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(54) **Stair lift**

(57) A stair lift comprising a rail (11,12) which extends, at least in part, upwards at an angle of inclination, and a frame (13) which is movable along said rail (11,12), on which a chair (31,32,33) is mounted. The frame (13) is provided with guide means (14,15) which engage the rail and with driving means (23,24) which extend outside the frame (13) and which engage a driving element (25) which is present near the rail (11,12). The part of the driving means (23,24) that extends outside the frame (13) is disposed at some distance from the vertical centre plane of the chair (31,32,33) on the side thereof where the rail (11,12) extends upwards.

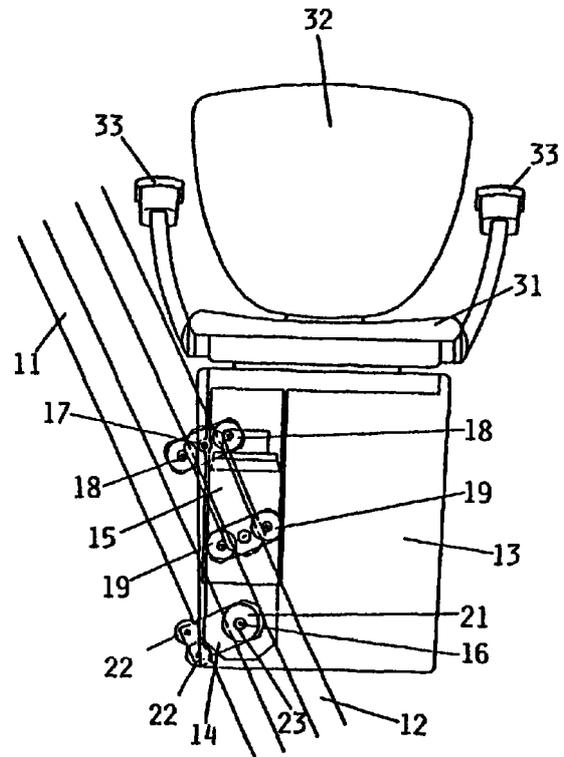


FIG. 2

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Description

[0001] The invention relates to a stair lift comprising a rail which extends, at least in part, upwards at an angle of inclination, and a frame which is movable along said rail, on which a chair is mounted, which frame is provided with guide means which engage the rail and with driving means which extend outside the frame and which engage a driving element which is present near said rail.

[0002] The driving means may comprise a substantially horizontal drive shaft extending substantially perpendicularly to the direction of movement of the frame, which drive shaft extends outside the frame and which is provided with a driving wheel at a location outside the frame. The frame is generally provided with an electric driving motor, which drives the drive shaft via a mechanical reduction gear unit. A gear wheel may be mounted on the drive shaft as said driving wheel, which gear wheel meshes with a driving element in the form of a toothed rack which extends along the rail.

[0003] A stair lift of this kind can be used for conveying a person seated on the chair, for example a handicapped person, along a staircase. The rail is thereby mounted on one side of the stairs, as a result of which it may form an obstacle when the stairs are used in the normal manner.

[0004] Usually the rail is mounted on the side of the stairs that forms the outside bend, for example because the stairs are less steep at that location than in the inside bend. The rail forms more of an obstacle at that location, however, because persons who are walking up or down the stairs prefer to use said outside bend.

[0005] Furthermore it is not possible thereby for the stair lift to extend over more than one storey.

[0006] It is an object of the invention to provide a stair lift of simple construction, wherein the rail can be mounted at a relatively large angle of inclination. In addition it is an object of the invention to provide a stair lift wherein the distance between the chair and the stairs is greater, or wherein the rail can be mounted closer to the steps.

[0007] In order to accomplish that objective, the part of the driving means that extends outside the frame is according to the invention disposed at some distance from the vertical centre plane (plane of symmetry) of the chair on the side thereof where the rail extends upwards. The part of the driving means that extends outside the frame is thereby preferably disposed at some distance from the vertical centre plane of the frame on the side thereof where the rail extends upwards. The chair may be mounted centrally above the frame in that case, so that the vertical centre plane of the frame coincides with the vertical centre plane, or plane of symmetry, of the chair.

[0008] The term vertical centre plane is understood to mean the plane centrally through the chair or the frame, which extends substantially transversely to the

direction of movement, at least the horizontal component of the direction of movement.

[0009] Seen in top plan view, the frame extends primarily on one side of the drive shaft, therefore.

[0010] The chair can be mounted on the frame in such a manner that the chair can tilt more or less with respect to the frame whilst the frame is being moved along the rail, in order to maintain its upright position while the frame makes a tilting movement. Preferably, the chair is present on the frame in a fixed position, at least during the movement of the frame along the rail.

[0011] The aforesaid distance is preferably larger than 5 cm, more preferably larger than 10 cm, and even more preferably larger than 15 cm.

[0012] A larger distance between the chair and the steps is made possible by providing the drive shaft near the side of the frame/chair unit rather than centrally, especially in the case of a steeply inclined rail.

[0013] Preferably, the rail comprises two tubes disposed one above another, and the guide means comprise a first guide element which engages the lower tube and a second guide element which engages the upper tube, whilst the two guide elements are rotatably attached to the frame about a substantially horizontal axis. The perpendicular distance between the two tubes thereby determines the position of the frame relative to the direction in which the tubes extend, so that the chair can be maintained in an upright position, while the angle of inclination of the rail varies, by varying said perpendicular distance.

[0014] Preferably, one of the two guide elements, preferably the first guide element, can rotate about the drive shaft and the axis of rotation of the second guide element is located near the side of the frame that faces towards the direction in which the rail extends upwards. The drive shaft is preferably mounted near the underside of the frame. These relative positions will be explained in more detail yet by means of an embodiment.

[0015] In one preferred embodiment the drive shaft is mounted at a fixed location in the frame, and the drive shaft can be mounted in such manner as to extend outside the frame on one side or on the other side thereof, according to which is desired. This makes it possible to use the same frame both for a rail that turns upwards to the right and for a rail that turns upwards to the left through the frame. The frame, in which batteries and other facilities may be present besides the driving motor, will be turned through 180 degrees about a vertical axis with respect to the chair and possibly also with respect to its encasing in that case.

[0016] The above possibility of using the same frame both for a stair lift which turns to the right and for a stair lift which turns to the left can be considered to constitute a separate invention.

[0017] In particular it is possible to use the stair lift described herein in combination with a rail which extends, at least in part, at an angle of inclination of

more than 55 degrees, preferably more than 60 degrees, more preferably more than 70 degrees. The stair lift can successfully be mounted in the inside bend of a flight of stairs, where the angle of inclination is much larger than in the outside bend.

[0018] By mounting the stair lift in the inside bend, upwardly inclined parts of the rail can extend over two parts of the stairs, which are respectively disposed below and above a horizontal floor, whereby the rail part present above the floor comprises a portion which has a small angle of inclination, so that the chair can be positioned above the floor in such a manner that a person can sit down on the chair.

[0019] Also at its lower end the rail may comprise a portion which extends at a small angle of inclination, which portion can serve to move the chair to a location where it forms less of an obstacle, for example more or less under the stairs or against a wall present near the stairs.

[0020] Preferably, said angle of inclination is smaller than 30 degrees, more preferably smaller than 20 degrees and even more preferably smaller than 10 degrees.

[0021] When the stair lift is mounted in the inside bend of a flight of stairs, the rail is preferably attached to the vertical pillar to which the stairs, at least the steps, are attached on the side of the inside bend. Said pillar may be a central wooden or metal post, around which the flight of stairs extends, the pillar may also comprise a flat wall portion along which the stairs extend. Generally such a pillar is of solid construction, because the steps are attached thereto, and consequently it is sufficiently strong for attaching the rail thereto. Not only does this result in an attractive appearance, but it is furthermore advantageous that the steps remain clear of fixing elements, for example with a view to cleaning the stairs.

[0022] The invention furthermore relates to a lift unit for a stair lift comprising a chair and a horizontal drive shaft which extends substantially parallel to the centre plane (plane of symmetry) of the chair and which carries a gear wheel which is capable of engaging a stationary toothed rack, wherein the drive shaft is spaced from the centre plane by some distance.

[0023] The invention furthermore relates to a method for mounting a stair lift along a flight of stairs, wherein the rail of the stair lift is attached to the vertical pillar, to which the stairs, at least the steps, are attached, in the inside bend.

[0024] In order to explain the invention more fully, two embodiments of a stair lift will be described hereafter with reference to the drawing.

Figure 1 is a rear view of a frame and a chair of a conventional stair lift;

Figure 2 is a rear view of a frame and a chair according to the invention; and

Figure 3 is a side view of the frame and the chair.

[0025] The figures are merely schematic representations, wherein like parts are numbered alike.

[0026] The figures show only a small part of the rail in the form of a lower tube 11 and an upper tube 12. Both tubes 11, 12 are of circular cross-section. In Figures 1 and 2 the tubes 11, 12 are transparent, as it were, in order to show the parts of the frame 13 and the lower guide element 14 and the upper guide elements 15 present behind said tubes.

[0027] The upper guide element 15 is rotatably attached to frame 13 about axis 17, it is provided with four wheels 18, 19 which engage the upper tube 12. The wheels 18 engage tube 12 near the axis of rotation 17 and the wheels 19 engage tube 12 at some distance therefrom.

[0028] The lower guide element 14 is rotatably attached to frame 13 about axis 16, it is provided with three wheels 21, 22 which engage the lower tube 11. Wheel 21 rotates about said axis 16 and wheels 22 are in contact with tube 11 on the opposite side.

[0029] Furthermore a drive shaft 23 is provided coaxially with axis 16, on which drive shaft the lower guide element 14 is freely rotatably supported, as is wheel 21. Drive shaft 23 is provided at its end with a gear wheel 24 (only shown in Figure 3), which gear wheel 24 is in engagement with a stationary driving element 25 in the form of a toothed rack, which is mounted along lower tube 11.

[0030] Frame 13 is further provided with a chair fitted with a seat 31, a back 32 and two armrests 33, as well as with a footrest 34, so that a person can be comfortably and safely seated on the chair. An operating knob 35 is present on one of the armrests 33.

[0031] Figure 1 shows a conventional stair lift, wherein drive shaft 23 is positioned centrally in frame 13, near the underside thereof. Figure 2 shows a stair lift according to the invention, wherein the drive shaft 23 is positioned to the left of the centre of frame 13. In both cases the axis of rotation 17 is located obliquely above the drive shaft 23.

[0032] In Figure 3 the back 32 of the chair is positioned above the upper tube 12 in order to make it possible to position the chair of the stair lift as closely as possible against the wall along a flight of stairs. If rail 11, 12 extends at an angle of inclination, as shown in Figures 1 and 2, the chair will be positioned close to the upper tube 12, and that in such a manner that a specific maximum angle of inclination is possible. It will be apparent that the stair lift according to Figure 2 allows a larger angle of inclination than the stair lift according to Figure 1.

[0033] The frame 13 which is shown in the figures can be used for a left-hand lift as well as for a right-hand lift. With the stair lift according to Figure 1 this is possible by having the upper guide element 15 rotate at the location of frame 41 rather than at the location of axis 17. The frame has two points of attachment for the upper guide element 15, therefore.

[0034] Frame 13 of the stair lift which is shown in Figure 2 is so constructed that the guide elements 14, 15 can be attached to the frame both on the front side and on the rear side thereof, whereby also drive shaft 23 with wheel 24 extends outside frame 13 on the other side. The parts of the chair are also mounted on the frame in the reverse manner thereby, as is the encasing of the frame.

[0035] This arrangement makes it possible to use the same frame 13, including the driving motor and other parts which are present in the frame, for both versions of the stair lift.

[0036] The schematically represented embodiments are merely examples, many other embodiments are conceivable.

[0037] The stair lift preferably has embodiments which can be defined as follows.

[0038] A stair lift wherein the chair, at least parts which form the chair, is (are) attached to the frame in such a manner that the chair will take up a substantially fixed position with respect to the frame upon being moved along the rail.

[0039] A stair lift wherein the aforesaid distance is preferably larger than 5 cm, more preferably larger than 10 cm, and even more preferably larger than 15 cm.

[0040] A stair lift wherein the drive shaft is mounted near the underside of the frame.

[0041] A stair lift wherein the angle of inclination is, at least in part, more than 55 degrees, preferably more than 60 degrees, more preferably more than 70 degrees.

[0042] A stair lift wherein the rail extends with upwardly inclined portions thereof over two stair portions respectively disposed below and above a horizontal floor, and wherein the rail part located above the floor comprises a portion which has a small angle of inclination.

[0043] A stair lift wherein the rail comprises a portion near its lower end which has a small angle of inclination.

[0044] A stair lift wherein said small angle of inclination is less than 30 degrees, preferably less than 20 degrees, more preferably less than 10 degrees.

[0045] A stair lift wherein the rail is attached to the vertical pillar to which the stairs, at least the steps, are attached on the side of the inside bend.

Claims

1. A stair lift comprising a rail (11,12) which extends, at least in part, upwards at an angle of inclination, and a frame (13) which is movable along said rail (11,12), on which a chair (31,32,33) is mounted, which frame (13) is provided with guide means (14,15) which engage the rail (11,12) and with driving means (23,24) which extend outside the frame (13) and which engage a driving element (25) which is present near said rail (11,12), character-

ized in that the part of the driving means (23,24) that extends outside the frame (13) is disposed at some distance from the vertical centre plane of the chair (31,32,33) on the side thereof where the rail (11,12) extends upwards.

2. A stair lift according to claim 1, characterized in that the part of the driving (23,24) means that extends outside the frame (13) is thereby preferably disposed at some distance from the vertical centre plane of the frame (13) on the side thereof where the rail (11,12) extends upwards.

3. A stair lift according to any one of the preceding claims, characterized in that said driving means comprise a substantially horizontal drive shaft (23) extending substantially perpendicularly to the direction of movement of the frame (13), which drive shaft (23) extends outside the frame (13) and which is provided, at a location outside the frame (13), with a driving wheel, which is in engagement with a stationary driving element (25), wherein the drive shaft (23) is spaced from the vertical centre plane of the chair (31,32,33) by some distance.

4. A stair lift according to any one of the preceding claims, characterized in that the rail comprises two tubes disposed one above another, and the guide means comprise a first guide element (14) which engages the lower tube (11) and a second guide element (15) which engages the upper tube, and in that the two guide elements (14,15) are rotatably attached to the frame (13) about a substantially horizontal axis (16).

5. A stair lift according to claim 4, characterized in that one of said guide elements, preferably the first guide element (14), can rotate about the drive shaft (23).

6. A stair lift according to claim 5, characterized in that the first guide element (14) can rotate about the drive shaft (23) and/or that the axis of rotation (17) of the second guide element (15) is located near the side of the frame (13) that faces towards the direction in which the rail (11,12) extends upwards.

7. A stair lift according to any one of the preceding claims, characterized in that the drive shaft (23) is mounted at a fixed location in the frame (13), and that the drive shaft (23) can be mounted in such manner as to extend outside the frame (13) on one side or on the other side thereof, according to which is desired.

8. A stair lift according to claim 7, characterized in that the frame (13) is provided with a removable encasing and/or a chair (31,32,33), which can be

mounted on the frame (13) in either one of two positions which are turned through 180 degrees about a vertical axis relative to each other.

9. A stair lift according to any one of the preceding claims, characterized in that the rail (11,12) is mounted in the inside bend of a flight of stairs. 5
10. A lift unit for a stair lift comprising a chair (31,32,33) and a horizontal drive shaft (23) which extends substantially parallel to the centre plane of the chair (31,32,33) and which carries a gear wheel (24) which is capable of engaging a stationary toothed rack (25), characterized in that the drive shaft (23) is spaced from the centre plane by some distance. 10
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11. A method for mounting a stair lift along a flight of stairs, wherein the rail (11,12) of the stair lift is attached to the vertical pillar, to which the stairs, at least the steps, are attached, in the inside bend. 20

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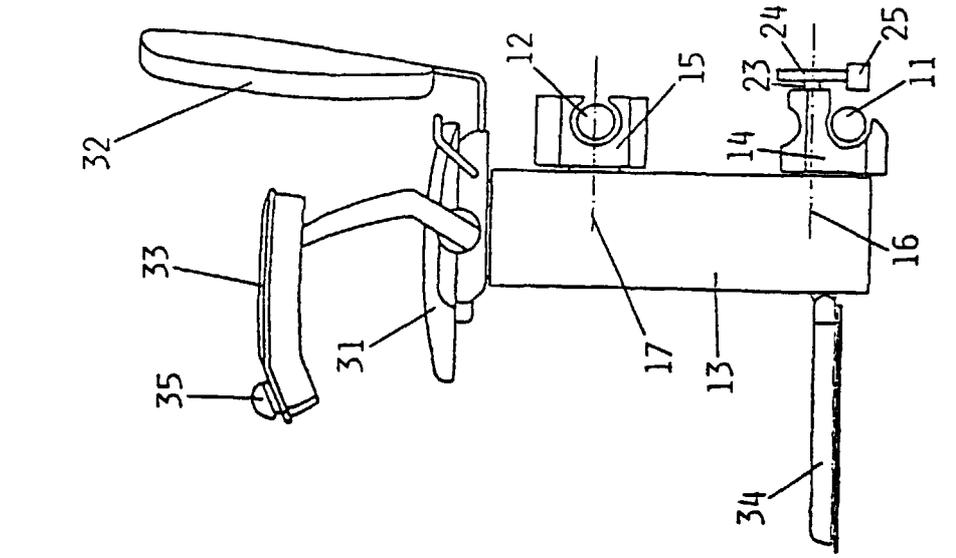


FIG. 1

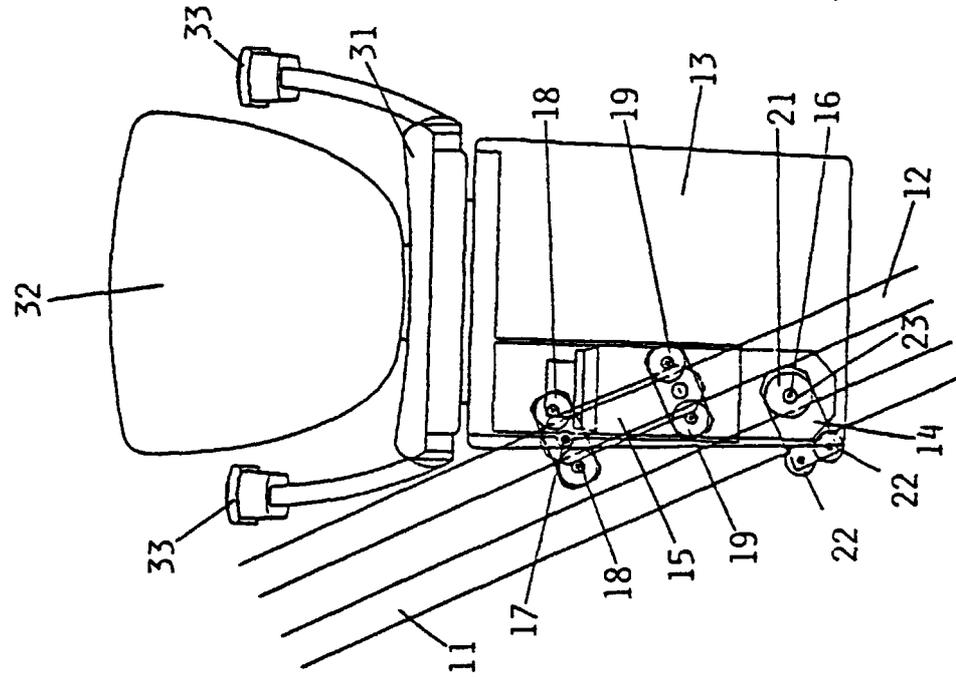


FIG. 2

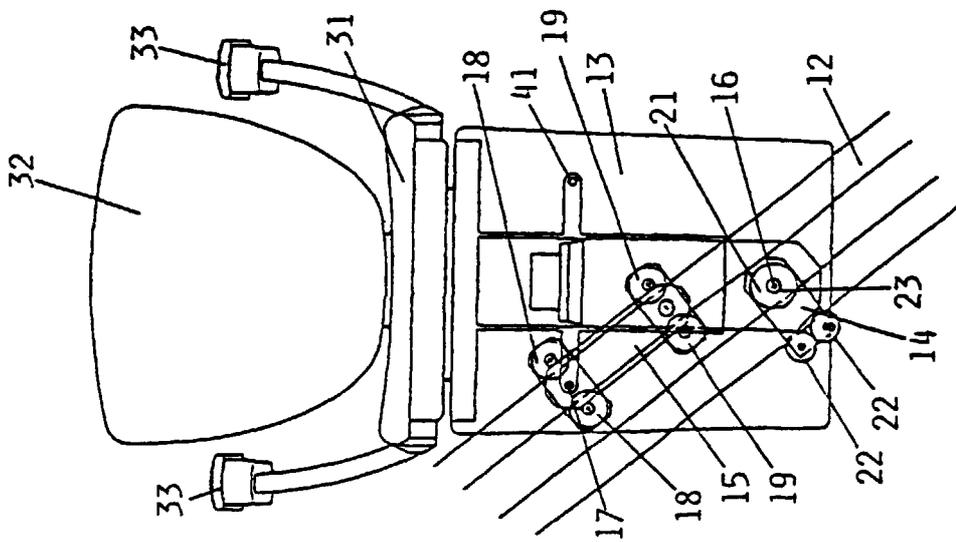


FIG. 3



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EUROPEAN SEARCH REPORT

Application Number
EP 00 20 0869

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The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 23 May 2000	Examiner Sozzi, R
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EPO FORM 1503 03.82 (P/4C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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