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

(11) EP 1 382 558 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
21.01.2004 Bulletin 2004/04

(51) Int Cl.[7]: **B66B 9/08**

(21) Application number: **03102147.0**

(22) Date of filing: **14.07.2003**

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

(30) Priority: **18.07.2002 NL 1021099**

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(54) Linear motor driven stairlift

(57) A lift assembly for conveying persons along a staircase, comprising guide means which are mounted substantially parallel to the slope of the staircase, and a lift which is movable along said guide means, for example a lift for a handicapped person, said stair lift and said guide means being provided with mating interacting drive means, wherein the driving means comprise a linear induction motor, which induction motor comprises actively connected electromagnets and at least one reactive element.

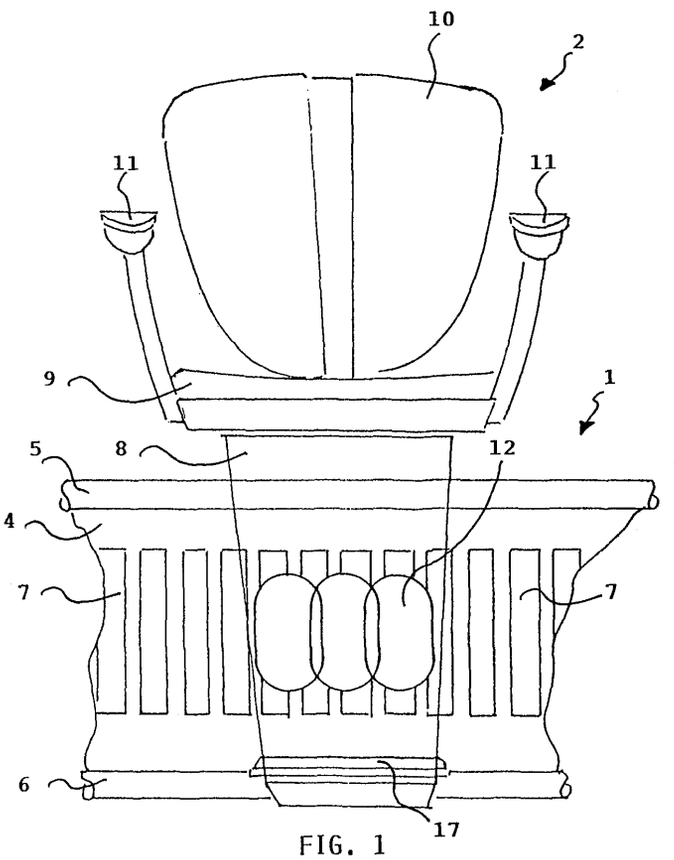

FIG. 1

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Description

[0001] A lift assembly for conveying persons along a staircase, comprising guide means which are mounted substantially parallel to the slope of the staircase, and a lift which is movable along said guide means, for example a lift for a handicapped person, said stair lift and said guide means being provided with mating interacting drive means.

[0002] Such a lift assembly is generally known. Lifts of this type may be used for conveying a handicapped person who is unable to use the stairs to a higher or lower level along said stairs. The guide means are mounted along the staircase in such a manner that a lift positioned some distance above the stairs can move along said guide means. The guide means along which the lift moves may be fixed to a wall along the staircase, for example, but it may also be mounted on supports that are fixed to the steps on one side of the staircase. The lift may be in the form of a chair on which a person can be seated, but it may also consist of a platform onto which a wheelchair can be driven. Also other lift forms are possible.

[0003] The usual manner for driving the known stair lift is by means of a rack mounted along the length of the guide means, along which rack the lift is moved up and down by means of a motor driving a gear wheel. One problem that occurs in particular in the case of stair lifts is the fact that the positioning of the gear rack must take place with great precision upon installation of the stair lift, so as to achieve a correct engagement of the gear, which may be problematic especially in the case of erratically shaped staircases. Said positioning involves quite a few working hours, which is very important factor in the cost price of the stair lift. Another drawback of this method of driving the lift is the fact that the stair lift produces a great deal of noise during operation, which, especially when used in houses, may constitute a problem for the occupants and their neighbours. Furthermore, the moving parts of the driving gear are liable to wear, which may lead to failure, considering the aforesaid precise tolerance between the gear and the rack. Furthermore, only a limited maximum speed can be achieved when using such a driving arrangement.

[0004] The object of the invention is to provide a lift assembly which is simpler to install in less time. An additional objective is to provide a stair lift assembly which, in use, produces less noise than existing installations, which is less liable to wear and/or by means of which higher velocities of movement can be achieved, if desired.

[0005] In order to accomplish that objective, the drive means comprise a linear induction motor, which induction motor comprises actively connected electromagnets and at least one reactive element. The principle of a linear induction motor, which is generally used with modern light rails and highspeed trains, is considered to be known, it is generally described in International patent publication WO 96/14685. As a result of the use of a linear induction motor, there is no longer any mechanical contact between a motor on the lift and the guide means, and the aforesaid tolerance plays a much smaller part than in the case of a rack and pinion driving arrangement.

[0006] In a first preferred embodiment, the lift is provided with the electromagnets, and the guide means are provided with the reactive element, which extends substantially along the length of the guide means. In a second preferred embodiment, the guide means are provided with the electromagnets substantially along their entire length, and the lift is provided with the reactive element.

[0007] In a first preferred variant, the reactive element comprises a multitude of separate electrically conductive non-ferrous parts, which are arranged a fixed distance apart along the reactive element. In a second preferred variant, the reactive element essentially consists of an electrically conductive non-ferrous part extending continuously along the guide means. The above two variants are variants of linear induction motors that are known per se.

[0008] Preferably, the guide means comprise two reactive elements, which are essentially arranged one above the other, with the lift being provided with two groups of electromagnets that interact therewith. Furthermore preferably, the lift comprises two groups of electromagnets which are disposed on two sides of the reactive element. In this manner a stable and uniform transmission of forces between the guide means and the lift is realised.

[0009] Preferably, the reactive element is substantially plate-shaped, so that it can be mounted, for example along the wall, in a simple manner without taking up a great deal of space. Preferably, the electrically conductive, reactive non-ferrous parts are made of copper or aluminium. Preferably, the guide means comprise a rail, with the lift being provided with guide wheels that engage said rail. The rail preferably forms part of the electrically conductive reactive part, and preferably it is made of the same material. In this way and inexpensive and at the same time elegant alternative can be provided for be conventional rail along the staircase, which is generally considered to be unsightly.

[0010] The invention will now be explained in more detail by means of embodiments as shown in the Figures, in which:

Figure 1 is a schematic front view of a first embodiment of a stair lift assembly;

Figure 2 is a schematic side elevation of the stair lift assembly that is shown in Figure 1;

Figure 3 is a schematic front view of a second embodiment of a stair lift assembly;

Figure 4 is a schematic side elevation of the stair lift assembly that is shown in Figure 3;

Figure 5 is a schematic front view of a third embodiment of a stair lift assembly;

Figure 6 is a schematic side elevation of the stair lift assembly that is shown in Figure 5;

Figure 7 is a schematic front view of a fourth embodiment of a stair lift assembly;

Figure 8 is a schematic side elevation of the stair lift assembly that is shown in Figure 7;

Figure 9 is a schematic front view of a fifth embodiment of a stair lift assembly; and

Figure 10 is a schematic side elevation of the stair lift assembly that is shown in Figure 9.

[0011] According to Figures 1 and 2, a lift assembly comprises guide means 1 and a lift 2. The guide means 1 are mounted on a wall 3, above the steps of a staircase, for example. The wall 3 is only schematically indicated in the Figures, and the means for mounting the guide means 1 on the wall 3 are not shown. The guide means 1 comprise a plate-shaped part 4, on the upper side and bottom side of which rails 5 and 6, respectively, are present. Furthermore, aluminium reactive parts 7 are arranged a regular distance apart on the plate-shaped part 4 along the length of the guide means 1.

[0012] The lift two comprises a support 8, on which a seat portion 9, a back portion 10 and armrests 11 are mounted. The support 8 is connected to a holder 18 provided with three electromagnetic coils 12, which can alternately be magnetised and demagnetised by means of a pulsating alternating current. For an explanation of the operation of a linear induction motor constructed in this manner, and in particular of the guidelines regarding the dimensions of the coils 10 and the reactive parts 7 and the spacing there between, reference is made to the general professional literature in this field, such as the aforesaid publication WO 96/14685. Furthermore, the support is fitted with two pairs of guide wheels 13, 14; 15, 16, which engage two respective tubular rail members 5; 6. In order to ensure a proper grip, the treads of the guide wheels 13, 14; 15, 16 are concave, seen in sectional view, as shown, with the radius thereof being slightly larger than the radius of the respective tubes 5; 6. Furthermore, the lift 2 comprises a hinged footrest 17.

[0013] The lift assembly according to Figures 3 and 4 corresponds in large measure to the lift assembly that is shown in Figures 1 and 2, and consequently only the differences between the two embodiments will be indicated. The guide means 1 comprise a plate-shaped part 4, which is only provided with a tubular rail 5 on the upper side thereof. Mounted some distance below the plate-shaped part 4 is a second tubular rail 6. The plate-shaped part 4 is provided with two rows of aluminium reactive parts 7a, 7b. The support 8 comprises a U-shaped holder 18, which is positioned around the plate-shaped part 4, with the closed end being present at the bottom side, which holder is provided with two rows of electromagnetic coils 12a, 12b; 12c, 12d both on the front side and on the rear side of the plate-shaped part 4, which coils interact with the respective rows of reactive element 7a, 7b.

[0014] The lift assembly according to Figures 5 and 6, too, corresponds in large measure to the lift assembly that is shown in Figures 1 and 2. The plate-shaped element is entirely made of aluminium, it is not provided with the aforesaid tubular rails. The support 8 comprises a U-shaped holder 18, which is positioned around the plate-shaped part 4, with the closed end being present at the upper side. The holder 18 is provided with a row of electromagnetic coils 12a; 12c both on the front side and on the rear side of the plate-shaped part 4, which coils interact with the aluminium plate-shaped part 4, which functions as a continuous reactive element. Since the linear induction motor that is constructed in this manner is capable of holding the plate-shaped part 4 in a position precisely between the coils 12a; 12c, without the coils touching each other, only guide wheels 13 travelling over the upper side of the plate-shaped part 4 are required in this embodiment. The guide wheels 13 have straight treads in this case.

[0015] The lift assembly according to Figures 7 and 8 corresponds in large measure to the lift assembly that is shown in Figures 3 and 4. In this embodiment, two plate-shaped parts 4a; 4b are provided. The plate-shaped parts 4a; 4b are disposed at an angle, with tubular rails 5a; 5b being present only at the upper side thereof. A section of this kind can be produced in one operation, for example by means of an extrusion process. The support 8 is fitted with two U-shaped holders 18a; 18b, which are likewise disposed at an angle, with the closed end being present at the bottom side, which holder is provided with a row of electromagnetic coils 12a, 12b; 12c, 12d both on the front side and on the rear side of the plate-shaped parts 4a; 4b, which coils interact with the aluminium plate-shaped parts 4a; 4b, which functions as continuous reactive elements. Since the linear induction motor that is constructed in this manner is capable of holding the plate-shaped parts 4a; 4b in a position precisely between the coils 12a, 12b; 12c, 12d, without the coils touching each other, only guide wheels 13a; 13b travelling over the upper side of the rails 5a; 5b are required in this embodiment.

[0016] The lift assembly according to Figures 9 and 10 corresponds in large measure to the lift assembly that is shown in Figures 1 and 2. In this embodiment, however, the electromagnetic coils 12a, 12b are present in the plate-shaped part 4, on the upper side of which a tubular rail 5 is present, which is provided with a vertical,

flat running surface 19 on its bottom side. The coils 12a, 12b are alternately arranged one behind the other. Mounted in the support 8 are three aluminium reactive parts 7, which interact with the coils 12a, 12b. Furthermore, the support 8 is fitted with an upper pair of guide wheels 13, which travel over the upper side of the tubular rail 5, and a lower pair of guide wheels 16, which travel over the running surface 19.

[0017] Although only a few possible embodiments of the invention have been described in the foregoing, it will be apparent to those skilled in the art that many combinations and variants of the various embodiments are possible.

Claims

1. A lift assembly for conveying persons along a staircase, comprising guide means (1) which are mounted substantially parallel to the slope of the staircase, and a lift (2) which is movable along said guide means, for example a lift for a handicapped person, said stair lift (2) and said guide means (1) being provided with mating interacting drive means (7, 12), **characterized in that** the drive means (7, 12) comprise a linear induction motor, which induction motor comprises actively connected electromagnets (12) and at least one reactive element (7).

2. A lift assembly according to claim 1, **characterized in that** the lift (2) is provided with the electromagnets (12), and the guide means (1) are provided with the reactive element (7), which extends substantially along the length of the guide means (1).

3. A lift assembly according to claim 1, **characterized in that** the reactive element (7) comprises a multitude of separate electrically conductive non-ferrous parts, which are arranged a fixed distance apart along the reactive element (7).

4. A lift assembly according to claim 1, **characterized in that** the reactive element (7) essentially consists of an electrically conductive non-ferrous part extending continuously along the guide means (1).

5. A lift assembly according to any one of the claims 2, 3 or 4, **characterized in that** the guide means (1) comprise two reactive elements (7a, 7b), which are essentially arranged one above the other, with the lift (2) being provided with two groups of electromagnets (12a, 12b) that interact therewith.

6. A lift assembly according to any one of the preceding claims 2 - 5, **characterized in that** the lift (2) comprises two groups of electromagnets (12a, 12b) which are disposed on two sides of the reactive element (7a, 7b).

7. A lift assembly according to claim 1, **characterized in that** the guide means (1) are provided with the electromagnets (12) substantially along their entire length, and the lift (2) is provided with the reactive element (7).

8. A lift assembly according to any one of the preceding claims 1 - 7, **characterized in that** the reactive element (7) is substantially plate-shaped.

9. A lift assembly according to any one of the preceding claims 1 - 9, **characterized in that** the electrically conductive, reactive non-ferrous parts (7) are made of copper or aluminium.

10. A lift assembly according to any one of the preceding claims 1 - 9 , **characterized in that** the guide means (1) comprise a rail (5, 6), with the lift (2) being provided with guide wheels (13, 14, 15, 16) that engage said rail.

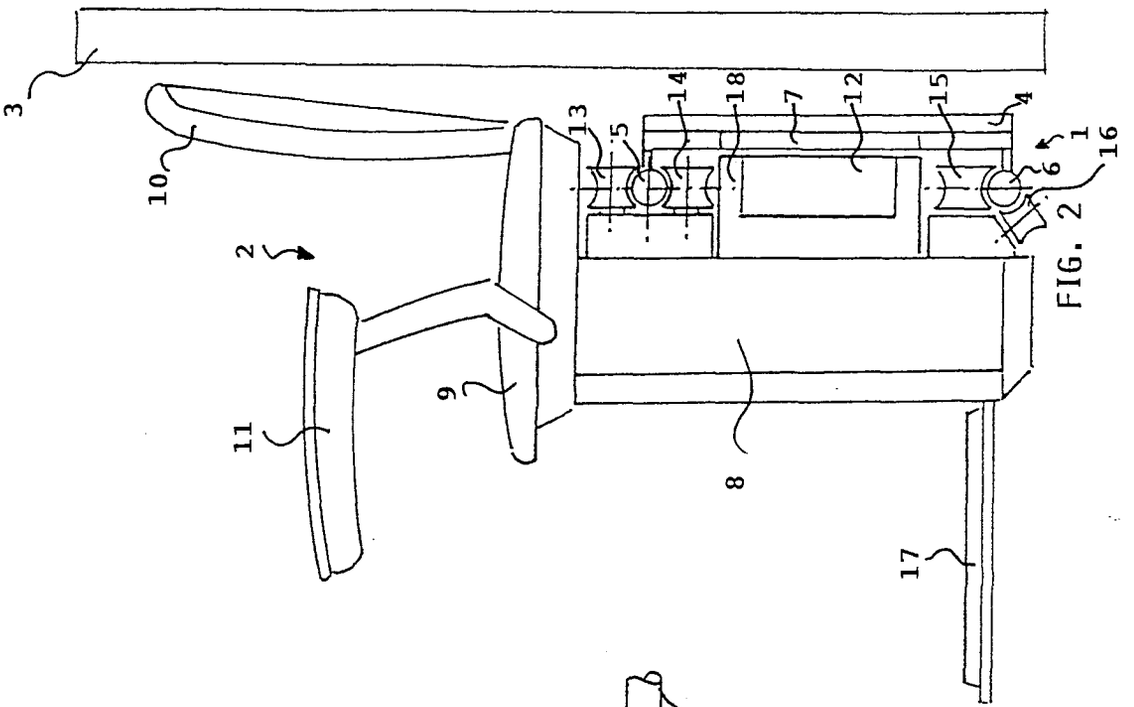

FIG. 2

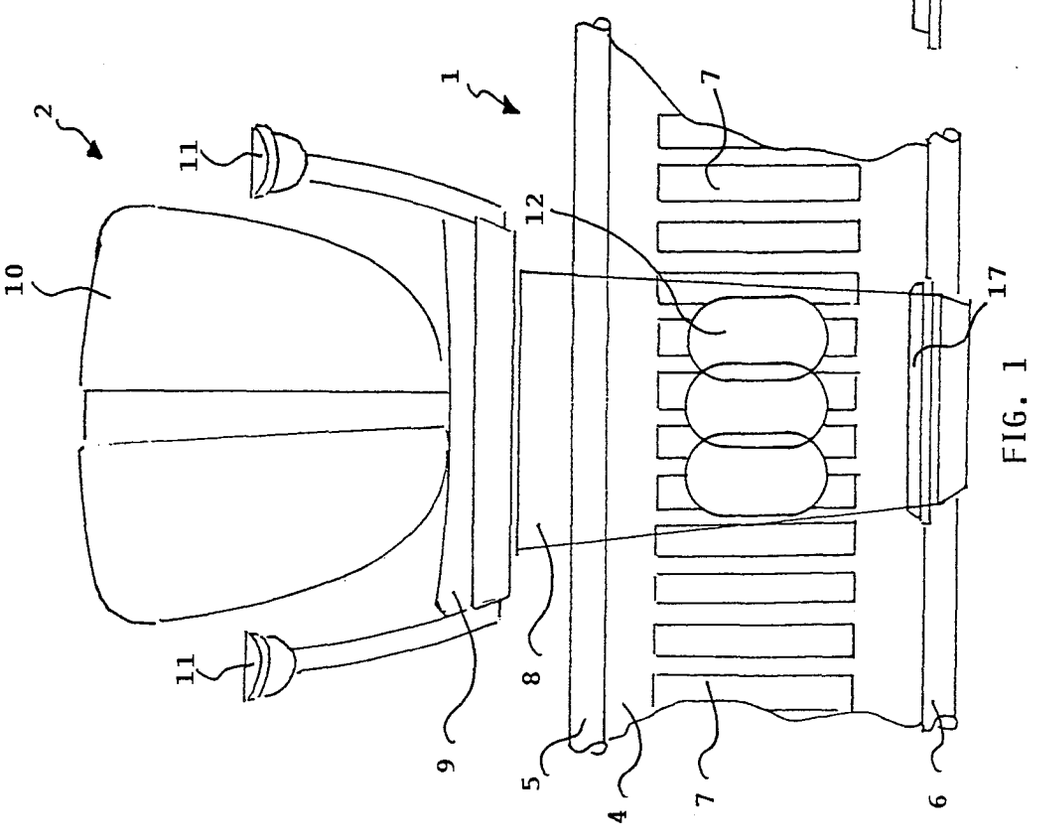

FIG. 1

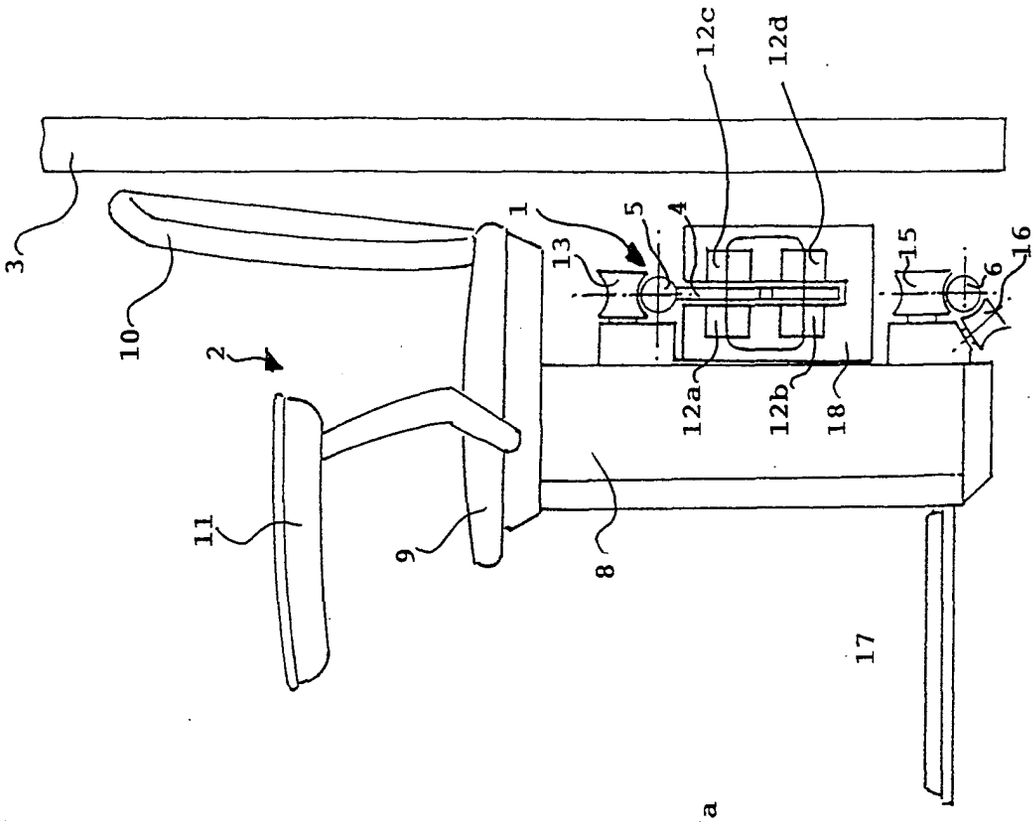
12c
12d
3
1
5
4
13
15
6
16
10
2
12a
12b
18
11
9
8
17

FIG. 4

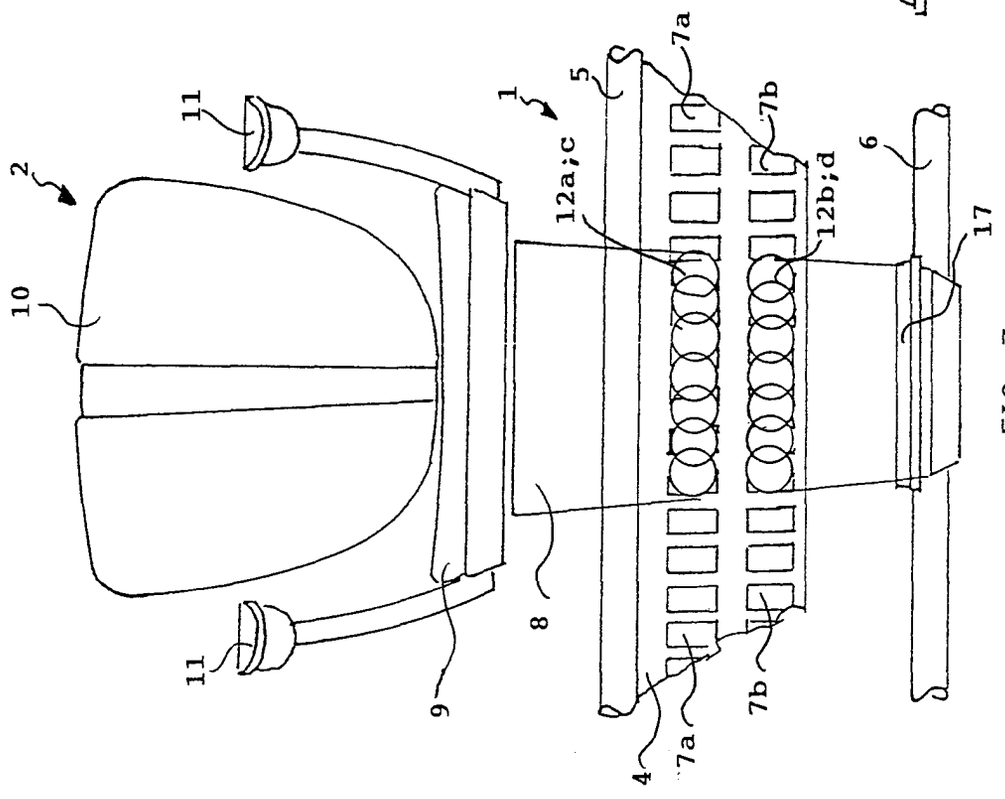
11
1
5
7a
2
7b
6
12a;c
12b;d
17
10
8
11
9
4
7a
7b

FIG. 3

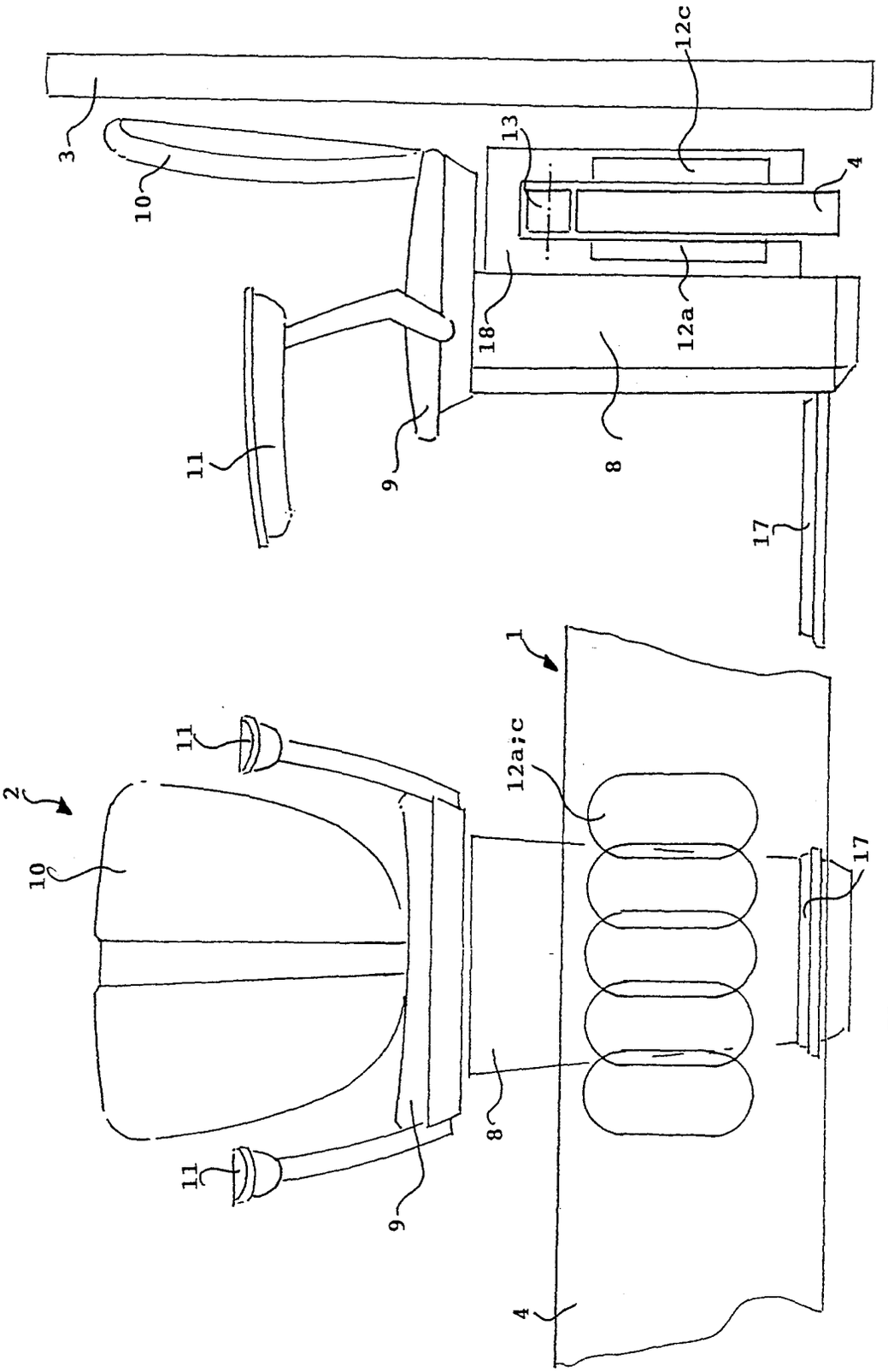

FIG. 6

FIG. 5

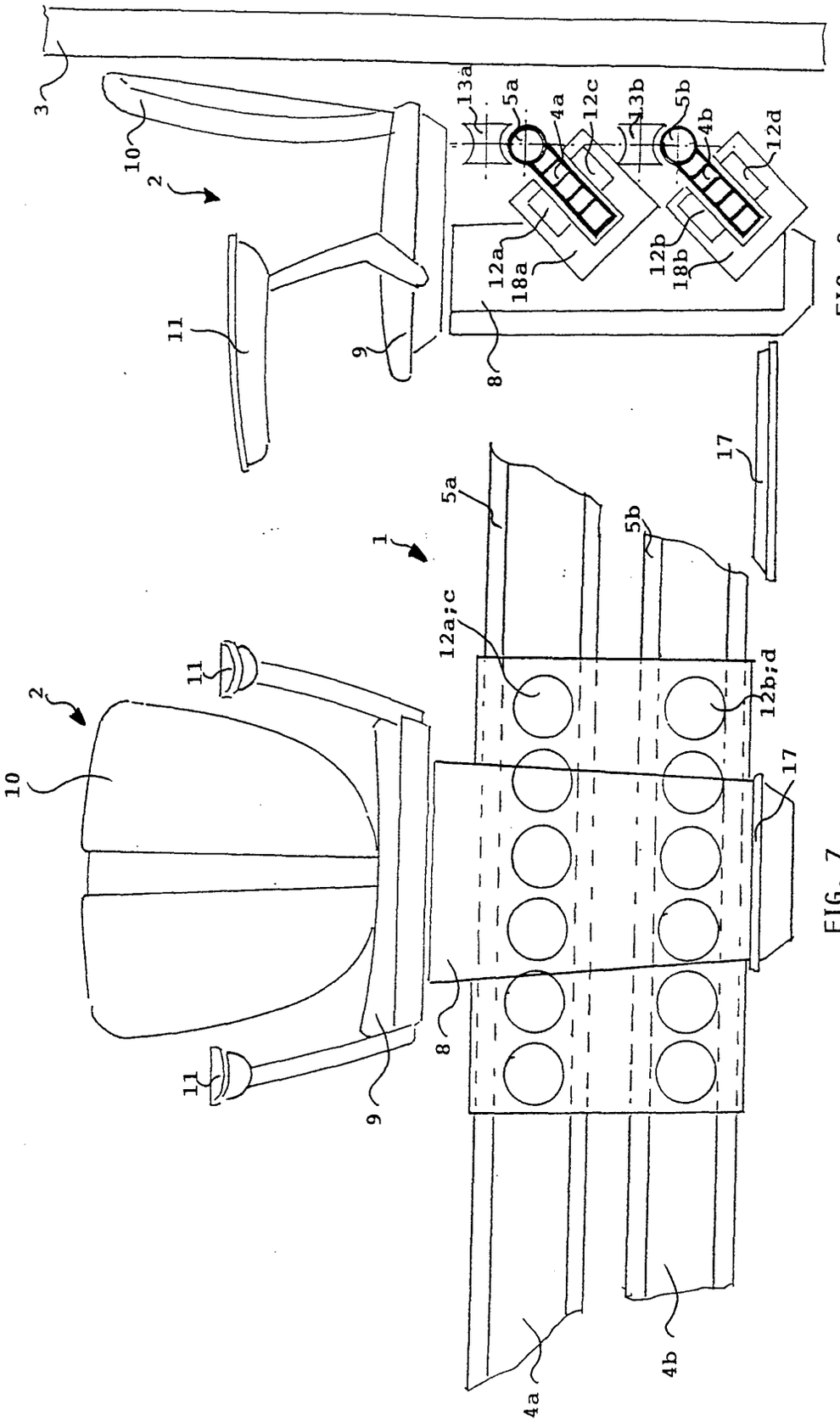
3
10
2
11
9
13a
5a
4a
12c
13b
5b
4b
12d
12a
18a
12b
18b
8
17
1
5a
5b
12a;c
12b;d
17
2
10
11
11
9
8
4a
4b

FIG. 8

FIG. 7

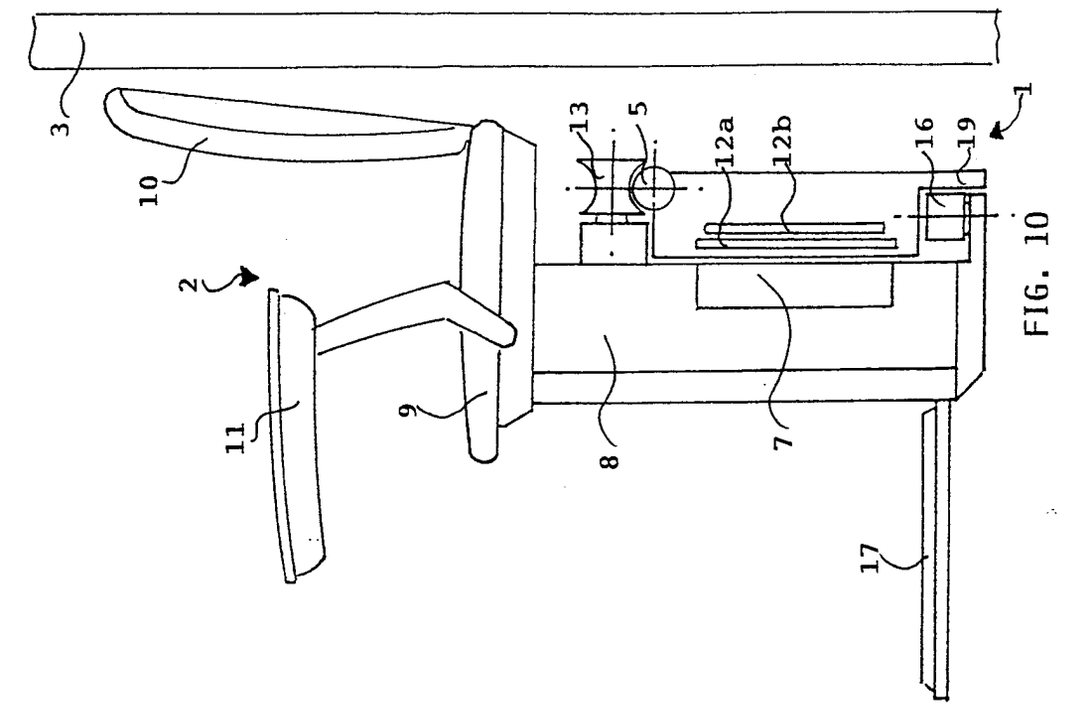

FIG. 10

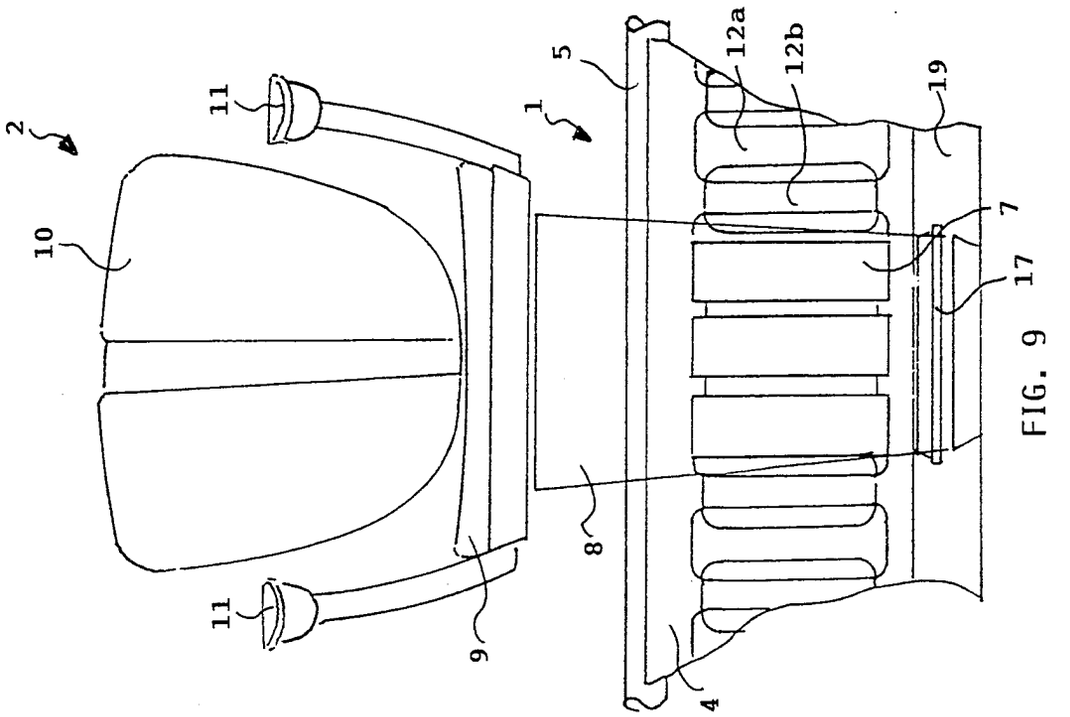

FIG. 9

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 03 10 2147

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
A	EP 1 053 968 A (VIMEC SRL) 22 November 2000 (2000-11-22) * abstract; figure 1 *	1	B66B9/08
A	WO 99 50166 A (NEW LIFT I NYNAESHAMN AB) 7 October 1999 (1999-10-07) * abstract; figures 1,2 *	1-10	
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	13 November 2003	Nelis, Y

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