plurality of steps 5; and a step chain driving sprocket 13 and a step chain driven sprocket 14 for moving and circulating the step chain by wrapping the step chain 12 on the sprockets at direction turning portions between the forward path and the returning path, wherein the step 5 is coupled to the step chain 12 through a crank mechanism (8, 24, 25).

FIG. 2



EP 1 306 342 A1

Description

BACKGROUND OF THE INVENTION

[0001] The present invention relates to a passenger conveyer such as an escalator, a moving sidewalk and, more particularly, to a passenger conveyer in which the steps or the step treads are moved and circulated by being turned by 180 degrees at a direction turning portion between the forward path and the returning path so that the tread faces upward on the forward path and downward on the returning path.

[0002] In a conventional escalator, a kind of passenger conveyer, the step treads are moved and circulated with the tread facing upward on the forward path side, and turned by 180 degrees at the direction turning portion so that the tread faces downward on the returning path side, as disclosed, for example, in Japanese Patent Application Laid-Open No.1-55195.

[0003] In the escalator having the above construction, a space for turning the direction of the step is not considered, and accordingly the space for turning the direction of the step is unnecessarily larger. Therefore, the space for turning the direction of the step has affected on the portion around the installation place of the escalator.

SUMMARY OF THE INVENTION

[0004] An object of the present invention is to provide a novel passenger conveyer of which the installation space is small.

[0005] Another object of the present invention is to provide a novel passenger conveyer which can reduce the volume of the direction turning space between the forward path and the returning path of the steps.

[0006] A further object of the present invention is to provide a novel passenger conveyer which can smoothly perform the direction turning operation of the steps between the forward path and the returning path when the volume of the direction turning space between the forward path and the returning path of the steps is reduced.

[0007] In order to attain the above objects, in the present invention, a plurality of steps are moved and circulated so that a tread faces upward on a forward path and faces downward on a returning path, and the step is coupled to step a chain through a crank mechanism which swings at a direction turning portion between the forward path and the returning path.

[0008] By the construction described above, the step under turning direction at the direction turning portion between the forward path and the returning path can be turned by 180 degrees by being displaced toward the outer side of the moving direction of the step chain with respect to the moving path of the step chain. Therefore, even if diameters of the step chain driving sprocket and the step chain driven sprocket to be wrapped with the step chain are made small, the gap between the steps adjacent to each other during turning direction can be secured. As the result, interference between the steps adjacent to each other during turning direction can be prevented. Therefore, the smoothness of the direction turning operation of the step can not be deteriorated, the turning radius of the step can be minimized to reduce the volume of the direction turning space, and the installation space of the passenger conveyer can be reduced.

BRIEF DESCRIPTION OF DRAWINGS

[0009]

FIG. 1 is a plan view showing the main portion of steps of escalator of an embodiment of an escalator in accordance with the present invention.

FIG. 2 is a schematic side view showing a step direction turning portion of the escalator of FIG. 2.

FIG. 3 is an enlarged sectional view showing a portion around the step direction turning portion being taken on the plane of the line III - III of FIG. 2.

FIG. 4 is a schematic side view showing the whole escalator having the step direction turning mechanism of FIG. 2.

FIG. 5 is an enlarged side view showing the escalator being taken on the plane of the line V - V of FIG. 4.

FIG. 6 is a plan view showing another embodiment of a coupling portion of the coupling link of FIG. 1.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0010] An embodiment of a passenger conveyer in accordance with the present invention will be described below, referring to an escalator shown FIG. 1 to FIG. 5.

[0011] The escalator 1 of the present invention is constructed as follows. That is, as shown in FIG. 4, a main frame 4 is installed between an upper floor 2 and a lower floor 3 vertically apart from each other, and in the main frame 4 a plurality of steps 5 moving along the longitudinal direction of the main frame are guided. Front wheels 6 are supported in the both sides in the width direction of the upper step side of the step 5, and rear wheels 7 are supported in the both sides in the width direction of the lower step side with a spacing between the rear wheels narrower than the spacing between the front wheels 6. As shown in FIG. 1, the front wheel 6 and the rear wheel 7 are rotatably supported to the step 5 through wheel shafts 8 and 9 projecting in the width direction of the step, respectively.

[0012] The front wheel 6 and the rear wheel 7 supported as described above rotate and move on a pair of right and left front wheel guide rails 10, 10' and on a pair of right and left rear wheel guide rails 11, 11' installed in the main frame 4, respectively. By rotation and motion of the front wheel 6 and the rear wheel 7. The steps 5

are circulated and moved the forward path and the returning path between an upper machine room UM and a lower machine room LM arranged in the both ends in the longitudinal direction of the main frame 4.

[0013] In order to circulate and move the plurality of steps 5, each of the steps is coupled to endless step chains 12. The pair of step chains 12 are arranged in the both sides in the width direction of the step 5, and each of the step chains is wrapped over a step chain driving sprocket 13 supported to the upper machine room UM and a step chain driven sprocket 14 supported to the lower machine room LM.

[0014] As shown in FIG. 3, the pair of step chain driving sprockets 13 are attached to a rotary shaft 13S, and the rotary shaft 13S is supported by a right and a left side frame bodies 4A and 4B composing the main frame 4. A power transmitting sprocket 26 is coaxial with the pair of step chain driving sprockets 13, and arranged in the side opposite to the step. Power of a motor 17 is transmitted to the power transmitting sprocket 26 through a power chain 15 and a reduction gear 16.

[0015] On the other hand, a pair of balustrade panels 18 composing balustrades are supported by the right and the left side frame bodies 4A, 4B to stand in the both sides of the steps 5 endlessly coupled by the step chains 12, and a handrail 19 is guided along the periphery of the balustrade panel 18. The handrail 19 is driven in synchronism with the steps by obtaining power from the power transmitting sprocket 26.

[0016] A base portion of the balustrade panel 18 is covered with an inner deck 20 and an outer deck 21, and further the both sides in the width direction of the step 5 and the balustrade are partitioned with a skirt guard 22 arranged vertically. Further, the out side of the main frame 4 is covered with an outer panel 23 composed of ornamental boards.

[0017] The most important structure among the structures described above is the front wheel 6 and the step chain 12 and the coupling mechanism. In the present embodiment, as shown in FIG. 1 to FIG. 3, the front wheel 6 is supported to the wheel shaft 8 of step shaft projecting in the width direction of the step 5, and is coupled to the step chain 12 at a position outside of the front wheel 6 of the wheel shaft 8.

[0018] The coupling structure between the wheel shaft 8 and the step chain 12 will be described in detail. That is, one end of the coupling link 24 is coupled to the shaft end portion of the wheel shaft 8 supporting the front wheel 6 so as to be rotatable around the shaft, and the other end of the coupling link 24 is extended toward the side of the rear wheel 7, and the other end of the coupling link 24 is coupled to the step chain 12 corresponding to the extended end through the link shaft 25 so as to be rotatable. The link shaft 25 is arranged in parallel to the wheel shaft 8, and each of the shafts 8, 25 coupling the coupling link 24 is arranged intersecting at right angle with the step chain 12. By such a construction, the step 5 and the step chain 12 are coupled with each other through a crank mechanism having the wheel shaft 8, the coupling link 24 and the link shaft 25, that is, a link mechanism having the shaft intersecting at right angle with the step chain 12 and the coupling link 24 coupled to the shaft. Therein, instead of using the wheel shaft 8 as the step shaft, a shaft dedicated to coupling may be provided in the step 5.

[0019] A normal chain link 12A and a specific chain link 12B are connected to the step chain 12, and the link shaft 25 is attached to the specific chain link 25B, and the other end of the coupling link 24 is coupled to the link shaft 25. Here, it is assumed that the normal chain link 12A and the specific chain link 12B are equal to each other in shape in order to make the chain pitch equal to each other. Therefore, if the chain pitch is equal to each other, it is not necessary that the normal chain link 12A and the specific chain link 12B always have the same shape. Further, instead of using the specific chain link 12B, it may be possible that the other end of the coupling link 24 is couple to a link pin 12P coupling between the normal links 12A adjacent to each other.

[0020] In the structure described above, when the step 5 approaches to the step chain driving sprocket 13 (FIG. 2), the front wheel 6 is rotated and moved by guided in a hemispherical double rail portion (having an opening width m which is slightly larger than the diameter of the front wheel 6) of the guiding rail 10 arranged in the direction turning portion. Therein, the hemispherical guiding rail 10 for guiding the front wheel is arranged in order that the wheel shaft 8 side of the coupling link 24 is swung with respect to the step chain 12 so as to be moved slightly projecting toward the outer side of the moving direction of the step chain 12 with respect to the moving path of the step chain 12 which is moved along the outer periphery of the step chain driving sprocket 13. In addition, the hemispherical guiding rail 10 is formed so that displacement of the center of the front wheel 6 with respect to the moving path of the step chain 12 at the endmost position of the direction turning portion becomes the maximum center displacement W. The gap between the steps 5 adjacent to each other is increased by the eccentricity of the guiding rail 10 increasing to the maximum center displacement W, and accordingly interference (collision) between the steps 5 adjacent to each other at turning direction can be prevented.

[0021] Therein, when the length of the shaft supporting pitch P of the coupling link 24 is shorter than the maximum center displacement W, it is impossible that the front wheel 6 is moved projecting toward the outer side of the moving direction of the step chain 12 with respect to the moving path of the step chain 12. Further, when the length of the shaft supporting pitch P of the coupling link 24 is equal to the maximum center displacement W, the coupling link 24 becomes horizontal at the maximum center displacement W portion. Therefore, the moving force of the step chain 12 can not be transmitted to the step 5 at a position near the maximum center displacement W portion. Accordingly, the smooth

direction turning operation of the step 5 is deteriorated by that the front wheel 6 falls down inside the hemispherical guide rail 10 due to the deadweight of the step to narrowing the gap to the preceding step 5 or by that the front wheel 6 is stopped to be moved there to narrowing gap to the following step 5. Therefore, it is necessary that the length of the shaft supporting pitch P of the coupling link 24 is longer than the maximum center displacement W.

[0022] By making the length of the shaft supporting pitch P of the coupling link 24 longer than the maximum center displacement W, as described above, the front wheel 6 moving on the path projecting toward the outer side with respect to the moving path of the step chain can be smoothly moved in the direction turning portion and accordingly the trouble described above can be avoided. When the front wheel 6 reaches the horizontal portion of the guide rail 10' in the returning path side, the coupling link 24 is returned to the original state parallel to the step chain 12.

[0023] At that time the rear wheel 7 is guided by the guide rail 11' having a path different from the guide rail 10'.

[0024] Moving state of the step 5 inside the upper machine room from the forward path to the returning path will be described below in detail, referring to FIG. 2. As shown in FIG. 2, the step 5 (a) moving on the guide rails 10, 11 from left-hand side to right-hand side is in the state that the coupling link 24 coupled to the wheel shaft 8 of the front wheel 6 is parallel to the step chain 12 and the link shaft 25 of coupling portion to the step chain 12 of the coupling link 24 is at a backside position with respect to the moving direction of the step 5.

[0025] When the step 5 (a) in this state reaches the outer periphery of the step chain drive sprocket 13 as the step chain 12 is moved, the front wheel 6 is initially guided along the hemispherical portion of the guide rail 10 and then the rear wheel 7 is guided along the hemispherical portion of the guide rail 11. The step 5 (b) guided as described above begins to be tilted by the outer periphery of the step chain drive sprocket 13 while the end portion of the step in the moving direction is directed downward.

[0026] At that time, because the radius of rotation and the center of rotation of the guide rails 10 and 11 are different from the radius of rotation and the center of rotation of the step chain driving sprocket 13 by the dimension of the depth of the step 5 (b), that is, because the moving path of the front wheel 6 is positioned toward outer side of the moving direction with respect to the moving path of the step chain 12, the coupling link 24 is swung to be displaced by the difference in the different dimension (the shifted dimension of the center). Since the gap between the steps adjacent to each other 5 (b) - 5 (a) and between 5 (b) - 5 (c) at turning direction, interference between the steps adjacent to each other can be eliminated and accordingly the direction turning operation of the step can be smoothly performed.

[0027] The inclination of the tread is further increased as the step 5 is moved from 5 (b) to 5 (c), and the tread faces downward when the step exceeds the midpoint of the direction turning portion. As the inclination of the step is changed, the front wheel 6 is moved on and departed from the outer periphery of the step chain driving sprocket 13, as shown by 6 (1), 6 (2). Then, the front wheel 6 is moved on and approaches to the outer periphery of the step chain driving sprocket 13, as shown by 6 (3), 6 (4). When the step 5 (d) is guided by the guide rails 10', 11' in the returning path, the tread completely faces downward, and the coupling link 24 becomes horizontal and parallel to the step chain 12.

[0028] As described above, by placing the moving path of the front wheel 6 in the direction turning portion toward the outer side of the moving direction of the step chain 12, interference between the steps adjacent to each other in the direction turning portion can be eliminated and accordingly direction turning of the step can be smoothly performed even if diameter of the step chain driving sprocket 13 is made small. Therefore, the direction turning space of the step 5 can be minimized and the height H of the upper machine room UM can be decreased.

[0029] The above description has been made on the direction turning operation of the step in the upper machine room UM. In the lower machine room LM, the tread 5F facing downward in the returning path is changed to face upward as the step 5 approaches to the forward path. The direction turning operation is performed using the step chain driven sprocket 14. The mechanism and the operation are similar to the mechanism and the operation in the upper machine room UM. That is, the direction turning operation of the step 5 from the returning path to the forward path in the lower machine room LM is performed by a construction similar to a construction when the construction of FIG. 2 is upside down by rotating the figure by 1890 degrees. Therefore, the explanation is omitted here.

[0030] In order to realize further stable motion of the step driving system, whether or not a dedicated guide rail is arranged in the step chain 12, particularly whether or not there is provided a dedicated rail which is rotatable with respect to the step chain 12 and to which the front wheel 6 and the coupling link 24 correctly follow may be determined depending on the necessity.

[0031] The embodiment described above has been made by taking an example of the escalator 1, the present invention can be applied to a moving sidewalk for horizontally moving or for slightly inclining moving. In that case, the step may be read for the step tread, and the step chain may be read for the step tread chain.

[0032] On the other hand, in the escalator having the construction described above, the front wheel 6 is restricted motion in the lateral direction (snaking) by being guided by the front wheel guide rail 10, 10' during moving the step 5 so as to prevent the step 5 from coming in contact with the machine of the escalator such as skirt

guard 22 (FIG. 3).

[0033] However, if the installation accuracy of the front wheel guide rail 10, 10' is low, the front wheel 6 snakes in the lateral direction during moving of the step 5 to produce a force in a direction to change the distance between the step chain 12 and the step 5 and accordingly to produce a moment load in the both end portions of the coupling link 24 as the coupling portion between the step 5 and the step chain 12. If the moment load is repetitively produced in the both end portions of the coupling link 24, the both end portions will be broken.

[0034] Therefore, in another embodiment of the present invention, as shown in FIG. 6,bearings 30A, 30B is arranged between the coupling link 24 and the wheel shaft 8 and between the coupling link 24 and the link shaft 25 so that both of the bearing 30A, 30B are movable in the shaft direction. That is, in regard to the coupling between the step chain 12 and the link shaft 25, an inner wheel 32 of the bearing 30B is inserted over the link shaft 25 arranged in the specific link 12B of the step chain 12 through a collar 31, an outer wheel 34 is inserted over the outer periphery of the inner wheel 32 through a plurality of rollers 33, further a housing 35 of the coupling link 24 is arranged in the periphery of the outer wheel 34, the outer wheel 34 is fixed to the housing 35 using a ring 36, and a bearing nut 37 is arranged in the link shaft 25.

Similarly, in regard to the coupling between the wheel shaft 8 of the front wheel 6 and the coupling link 24, an inner wheel 42 of the bearing 30A is inserted over the wheel shaft 8 through a collar 41, an outer wheel 42 is inserted over the outer periphery of the inner wheel 42 through a plurality of rollers 43, a housing 45 of the coupling link 24 is arranged in the outer periphery of an outer wheel 44, the housing 45 is fixed to the outer wheel 44 using a ring 46, and a bearing nut 47 is arranged in the top end of the wheel shaft 8.

[0035] As described above, by coupling the coupling link 24 between the wheel shaft 8 and the step chain 12 through the roller bearings, the outer wheels 34, 44 can slide and move the inner wheels 32, 42 in the shaft direction through the rollers 33, 43, and the outer wheels 34, 44 can be moved until the outer wheels 34, 44 come in contact with the collars 31, 41 or with the bearing nuts 36, 46.

[0036] Therefore, even if the front wheel 6 snakes in the lateral direction during moving of the step to produce a force in a direction to change the distance between the step chain 12 and the step 5 due to the low installation accuracy of the front wheel guide rail 10, 10', the moment load produced in the bearings 30A, 30B portions as the coupling portions of the coupling link 24 can be suppressed low and shortening of the lifetime of the coupling portion can be suppressed.

[0037] In the embodiment described above, both of the bearings provided in the both of the end portions of the coupling link 24 are the roller bearings. However, even in a case where a ball bearing is used for one of the bearings and a roller bearing is used for the other of the bearings so as to be displaceable only one side, the moment load produced can be suppressed low.

Claims

1. A passenger conveyer comprising a plurality of steps moved and circulated so that a tread faces upward on a forward path and faces downward on a returning path; a step chain for endlessly coupling the plurality of steps; and a step chain driving sprocket and a step chain driven sprocket for moving and circulating the step chain by wrapping the step chain on the sprockets at direction turning portions between the forward path and the returning path, wherein

   said step is coupled to said step chain through a crank mechanism.

2. A passenger conveyer according to claim 1, wherein said crank mechanism comprises a step shaft projecting in a width direction from said step; a link shaft projecting in the side of said step from said step chain, said link shaft being parallel to said step shaft; and a coupling link for coupling between said link shaft and said step shaft.

3. A passenger conveyer comprising a plurality of steps moved and circulated so that a tread faces upward on a forward path and faces downward on a returning path; a step chain for endlessly coupling the plurality of steps; and a step chain driving sprocket and a step chain driven sprocket for moving and circulating the step chain by wrapping the step chain on the sprockets at direction turning portions between the forward path and the returning path, wherein

   said step is coupled to said step chain through a coupling link, said coupling link being coupled to a shaft intersecting at right angle with said step chain to swing at said direction turning portion.

4. A passenger conveyer according to claim 3, wherein said step comprises a pair of front wheels and a pair of rear wheels, and one side portion of said coupling link is coupled to a wheel shaft supporting said front wheels.

5. A passenger conveyer according to claim 4, wherein said step chains are a pair of step chains coupling both sides of said step in a width direction, and said pair of step chains are arranged at positions in the sides opposite to the step from said front wheels and said rear wheels.

6. A passenger conveyer comprising a main frame installed between floors vertically apart from each

other; a plurality of steps being moved and circulated so that a tread faces upward on a forward path in said main frame and faces downward on the returning path; a pair of step chains for endlessly coupling said plurality of steps; front wheels and rear wheels supported each of said plurality of steps by shafts, said front wheels and said rear wheels running on guide rails installed in said forward path and said returning path; and step chain driving sprockets and step chain driven sprockets for moving and circulating said pair of step chains by wrapping said step chains on the sprockets at direction turning portions between the forward path and the returning path, wherein

means is arranged and coupled between said step chain and said step, said means displacing a moving path of said front wheel of the step moving in said direction turning portion toward an outer side of a moving direction of said step chain with respect to a moving path of said step chain.

7. A passenger conveyer comprising a main frame installed between floors vertically apart from each other; a plurality of steps being moved and circulated so that a tread faces upward on a forward path in said main frame and faces downward on the returning path; a pair of step chains for endlessly coupling said plurality of steps; front wheels and rear wheels supported each of said plurality of steps by shafts, said front wheels and said rear wheels running on guide rails installed in said forward path and said returning path; and step chain driving sprockets and step chain driven sprockets for moving and circulating said pair of step chains by wrapping said step chains on the sprockets at direction turning portions between the forward path and the returning path, wherein

a wheel shaft supporting said front wheels and said tread chain are coupled with each other through a coupling link, and a guide rail for guiding said front wheel in said direction turning portion is installed at a position in an outer side of a moving direction of said step chain with respect to a moving path of said step chain.

8. A passenger conveyer comprising a plurality of steps moved and circulated so that a tread faces upward on a forward path and faces downward on a returning path; a step chain for endlessly coupling the plurality of steps; and a step chain driving sprocket and a step chain driven sprocket for moving and circulating the step chain by wrapping the step chain on the sprockets at direction turning portions between the forward path and the returning path, wherein

a wheel shaft supporting a guide wheel of said step and said step chain are coupled with each other through a coupling link, and a coupling portion of said coupling link is movable in the shaft direction.

9. A passenger conveyer according to claim 8, wherein said coupling portion of said coupling link has a bearing capable of displacing in the shaft direction.

FIG. 1

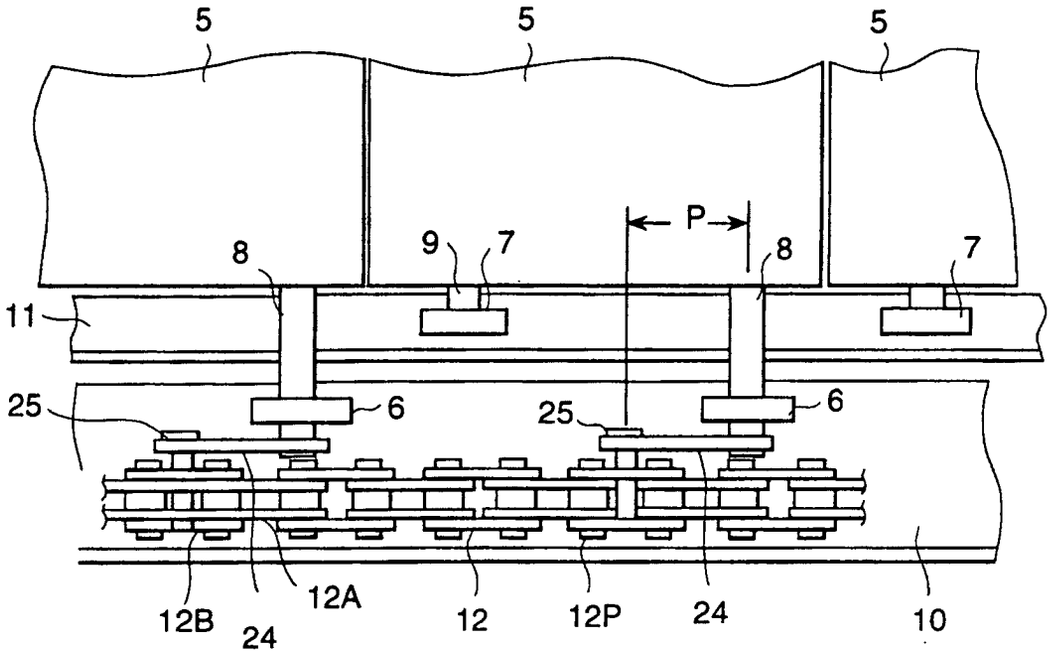

5
5
5
P
8
9
7
8
7
11
25
6
25
6
12B
24
12A
12
12P
24
10

FIG. 2

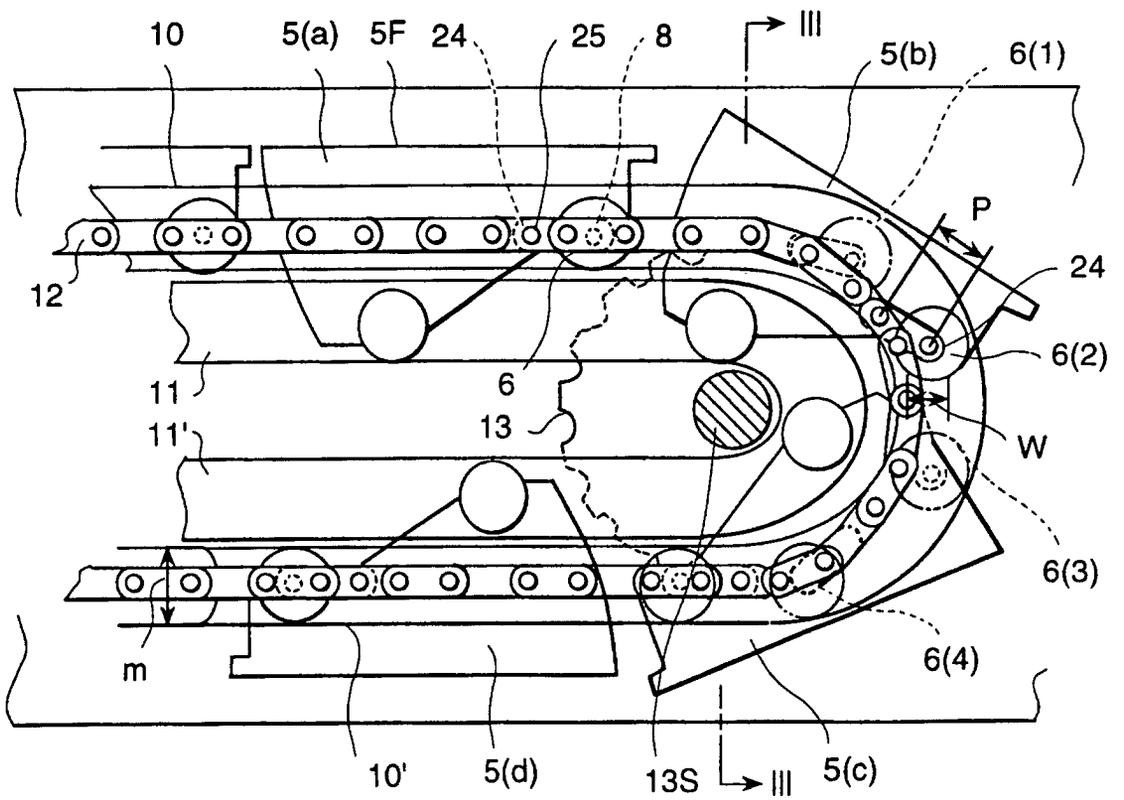

10
5(a)
5F
24
25
8
III
5(b)
6(1)
P
24
6(2)
W
6(3)
6(4)
12
11
11'
6
13
m
10'
5(d)
13S
III
5(c)

FIG. 3

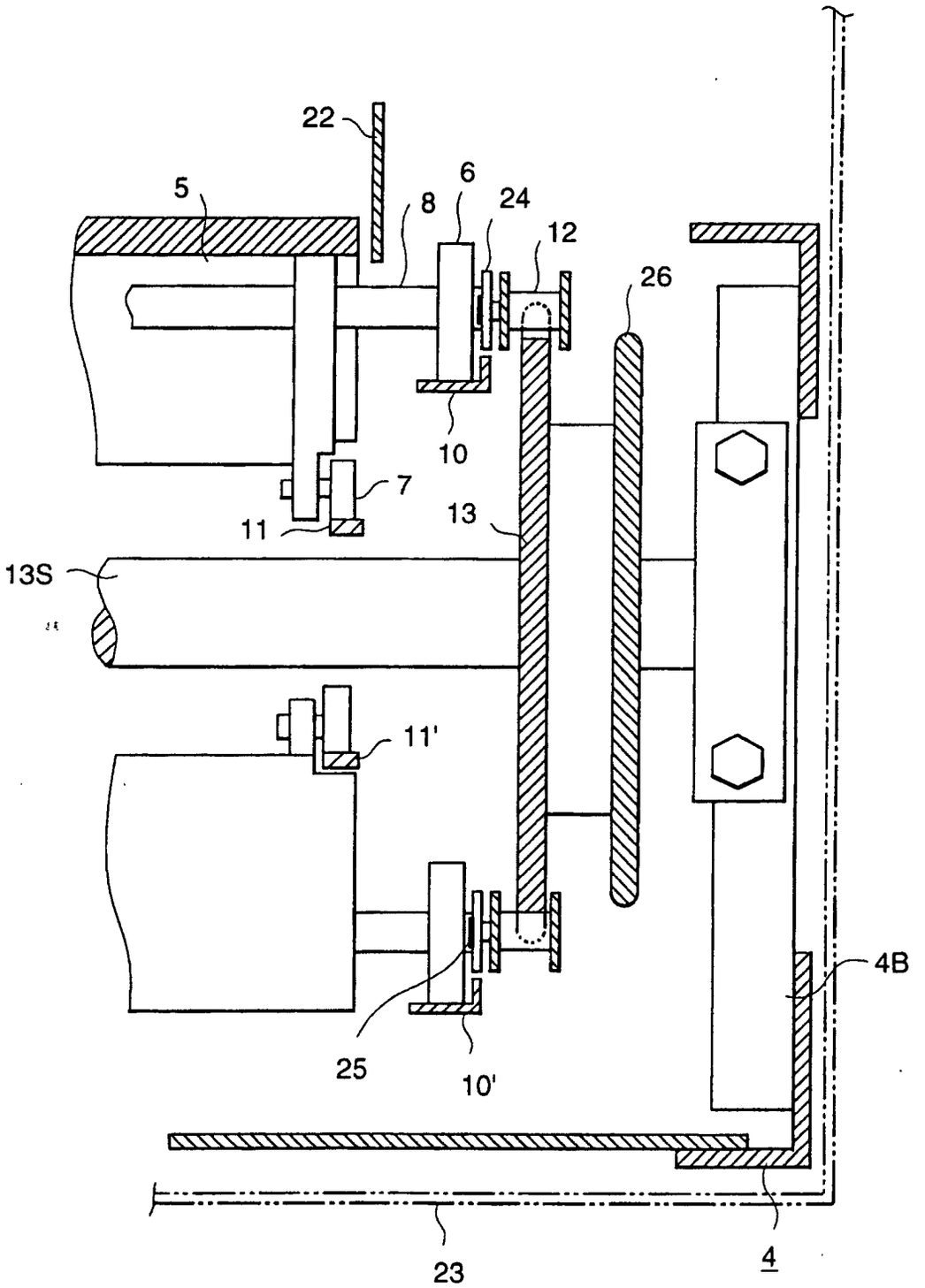


FIG. 4

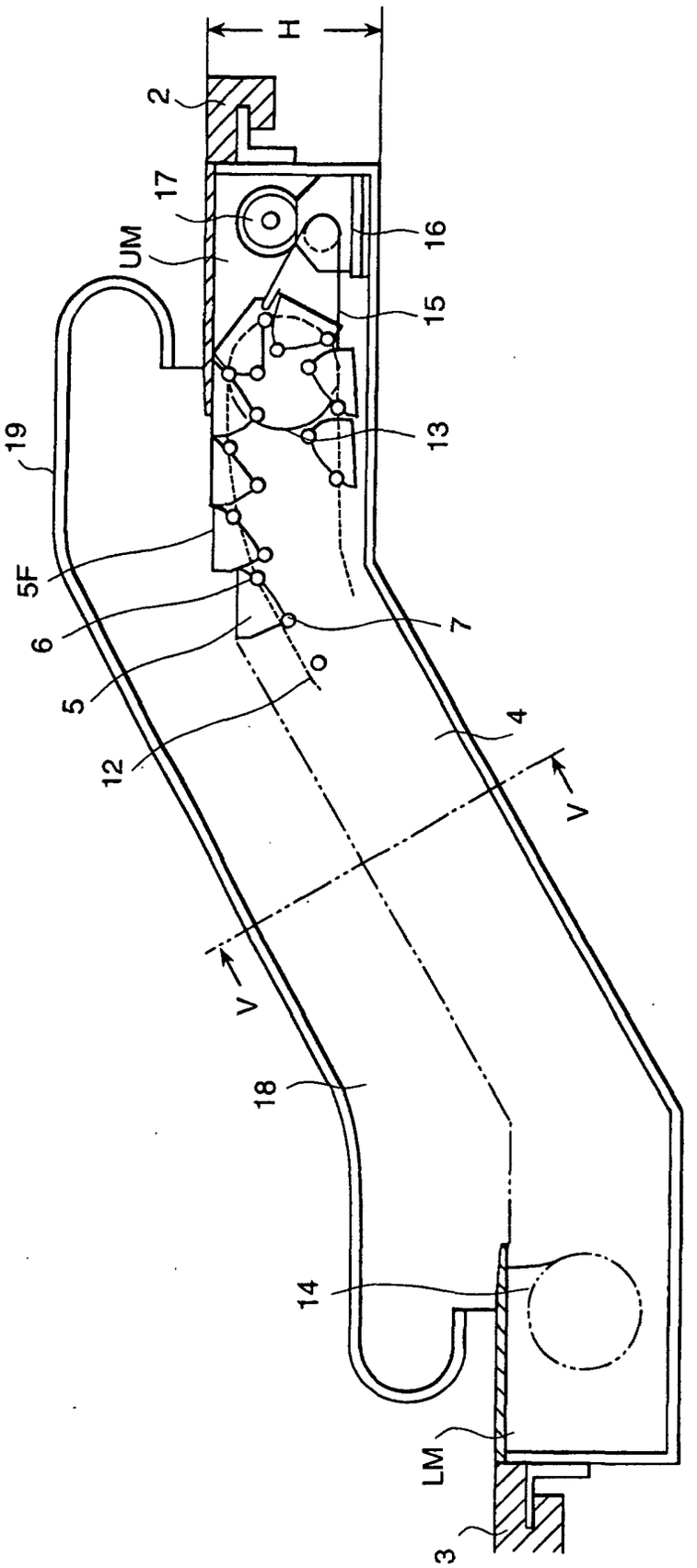


FIG. 5

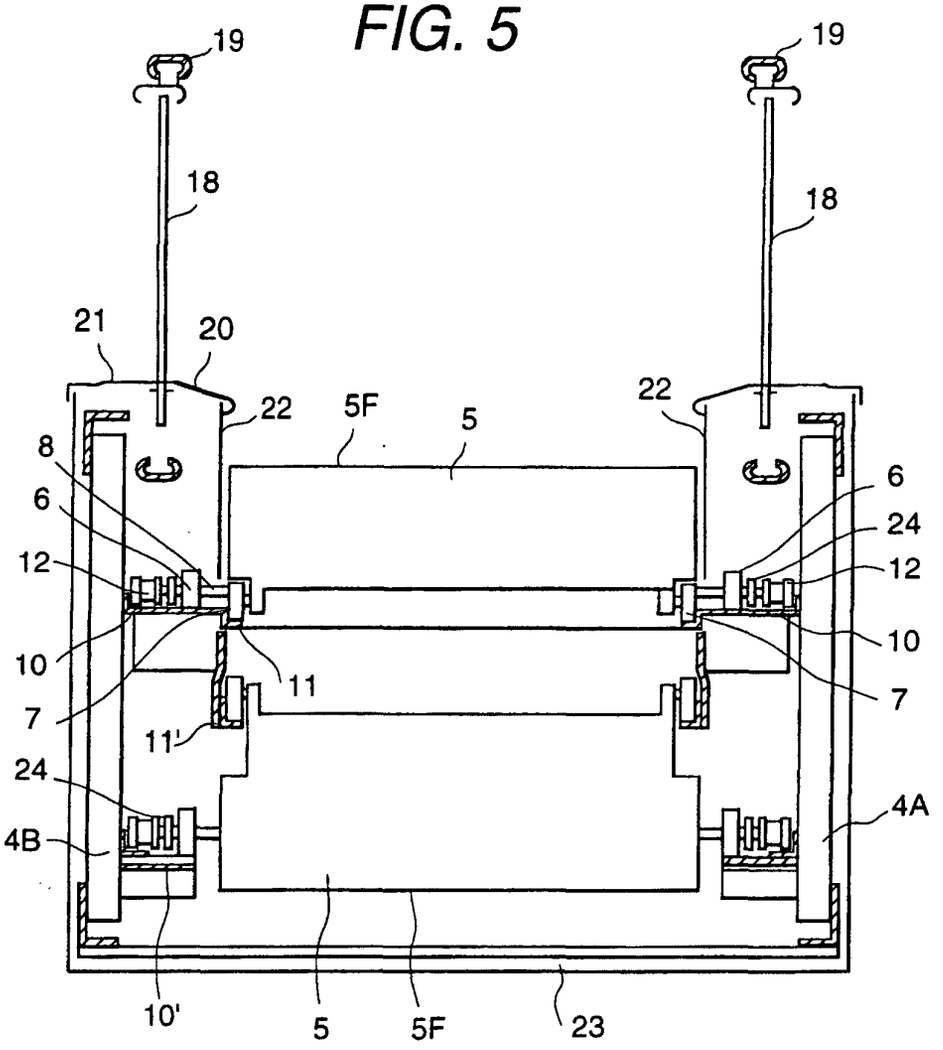
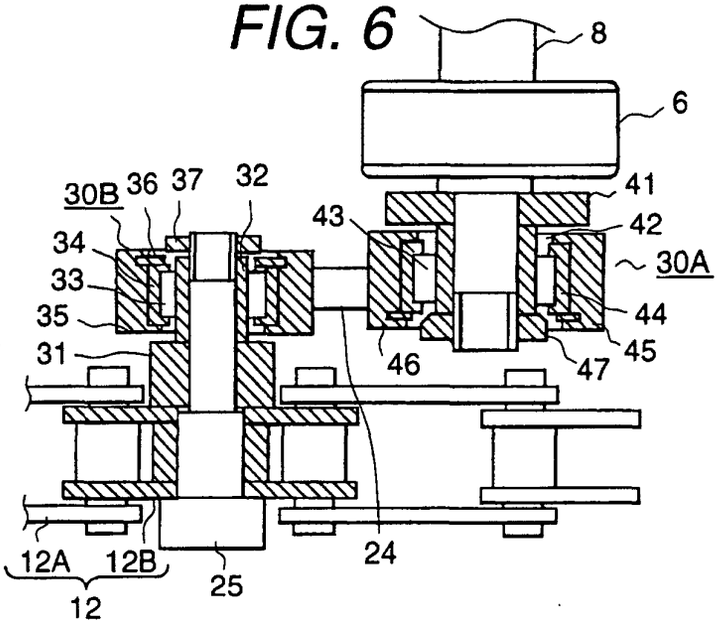

19
19
18
18
21
20
22
5F
5
22
8
6
6
24
12
12
10
10
11
7
11'
7
24
4A
4B
10'
5
5F
23

FIG. 6


8
6
41
30B
36
37
32
43
42
34
30A
33
35
44
31
46
47
45
24
12A
12B
25
12

INTERNATINAL SEARCH REPORT

INTERNATINAL APPLICATION No.
PCT/JP00/04243

A. CLASSIFICATION OF SUBJECT MATTER
Int.Cl[7] B66B 23/02

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
Int.Cl[7] B66B 21/00-B66B 31/02

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Jitsuyo Shinan Koho 1926-1996 Jitsuyo Shinan Toroku Koho 1996-2001
Kokai Jitsuyo Shinan Koho 1971-2001 Toroku Jitsuyo Shinan Koho 1994-2001

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X A	JP, 2552745, B2 (Mitsubishi Electric Corporation), 13 November, 1996 (13.11.96), & DE, 4101145, A1 & JP, 4-72289, A & KR, 9405950, A & US, 5184710, A	1-5,7-9 6
X A	JP, 52-11833, B2 (Yahei KIDA), 02 April, 1997 (02.04.97), & JP, 49-56382, A	7 6
A	JP, 11-222370, A (Nippon Filester Co., Ltd.), 17 August, 1999 (17.08.99), & AU, 8033298, A & EP, 0990616, A1 & WO, 98/57880, A1	6
A	JP, 58-207207, A (Hitachi, Ltd.), 02 December, 1983 (02.12.83), (Family: none)	6

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier document but published on or after the international filing date
"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)
"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
"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
"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
"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
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
13 December, 2000 (13.12.00)	26 December, 2000 (26.12.00)
Name and mailing address of the ISA/ Japanese Patent Office Facsimile No.	Authorized officer Telephone No.

Form PCT/ISA/210 (second sheet) (July 1992)