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(54) **A lift assembly and a method for installing a rail system**

Aufzugsanordnung und Verfahren zur Installation eines Schienensystems

Ensemble élévateur et procédé d'installation d'un système de rails

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**EP-A- 0 394 201** **WO-A-92/14673**  
**FR-A- 2 333 895** **US-A- 4 262 773**

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## Description

**[0001]** The invention relates to a lift assembly comprising a rail system and a lift being capable of movement along said rail system, for example a chair lift for a disabled person, whereby said lift can move upwards at an angle, at least along part of its path, said rail system comprising two guides in the form of tubes having a substantially round annular cross-section, one being provided substantially above the other, whereby the vertical spacing between said guides depends on the angle of inclination of said guides and whereby both guides are attached to supporting elements which are secured to a wall or to steps of a staircase. Such a lift assembly is disclosed in WO-A-92/14673.

**[0002]** This type of lift may be used to convey a disabled person, who is unable to use the staircase, upwards or downwards along said staircase. The rail system is thereby mounted along the staircase in such a manner that a lift can move along the staircase, said lift being positioned above said staircase during said movement. The rail along which the lift moves may for example be secured to a wall along the staircase, but it may also be mounted on supports which are secured to the steps on one side of the staircase. The lift may be in the form of a chair, in which a person may be seated, or consist of a platform onto which a wheelchair can be moved. Also other lift forms are possible.

**[0003]** In case of a straight staircase the rail system may consist of a straight assembly of sections, which is mounted at the same angle as the staircase. The lift is connected to the rail system in that it engages the upper and lower guides of the rail system via guide units mounted on the lift, whereby the lift takes up a substantially straight position at all times, that is, at an angle with respect to the rail system. The rail system may furthermore be provided with a rack, which is capable of cooperating with a gear connected to the lift, so that when the gear is driven by means of an electromotor provided in the lift, the lift is moved along the rail system.

**[0004]** Usually a staircase does not consist of a single straight part, by it may comprise different angles of inclination at different places, it may comprise a horizontal part and it may make one or more bends. In all these cases the rail system must be provided along the staircase in such a manner that the lift will take up a straight position at all times during its movement along the rail system. The position of the lift with respect to the rail system is determined by the spacing between the guides. Consequently said spacing must vary such that the lift will remain in a straight position at all times, irrespective of the angle of inclination of the rail system. That is, the two guides will be spaced less far apart when the staircase, and thus the rail system, is inclined at a steeper angle.

**[0005]** When a lift assembly is to be installed along a certain staircase, said staircase must be measured very precisely beforehand, after which the shape and the

construction of the rail system can be computed on the basis of said measurement. Generally the shape and the dimensions of the rail system will thereby vary along its length. In fact the rail system is assembled and made to size as a whole at the factory, or in parts if it should become too voluminous to transport, transported to the staircase in question and installed along the staircase there. In practice the rail system is always assembled at the factory by means of welded joints, partly because it is thus ensured that all dimensions of the rail system remain unchanged at all times.

**[0006]** Drawbacks of known lift assemblies are the fact that they must be made precisely to size on the basis of complicated calculations, requiring error-free measuring of the staircase, and that reuse of the system for another lift assembly is hardly possible, if at all, in the event that a rail system has to be removed from a house.

**[0007]** The object of the invention is to provide a lift assembly enabling reuse of the rail system, at least to a large extent. Particularly because of the fact that in some cases a lift assembly will be present in a house for a short time only, after which it must be removed again, the possibility of reusing a considerable part of such a lift assembly offers major advantages.

**[0008]** According to the invention said two guides are detachably connected to said supporting elements and each guide consists of a number of detachably interconnected tube sections.

**[0009]** Such a detachable interconnection may be effected by interposing a coupling element, which is slid into one end of each tube section, after which a fixation may take place in that screws are passed through the tube sections into the coupling element. The coupling elements may also be secured in the tube sections by means of a clamped fit.

**[0010]** The tube sections may consist of straight tube sections and bent tube sections, which are detachably interconnected by said coupling elements and which are likewise detachably connected to the supporting elements. Because straight and bent tube sections are utilized, each tube section may be used to form another rail system after the rail system has been dismantled, possibly in combination with tube sections from other rail systems that have been used before. Furthermore all components of the lift assembly can be made to size in situ, using simple hand-operated tools.

**[0011]** According to another aspect of the invention a rack may be detachably secured to the supporting elements, and that near the lower guide. The rack and/or gear meshing therewith referred to herein may comprise teeth of any desired shape. In particular a gear is meant comprising teeth in the shape of axial pins, which mesh with correspondingly shaped teeth of the rack.

**[0012]** The invention furthermore relates to a method for installing a rail system as defined in the claims.

**[0013]** Hereafter an embodiment of a lift assembly according to the invention will be described by way of il-

illustration with reference to the schematic drawing.

Figure 1 is a perspective view of a rail system of a lift assembly, and also an exploded view thereof;  
 Figure 2 is a view of a lift assembly;  
 Figure 3 is a view of an alternative embodiment of the lift;  
 Figure 4 is a partial cross-section of a rail system and a lift;  
 Figure 5 is a partial cross-section of a supporting element and rails; and  
 Figure 6 is a view, corresponding with Figure 3, of another embodiment.

**[0014]** The Figures are only diagrammatic view of the embodiment, wherein like parts are numbered alike in the various Figures.

**[0015]** Figure 1 is a perspective and schematic view of a rail system and also an exploded view showing the parts of said rail system. A number of supporting elements 2 are mounted on a staircase 1. Each of said supporting elements 2 comprises two legs 3, 4, said legs at their downwardly extending ends being provided with bases 5, which may be secured to the steps of a staircase, for example by means of screws. The legs 3, 4 may thereby be provided with an additional tube section 46 for adjusting the length of the leg. This will be explained in more detail with reference to Figure 5.

**[0016]** Each supporting element 2 is secured to two successive steps, whereby a plate-shaped intermediate piece 6 is placed under the base 5 of the shorter leg 4, said intermediate piece 6 engaging around the longer leg 3 with one end. In this manner the attachment of the supporting element 2 is strengthened. A supporting element 2 is placed on the horizontal floor 7 as well, whereby the two legs of said element have the same length.

**[0017]** Each supporting element 2 is provided with two securing points 8, 9, to which the lower guide 12 and the upper guide 13 can be secured by means of securing elements 10, 11. The position of the securing points 8 and 9 is the same for all supporting elements 2. It will be apparent that this location and also the shape of the securing elements 10 and 11 determine the relation between the spacing between the guides 12, 13 and the angle of inclination of said guides. This spacing between the guides 12, 13 must be attuned to the construction of the lift to be moved along the rail system, such that said lift will remain in a straight position while moving along its path. At the bottom side of the staircase the rail system according to Figure 1 is connected to the floor 15. At the upper side of the staircase 1 the rail system extends beyond the floor 7.

**[0018]** In the exploded view of the rail system shown in Figure 1 a number of parts thereof are illustrated in detached relationship. Each guide 12, 13 is thereby shown to be assembled from a number of straight tube sections and a number of bent tube sections. Said tube

sections are interconnected by coupling elements 16, which may be slid into the ends of two tube sections connecting to each other. The interconnection of the tube sections may be strong enough per se, because the coupling elements are provided with a clamped fit, it is also possible, however, to secure the ends of the tube sections to the coupling elements by means of screws.

**[0019]** Figure 2 is a view of a lift assembly provided on a staircase 1, whereby the rail system of said assembly corresponds with the rail system described with reference to Figure 1. As already described before, the supporting elements 2 are secured to successive steps of the staircase 1. Furthermore a supporting element 2 is provided on the horizontal part 17. Also Figure 2 shows how the spacing between the guides 12, 13 changes in dependence on the inclination of said guides. This dependence is determined by the position of the securing points 8 and 9 of the supporting elements 2 and by the shape of the securing elements, of which only securing element 10 is shown in Figure 2.

**[0020]** Upper guide 13 is secured to supporting element 2 in such a manner, that the central axis of guide 13 intersects the central axis of securing point 9. To this end the securing element 11, which is not shown in Figure 2, is capable of rotating movement about a horizontal axis of rotation through securing point 9, to which securing element 11 the upper guide 13 can be secured.

**[0021]** The lower securing element 10, which is capable of rotating movement about a horizontal axis of rotation through securing point 8, is shown in Figure 2. The lower guide 12 is secured to said securing element 10 in such a manner, that the central axis of said lower guide 12 crosses the horizontal axis of rotation through securing point 8 at some distance therefrom. It will be apparent that the position of securing points 8, 9 and the shape of the securing elements 10, 11 effect a certain relation between the spacing between the two guides 12, 13 on the one hand and the angle of inclination of said guides on the other hand.

**[0022]** Figure 2 shows a lift, on which a chair is placed in order to be able to move a handicapped person along the staircase in seated position. The lift, which is shown in rear view, is provided with a back support 18, two arm supports 19 and a seat 20.

**[0023]** The lift is provided with a frame 21, to which two guide units are secured, which are capable of rotating movement about a horizontal axis with respect to frame 21.

**[0024]** The lower guide unit 22 is provided with a guide wheel 24, which can roll on guide 12 with a concave running surface. The lower guide unit 22 is furthermore provided with a second guide wheel 25, which can likewise roll on guide 12. The guide wheels 24, 25 are interconnected in such a manner that they can jointly rotate about the central axis of guide wheel 24.

**[0025]** The lift drive is not shown in Figure 2. Said drive may consist of a rack, which may be secured to the securing elements 10 in front of the lower guide 12,

seen in Figure 2, and which may have upwardly directed teeth. Said teeth can mesh with a gear positioned in front of guide wheel 24, seen in Figure 2, which is driven via a shaft, about which the lower guide unit 22 can rotate. The drive just described is shown in Figure 4 and will be explained in more detail with reference to said Figure.

**[0026]** According to Figure 2 frame 21 is provided with an upper guide unit 23 comprising guide wheels 26 and 27, which both have a concave running surface and which can roll on upper guide 13. Guide unit 23 is capable of rotating movement with respect to frame 21 about a substantially horizontal axis, which lies in the same plane as the axes of guide wheels 26 and 27, said axis of rotation also intersecting the central axis of upper guide 13.

**[0027]** In order to keep the lift in its straight position in a stable manner the upper guide unit 23 is furthermore provided with two guide wheels 48, 49, which are positioned at some distance from the guide wheels 26 and 27. As a result of this the lift engages the rail system in three points, which results in an adequate stability.

**[0028]** As is apparent from Figure 2, the position of the axes of rotation of guide units 22 and 23 on frame 21 is such that when the lift is positioned at a certain location near the supporting element, said axes of rotation coincide with securing points 8 and 9 of a supporting element. The consequence of this is that with every angle of inclination of the guides 12, 13 the spacing between said guides is such that the lift will remain in the same straight position at all times.

**[0029]** Figure 3 shows an alternative embodiment of the lift, wherein a lower guide unit 22 being identical to the one shown in Figure 2 is secured to frame 21. The upper guide unit 23 is different from the one shown in Figure 2, however, because the guide unit 23 of Figure 3 only comprises two guide wheels 26, 27. A third guide unit 28 is provided in order to obtain a stable connection between the lift and the rail system, which third guide unit engages the upper guide 13. Said third guide unit 28 is capable of rotating movement with respect to frame 21 about a horizontal axis, which intersects the central axis of upper guide 13, but in addition to that said third guide is capable of moving in vertical direction along frame 21, for which purpose guide unit 28 is mounted in vertical guide means, for example consisting of a vertical bar 29, along which the guide unit 28 can move.

**[0030]** The advantage of the construction according to Figure 3 is that the horizontal spacing between guide units 23 and 28 (seen in plan view, therefore) will remain the same at all times. This results in a stabler connection between the lift and the rail system.

**[0031]** Figure 4 shows a detail wherein guide units 22, 23 are illustrated in partial sectional view, as is part of the rail system.

**[0032]** As part of the rail system a supporting element 2 is shown, with a lower guide unit 10 and an upper guide unit 11 secured thereto. The Figure shows in sectional view how lower guide unit 10 is connected to a section

32 of supporting element 2 by means of a screw 31. Securing element 10 can be fixed in various angular positions with respect to axis of rotation 33 thereby. Axis of rotation 33 coincides with securing point 8 according to Figure 2.

**[0033]** Attached to securing element 10 is lower guide rail 12, on which a guide wheel 24 and a guide wheel 25 can roll. Guide wheel 25 is capable of rotating movement in a support 34, which support 34 is capable of rotating movement about shaft 35 of electromotor 36, which forms the lift drive. Guide wheel 24 is likewise capable of rotating movement about shaft 35. Gear 37, in this embodiment consisting of two parallel discs, between which pins forming the teeth are provided, is fixedly mounted on shaft 35, so that said gear 37 can be driven by electromotor 36. Gear 37 thereby engages in a teeth rack 38, which is connected to securing portion 39 of securing element 10 by means of screws.

**[0034]** In this embodiment gear 37 is mounted directly on the shaft of electromotor 36, but it is also possible for the gear 37 to be driven by an electromotor via a reduction gear.

**[0035]** Guide 13 is connected to the upper securing element 11, and that in such a manner that the axis of rotation 40, about which securing element 11 can rotate before being fixed to supporting element 2, intersects the central axis of guide 13.

**[0036]** Guide 13 is engaged by two guide wheels 26, 27, which are both rotatably journaled in guide unit 23, which is freely rotatable about axis of rotation 41.

**[0037]** Figure 4 shows the situation wherein the position of the lift on the rail system is such that the axis of rotation 33 of securing element 10 coincides with the axis of rotation 42 of the lower guide unit, and whereby the axis of rotation 40 of the upper securing element 11 coincides with the axis of rotation of the upper guide unit 23.

**[0038]** Figure 5 is a more detailed view of the rail system in assembled condition. The lower guide 12 is thereby fixed to securing element 10 by means of a bolt 43, because securing element 10 is provided with a hole, through which bolt 43 may extend, and guide 12 is provided with a threaded hole, into which bolt 43 can be screwed. By securing the guides 12, 13 to securing elements 10, 11 in this manner the tubes forming the guides 12, 13 can be reused without the threaded holes being objectionable thereby. Said holes may thereby be covered up by threading a screw therein.

**[0039]** Figure 6 substantially corresponds with Figure 3, but in this embodiment the third guide unit 52, which is capable of movement in vertical direction along guide 53, is positioned in such manner as to engage lower guide 12. An important advantage of this is that the path of movement of guide unit 53 in Figure 6 is shorter than the path of movement 28 in Figure 3.

**[0040]** Supporting element 2 is provided with a section 32, in which the securing element 10 is fixed by means of bolt 31, and that in the desired angular position

with respect to the central axis of bolt 31. Of course said securing may take place in several other ways in order to achieve the same effect. In a corresponding manner upper guide 13 is secured to supporting element 2. A bolt 44 is screwed into guide 13 thereby, thus fixing guide 13 to securing element 11 as well as fixing securing element 11 to supporting element 2.

**[0041]** Figure 5 moreover shows the manner in which the length of leg 3, 4 can be adjusted. To that end tube end 45 of supporting element 2 is slid into a tube section 46, which tube section 46 is slid over an upwardly directed stub of base 5. The tube ends 45 of the supporting elements may all have a standard length thereby, whilst the height of supporting element 2 is determined by the length of tube section 46, which can readily be cut to the required length. The interconnection between tube end 45 and tube section 46 may be effected in various ways, for example by passing a bolt through both sections.

**[0042]** When the rail system as described above is used it becomes possible to install the rail system in a relatively fast and simple manner, even without measuring the staircase precisely beforehand. All tubular elements can be shortened by means of hand-operated tools and made to size therewith. Any bends in the tubes may be formed at the factory beforehand, but it is also possible to obtain bends by shortening a circular tube section to a length such that the required bend is obtained.

**[0043]** After the supporting elements 2 have been mounted in suitable places on a staircase, the tube sections may be cut to the required length by means of simple techniques, which can be carried out with hand-operated tools. Then the tube sections are linked together by means of coupling elements, which are slid into two abutting tube sections. When the guides thus formed are then fixed in the correct position with respect to the supporting elements, the threaded holes for securing the guides may be provided therein by means of tools, which may be specially adapted to that end, which tools are supported on the securing elements occupying the correct position. Thus it has become relatively simple to provide a lift system.

**[0044]** Also the dismantling of the rail system can take place in a simple manner, such that the parts can be reused after being disassembled. The used parts may thereby be sorted and stored until certain parts can be reused. It is also possible, however, to form another lift assembly based on an existing lift assembly, and that to size for another staircase. By measuring both the old staircase and the new one and by making a relatively simple computation it will then be possible to determine what parts of the old lift assembly may remain unchanged, what parts need to be shortened or what parts need to be added.

**[0045]** The embodiment described above is to be considered as such and a great many variations are possible within the scope of the invention.

## Claims

1. A lift assembly comprising a rail system and a lift being capable of movement along said rail system, for example a chair lift (18,19,20,21) for a disabled person, whereby said lift can move upwards at an angle, at least along part of its path, said rail system comprising two guides (12,13) in the form of tubes having a substantially round annular cross-section, one (13) being provided substantially above the other (12), whereby the vertical spacing between said guides (12,13) depends on the angle of inclination of said guides and whereby both guides (12,13) are attached to supporting elements (2) which are secured to a wall or to steps of a staircase (1), characterized in that said two guides (12,13) are detachably connected to said supporting elements (2) and that each guide (12,13) consists of a number of detachably interconnected tube sections.
2. A lift assembly according to claim 1, characterized in that tube sections are interconnected by a coupling element (16) which is slid into both ends of interconnected tubes sections.
3. A lift assembly according to any one of the preceding claims, characterized in that a rack (38) is detachably secured to the supporting elements (2) near the lower guide (12), which can mesh with a driven gear (37) of the lift.
4. A method for installing a rail system along a staircase (1), wherein a number of supporting elements (2) are secured to the steps and/or to the floor and/or to a wall, after which two guides (12,13) in the form of tubes are secured to the supporting elements (2), one (13) substantially above the other (12), whereby the vertical spacing between said guides (12,13) depends on the angle of inclination of said guides, the tubes having a substantially round annular cross-section, characterized in that said two guides (12,13) are detachably connected to said supporting elements (2) and that each guide (12,13) is composed from a number of detachably interconnected tube sections.

## Patentansprüche

1. Eine Fahrstuhlordnung mit einem Schienensystem und einem Fahrstuhl, der entlang des Schienensystems bewegbar ist, zum Beispiel ein Fahrstuhl (18, 19, 20, 21) für eine körperbehinderte Person, wobei sich der Fahrstuhl (18, 19, 20) wenigstens über einen Teil seines Weges in einem Winkel aufwärts bewegen kann, besagtes Schienensystem umfaßt zwei Führungen (12, 13) in Form von Röhren, die einen im wesentlichen runden ringförmigen

migen Querschnitt aufweisen und von denen eine (13) im wesentlichen über der anderen (12) angeordnet ist, wobei der vertikale Abstand zwischen besagten Führungen (12, 13) vom Neigungswinkel der besagten Führungen abhängt und wobei beide Führungen (12, 13) mit Tragelementen (2) verbunden sind, die an einer Wand oder auf den Stufen einer Treppe (1) befestigt sind, gekennzeichnet dadurch, daß besagte zwei Führungen (12, 13) abnehmbar mit den Tragelementen (2) verbunden sind und daß jede Führung (12, 13) aus einer Anzahl von lösbar miteinander verbundenen Rohrabschnitten besteht.

2. Eine Fahrstuhlanordnung gemäß Anspruch 1, gekennzeichnet dadurch, daß Rohrabschnitte durch ein Kopplungselement (16) miteinander verbunden sind, die in beide Enden der miteinander verbundenen Rohrabschnitte eingeschoben sind.
3. Eine Fahrstuhlanordnung gemäß einem der vorausgehenden Ansprüche, gekennzeichnet dadurch, daß nahe der unteren Führung (12) eine Zahnstange (38) mit den Tragelementen (2) abnehmbar befestigt ist, die mit einem angetriebenen Zahnrad (37) des Fahrstuhls in Eingriff stehen kann.
4. Verfahren zum Installieren eines Schienensystems entlang einer Treppe (1), worin eine Anzahl von Tragelementen (2) auf den Stufen und/oder dem Fußboden und/oder an einer Wand befestigt werden, wonach zwei Führungen (12, 13) in Form von Rohren an den Tragelementen (2) befestigt werden, von denen eine (13) im wesentlichen über der anderen (12) angeordnet ist, wobei der vertikale Abstand zwischen den besagten Führungen (12, 13) vom Neigungswinkel der besagten Führungen abhängt und wobei die Rohre einen im wesentlichen runden ringförmigen Querschnitt aufweisen, gekennzeichnet dadurch, daß besagte zwei Führungen (12, 13) abnehmbar mit den Tragelementen (2) verbunden sind und daß jede Führung (12, 13) aus einer Anzahl von lösbar miteinander verbundenen Rohrabschnitten zusammengesetzt ist.

siblement au-dessus de l'autre (12), dans lequel l'espacement vertical entre lesdits guides (12,13) dépend de l'angle d'inclinaison desdits guides et dans lequel les deux guides (12,13) sont fixés à des éléments de support (2) qui sont fixés à une paroi ou aux marches d'une cage d'escalier (1), caractérisé en ce que lesdits deux guides (12,13) sont fixés de façon démontable auxdits éléments de support (2) et que chaque guide (12,13) est constitué d'un certain nombre de sections de tubes interconnectées de façon démontable.

2. Ensemble élévateur selon la revendication 1, caractérisé en ce que les sections de tubes sont interconnectées par un élément de couplage (16) qui est monté à coulissement à l'intérieur des deux extrémités des sections de tubes interconnectées.
3. Ensemble élévateur selon l'une quelconque des revendications précédentes, caractérisé en ce qu'une crémaillère (38) est fixée de façon démontable aux éléments de support (2) à proximité du guide inférieur (12), qui peut engrener avec un pignon d'entraînement (37) de l'élévateur.
4. Procédé d'installation d'un système de rail le long d'une cage d'escalier (1), dans lequel un certain nombre d'éléments de support (2) sont fixés aux marches et/ou au plancher et/ou à une paroi, après quoi deux guides (12,13) sous la forme de tubes sont fixés aux éléments de support (2), l'un d'entre eux (13) étant situé sensiblement au-dessus de l'autre (12), dans lequel l'espacement vertical entre lesdits guides (12,13) dépend de l'angle d'inclinaison desdits guides, les tubes ayant une section transversale annulaire sensiblement ronde, caractérisé en ce que lesdits deux guides (12,13) sont fixés de façon à pouvoir être démontables par rapport auxdits éléments de support (2) et que chaque guide (12,13) est constitué d'un certain nombre de sections de tubes interconnectées de façon démontable.

## Revendications

1. Ensemble élévateur comprenant un système de rail et un dispositif élévateur susceptible de se déplacer le long dudit système de rail, par exemple un siège élévateur (18,19, 20,21) pour personne infirme, dans lequel ledit dispositif élévateur peut se déplacer en montant sous un certain angle, au moins le long d'une partie de son trajet, ledit système de rail comprenant deux guides (12,13) sous la forme de tubes présentant une section transversale annulaire sensiblement ronde, dont l'un (13) est prévu sen-

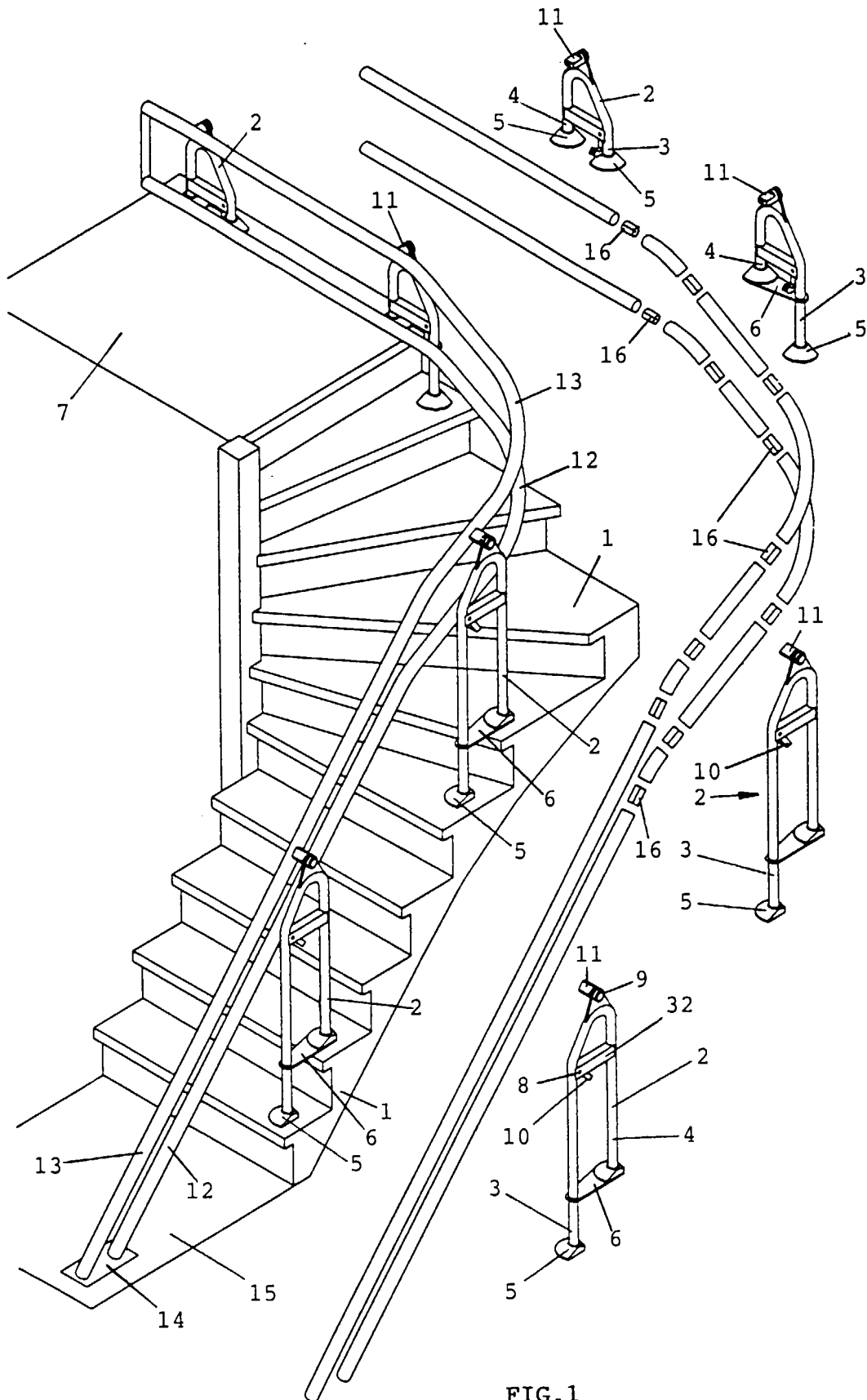


FIG.1

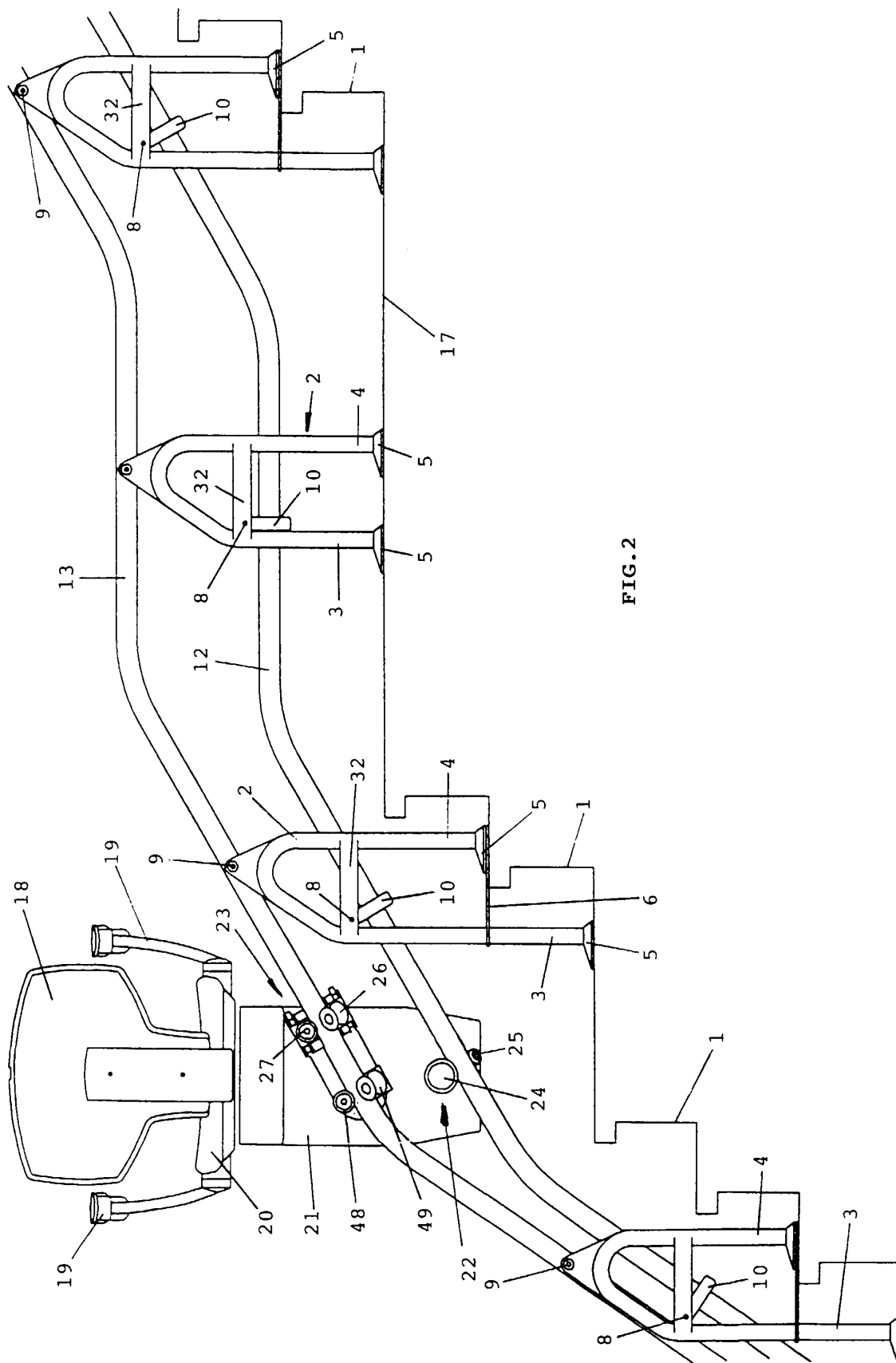


FIG. 2

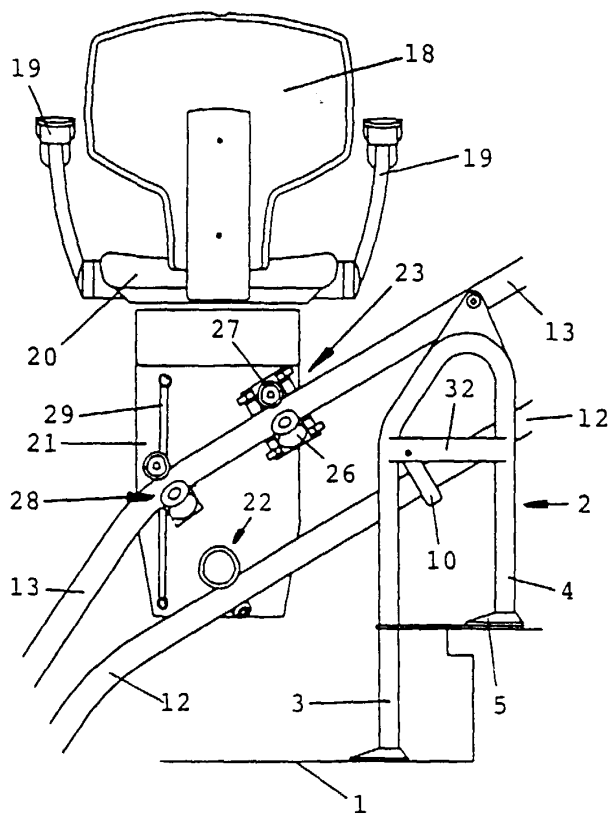


FIG. 3

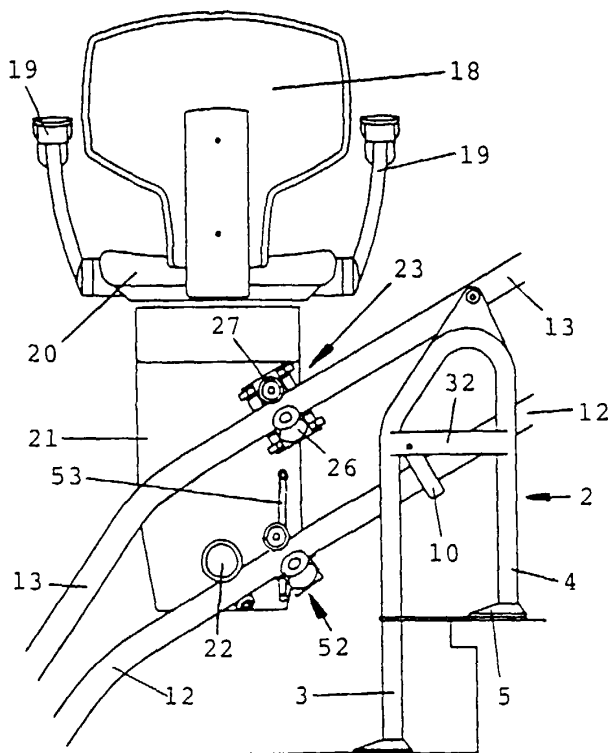


FIG. 6

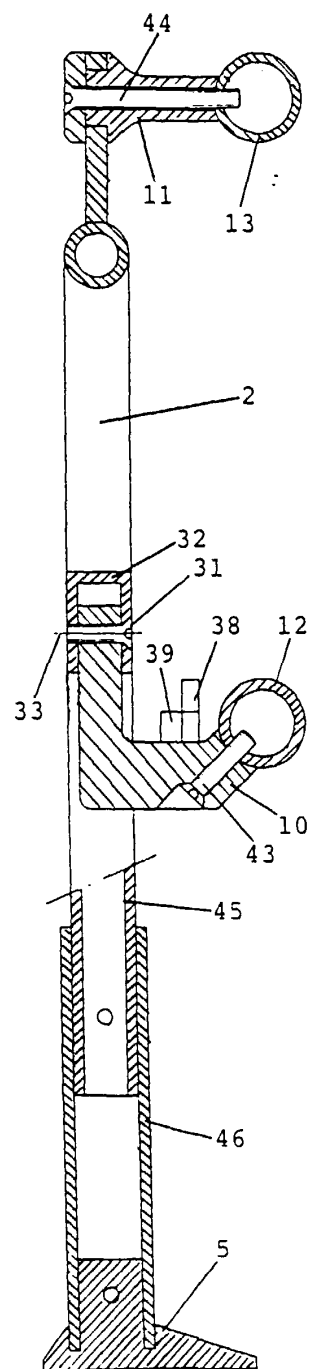


FIG. 5

