

(19)



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(11)

**EP 0 793 614 B1**

(12)

**EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention  
of the grant of the patent:

**17.03.1999 Bulletin 1999/11**

(21) Application number: **95937219.4**

(22) Date of filing: **23.11.1995**

(51) Int Cl.®: **B66B 9/08**

(86) International application number:  
**PCT/NL95/00401**

(87) International publication number:  
**WO 96/15974 (30.05.1996 Gazette 1996/25)**

(54) **STAIRLIFT**

TREPPENAUFZUG

CHAISE-ASCENSEUR

(84) Designated Contracting States:  
**AT BE CH DE DK ES FR GB GR IE IT LI LU MC NL  
PT SE**

(30) Priority: **23.11.1994 NL 9401963**

(43) Date of publication of application:  
**10.09.1997 Bulletin 1997/37**

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**Description**

**[0001]** The invention relates to a stairlift, comprising:

a main frame,  
 a support rail to be arranged along a staircase at some height thereabove;  
 support means for supporting said main frame such that it is movable along said support rail;  
 a first electric motor for moving the main frame along the support rail;  
 a support supported by the main frame for carrying a chair; and  
 leveling means for keeping the support in a fixed position relative to the horizontal.

**[0002]** Such a stairlift is e.g. known from EP-A-0 560 433.

**[0003]** The prior art stairlift is provided with leveling means which are embodied as a curve disc and a follower cam associated therewith. The curve urges the follower to follow a specific path with double sided control. The follower is associated with adjusting means for the angular position relative to a horizontal of the chair carried by the support. The information contained in the curve exactly corresponds with the specific anticipated angular position changes inherent to the specific arrangement and shape of the support rail.

**[0004]** The prior art system, therefore, does not allow any change or adaptation to a different situation. Furthermore, the prior art system allows only for correction of the angular position of a chair in one single degree of freedom. Thus, the prior art system does not allow corrections in any of the two remaining degrees of freedom. Due to this lack of ability for correction it cannot basically be avoided that the chair during its path along the support rail is subject to undesired angular deviations that cannot be compensated for.

**[0005]** It is a purpose of the invention to provide a stairlift allowing a ready adaptation or adjustment of the levelling means to other circumstances.

**[0006]** It is a further purpose of the invention to provide a stairlift that allows a complete correction of any deviation of the chair from that nominal position, i.e. including a correction in three degrees of freedom.

**[0007]** According to the invention these purposes are fulfilled by a stairlift as defined in Claim 1.

**[0008]** Such a stairlift can have the special feature that the first rotation degree of freedom is intended for up and downward pivoting of the support on a first, at least more or less horizontally extending axis. This first axis can advantageously extend in a plane which coincides with, or is located a short distance from, the main plane of the seat of a chair or wheelchair.

**[0009]** Another special feature of the stairlift can lie in the fact that the second rotation degree of freedom is intended for pivoting the support round a second axis extending substantially transversely of the rail and at

least more or less in horizontal direction. This second axis will preferably extend in the median plane of a chair or wheelchair and extend in the main plane of the seat or at a distance thereunder.

**[0010]** Said last two special features can be combined in a variant wherein the first and the second axis are at least more or less intersecting. In this embodiment the two rotation degrees of freedom extend substantially in one plane. The cardan mobility of the support determined by these degrees of freedom ensures a complete adaptability to any angle of inclination defined by the support rail.

**[0011]** The stairlift is further embodied such that it is able to displace in the translation degree of freedom such that a user effectively avoids contact with obstacles. In particular such an embodiment can display the feature that the translation degree of freedom is intended for moving the support up and downward.

**[0012]** The simplest possible control is ensured with an embodiment in which the three said degrees of freedom are mutually independent.

**[0013]** The stairlift is preferably provided with a battery. This battery is arranged for example on the main frame or the chair, in any case is movable together with the stairlift. The use of cables or drag connections is hereby avoided.

**[0014]** In order to always keep the battery in optimum charged state or to restore the charged state as required, the embodiment is recommended in which on at least one end of the support rail is placed a terminal of a charging device which can co-act with a complementary terminal which is present on the stairlift and which is connected to the battery for charging the battery in the coupled state of said terminals.

**[0015]** A practical embodiment displays the special feature that the first electric motor drives a toothed wheel which can co-act with a toothing arranged on the support rail, for instance a cardan fixed chain supported thereby. The use of a cardan fixed chain offers the option of following not only variations of angle in a vertical plane but also variations of angle in a horizontal plane.

**[0016]** The stairlift is preferably provided with a central control unit for operating by a user. For this purpose use can be made for example of a control unit bearing a plurality of control buttons which is arranged in an arm of the chair.

**[0017]** The stairlift preferably has the special feature that the central control unit is of the self-learning type. This latter embodiment has the advantage that the position adjustment in each of the three degrees of freedom does not have to be programmed in advance depending on the current position of the stairlift, but that through a learning process these positions for a given path of the support rail are automatically followed by the system. In the learning phase it can for example be ensured by external means that during use the chair is situated in each position along the path such that the seat is for instance situated in a substantially horizontal po-

sition or displays a selected variation therefrom. A suitable position can be programmed for stepping in and out at both end locations.

[0018] The invention will now be elucidated with reference to the annexed drawings, in which:

figure 1 shows a schematic perspective view of a stairlift according to the invention; and  
figure 2 shows a partly broken away perspective view on enlarged scale of that part of the stairlift into which the invention is incorporated.

[0019] Figure 1 shows a staircase 1 consisting of a plurality of parts, which is bounded on one side by walls 2. A support rail 4 consisting of segments is fixed to these walls by means of support bolts 3. For the sake of an optimal mechanical strength and safety this support rail 4 is further supported by supports 5 which rest with joint foot plates 6 on the treads 7 of the staircase.

[0020] As figure 1 shows, the stairlift carries a chair 8 with a seat 9 and a back 10, and a footrest 11 supported by the seat. As will be elucidated below with reference to figure 2, the chair is supported such that it is movable in three degrees of freedom.

[0021] The first degree of freedom is a rotation degree of freedom, which is indicated with reference numeral 12. In this rotation degree of freedom the chair 8 is pivotable up and downward round an axis 13.

[0022] In a second rotation degree of freedom 14 the chair 8 is pivotable round an axis 15.

[0023] In a third degree of freedom, a translation, the chair 8 is movable up and downward. This movement is not strictly vertical but has a vertical component. This degree of freedom is designated in the drawing with the reference numeral 16.

[0024] As is shown clearly in figure 1, the position of the support rail 4 is greatly variable along its length. The three degrees of freedom of the stairlift according to the invention enable full adaptation thereof. The position variations of the chair 9 are compensated by the rotation degrees of freedom 12 and 14, while the height adjustment is provided by the third degree of freedom 16. This may for instance be necessary to avoid contact between the head of a user and a relatively low ceiling edge 17. Use is made for this purpose of a motor 43 with output spindle shaft 44 which co-acts with a wire (not drawn) present in the block 32.

[0025] Figure 2 shows that the support rail 4 is open on the underside and supports a cardan linked chain 18. Through driving of the stairlift 19 this chain can co-act with a toothed wheel 20 which is driven by an electric motor 22 via a worm transmission 21. This electric motor 22 is of a relatively heavy type, since it must be capable of carrying the entire weight of a user and the stairlift 19 upward along the support rail 4. The motor 22 is supported by a main frame 23 which is rollable along support rail 4 by means of rollers generally designated 24.

[0026] The main frame 23 supports via an axis 13 an

auxiliary frame 25 by means of an electric motor 26 which can drive a threaded spindle 27 and the position of auxiliary frame 25 is adjustable relative to the main frame 23. For this purpose the spindle 27 co-acts with a tube 28 provided with internal thread which co-acts pivotally with a bracket 29 which is connected to an auxiliary frame 25 via sliding rods 30,31. The sliding rods 30,31 serve for slidable guiding of a support block 32 which bears a support shaft 33 rotatably round an axis 15. Supports 34 for the chair 8 are connected to support shaft 33. To the support shaft 33 is connected a toothed bracket 35 which co-acts with a toothed wheel driven by an electric motor 36. By driving the motor 36 the chair 8 can be pivoted round the axis 15. The folding arm-rest 38 carries a control panel 39.

[0027] It has not been shown that the stairlift 19 carries rechargeable batteries. Figure 1 shows that a terminal 40 is fixed to the seat of the chair which can contact with terminals 41,42 of a charging device arranged at the ends of the support rail. The batteries can hereby be recharged in the end positions of the stairlift.

## Claims

### 1. Stairlift, comprising:

a main frame;  
a support rail to be arranged along a staircase at some height thereabove;  
support means for supporting said main frame such that it is movable along said support rail;  
a first electric motor for moving the main frame along the support rail;  
a support supported by the main frame for carrying a chair; and  
leveling means for keeping the support in a fixed position relative to a horizontal;

### characterized in that

the leveling means comprise an auxiliary frame supported by the main frame for carrying a chair, for example a wheel chair, via the support, such that the support is movable and fixable relative to the main frame by three auxiliary electric motors in two rotation degrees of freedom and one translation degree of freedom.

2. Stairlift as claimed in claim 1, wherein the first rotation degree of freedom is intended for up and downward pivoting of the support on a first, at least more or less horizontally extending axis.

3. Stairlift as claimed in claim 1, wherein the second rotation degree of freedom is intended for pivoting the support round a second axis extending substantially transversely of the rail and at least more or less

in horizontal direction.

4. Stairlift as claimed in claims 2 and 3, wherein the first and the second axis are at least more or less intersecting. 5
5. Stairlift as claimed in claim 1, wherein the translation degree of freedom is intended for moving the support up and downward. 10
6. Stairlift as claimed in claim 1, wherein the three said degrees of freedom are mutually independent.
7. Stairlift as claimed in claim 1, comprising a battery. 15
8. Stairlift as claimed in claim 7, wherein on at least one end of the support rail is placed a terminal for a charging device which can co-act with a complementary terminal which is present on the stairlift and which is connected to the battery for charging the battery in the coupled state of said terminals. 20
9. Stairlift as claimed in claim 1, wherein the first electric motor drives a toothed wheel which can co-act with a toothing arranged on the support rail, for example a cardan fixed chain supported thereby. 25
10. Stairlift as claimed in claim 1, comprising a central control unit for operating by a user. 30
11. Stairlift as claimed in claim 10, wherein the central control unit is of the self-learning type. 35

#### Patentansprüche

1. Treppenaufzug mit:

einem Hauptrahmen;  
 einer Tragschiene, die entlang eines Treppenaufganges an einer Höhe darüber anzuordnen ist;  
 einem Tragmittel zum Tragen des Hauptrahmens derart, daß er entlang der Tragschiene bewegbar ist;  
 einem ersten Elektromotor zum Bewegen des Hauptrahmens entlang der Tragschiene;  
 einem Träger, der von dem Hauptrahmen zum Tragen eines Stuhles getragen wird;  
 einem Nivelliermittel zum Halten des Trägers in einer festen Position relativ zu einer Horizontalen;

dadurch gekennzeichnet,

daß das Nivelliermittel einen von dem Hauptrahmen getragenen Hilfsrahmen zum Tragen eines Stuhles, zum Beispiel eines Rollstuhles

durch den Träger aufweist,  
 so daß der Träger relativ zu dem Hauptrahmen durch drei Hilfselektromotoren in zwei Rotationsfreiheitsgraden und einem Translationsfreiheitsgrad bewegbar und fixierbar ist.

2. Treppenaufzug nach Anspruch 1, bei dem der erste Rotationsfreiheitsgrad zum Aufwärts- und Abwärts-schwenken des Trägers auf einer ersten sich mindestens mehr oder weniger horizontalen erstreckenden Achse vorgesehen ist.
3. Treppenaufzug nach Anspruch 1, bei dem der zweite Rotationsfreiheitsgrad zum Schwenken des Trägers um eine zweite Achse, die sich im wesentlichen quer zu der Schiene und mindestens mehr oder weniger in der horizontalen Richtung erstreckt, vorgesehen ist.
4. Treppenaufzug nach Ansprüchen 2 und 3, bei dem sich die erste und zweite Achse mindestens mehr oder weniger schneiden.
5. Treppenaufzug nach Anspruch 1, bei dem der Translationsfreiheitsgrad zum Bewegen des Trägers nach oben und nach unten vorgesehen ist.
6. Treppenaufzug nach Anspruch 1, bei dem die drei Freiheitsgrade unabhängig voneinander sind.
7. Treppenaufzug nach Anspruch 1 mit einer Batterie.
8. Treppenaufzug nach Anspruch 7, bei dem auf mindestens einem Ende der Tragschiene ein Anschluß für eine Ladeeinrichtung, die mit einem komplementären Anschluß zusammenwirken kann, der auf dem Treppenaufzug vorhanden ist und der mit der Batterie verbunden ist, zum Aufladen der Batterie in dem verbundenen Zustand der Anschlüsse angeordnet ist.
9. Treppenaufzug nach Anspruch 1, bei dem der erste Elektromotor ein Zahnrad antreibt, das mit einer Zahnung zusammenwirkt, die auf der Tragschiene angeordnet ist, zum Beispiel eine kardanbefestigte Kette, die dadurch getragen ist.
10. Treppenaufzug nach Anspruch 1 mit einer zentralen Steuereinheit zur Betätigung durch einen Benutzer.
11. Treppenaufzug nach Anspruch 10, bei dem die zentrale Steuereinheit vom selbstlernenden Typ ist.

#### Revendications

1. Ascenseur d'escalier comprenant :

un châssis principal ;  
 un rail de support devant être agencé le long d'un escalier à une certaine hauteur de celui-ci ;  
 des moyens de support destinés à supporter le dit châssis principal de telle sorte qu'il soit mobile le long dudit rail de support ;  
 un premier moteur électrique pour déplacer le châssis principal le long du rail de support ;  
 un support supporté par le châssis principal pour supporter un fauteuil ; et  
 des moyens de mise à niveau pour maintenir le support dans une position fixe par rapport à l'horizontale ;

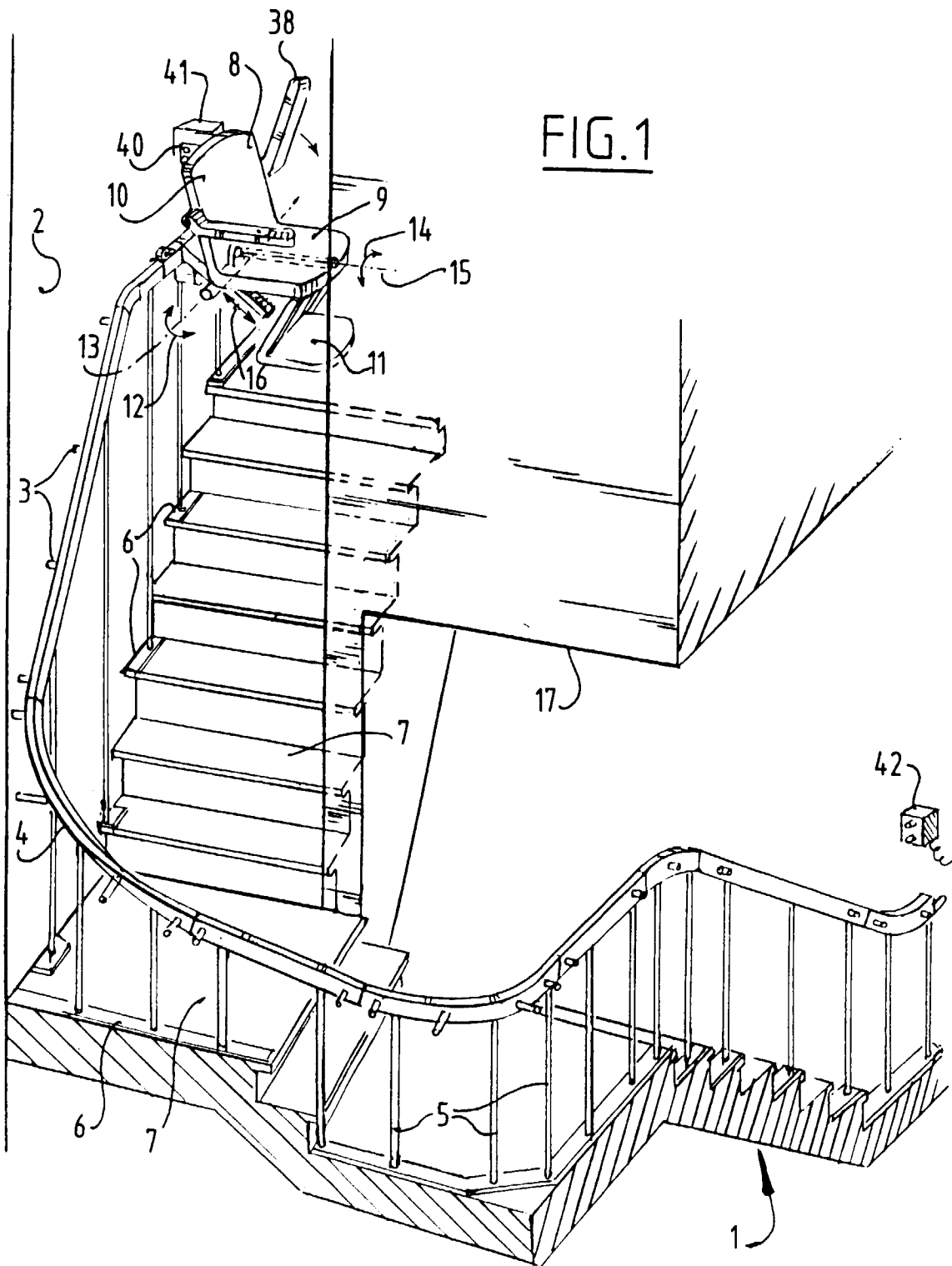
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les moyens de mise à niveau comprennent un châssis auxiliaire supporté par le châssis principal pour supporter un fauteuil, par exemple un fauteuil roulant, par l'intermédiaire d'un support, de telle sorte que le support peut être déplacé et fixé par rapport au châssis principal par trois moteurs électriques auxiliaires selon deux degrés de liberté de rotation et un degré de liberté de translation.

2. Ascenseur d'escalier selon la revendication 1, dans lequel le premier degré de liberté de rotation est prévu pour un pivotement vers le haut et vers le bas du support sur au moins un premier axe s'étendant plus ou moins horizontalement. 30
3. Ascenseur d'escalier selon la revendication 1, dans lequel le second degré de liberté de rotation est prévu pour faire pivoter le support autour d'un second axe s'étendant sensiblement transversalement au rail et au moins plus ou moins dans la direction horizontale. 35  
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4. Ascenseur d'escalier selon les revendications 2 et 3, dans lequel les premier et second axes, au moins, se recoupent plus ou moins.
5. Ascenseur d'escalier selon la revendication 1, dans lequel le degré de liberté de translation est prévu pour déplacer le support vers le haut et vers le bas. 45
6. Ascenseur d'escalier selon la revendication 1, dans lequel les trois dits degrés de liberté sont indépendants les uns des autres. 50
7. Ascenseur d'escalier selon la revendication 1, comprenant une batterie. 55
8. Ascenseur d'escalier selon la revendication 7, dans lequel, sur au moins une extrémité du rail de support, est placée une borne pour un dispositif de

charge pouvant agir conjointement avec une borne complémentaire qui est présente sur l'ascenseur d'escalier et qui est reliée à la batterie pour charger la batterie lorsque lesdites bornes sont à l'état coupé.

9. Ascenseur d'escalier selon la revendication 1, dans lequel le premier moteur électrique entraîne une roue dentée qui peut agir conjointement avec une denture agencée sur le rail de support, par exemple une chaîne fixe à cardan supportée par celui-ci.
10. Ascenseur d'escalier selon la revendication 1, comprenant une unité de commande centrale destinée à être manipulée par un utilisateur.
11. Ascenseur d'escalier selon la revendication 10, dans lequel l'unité de commande centrale est du type auto-adaptatif.



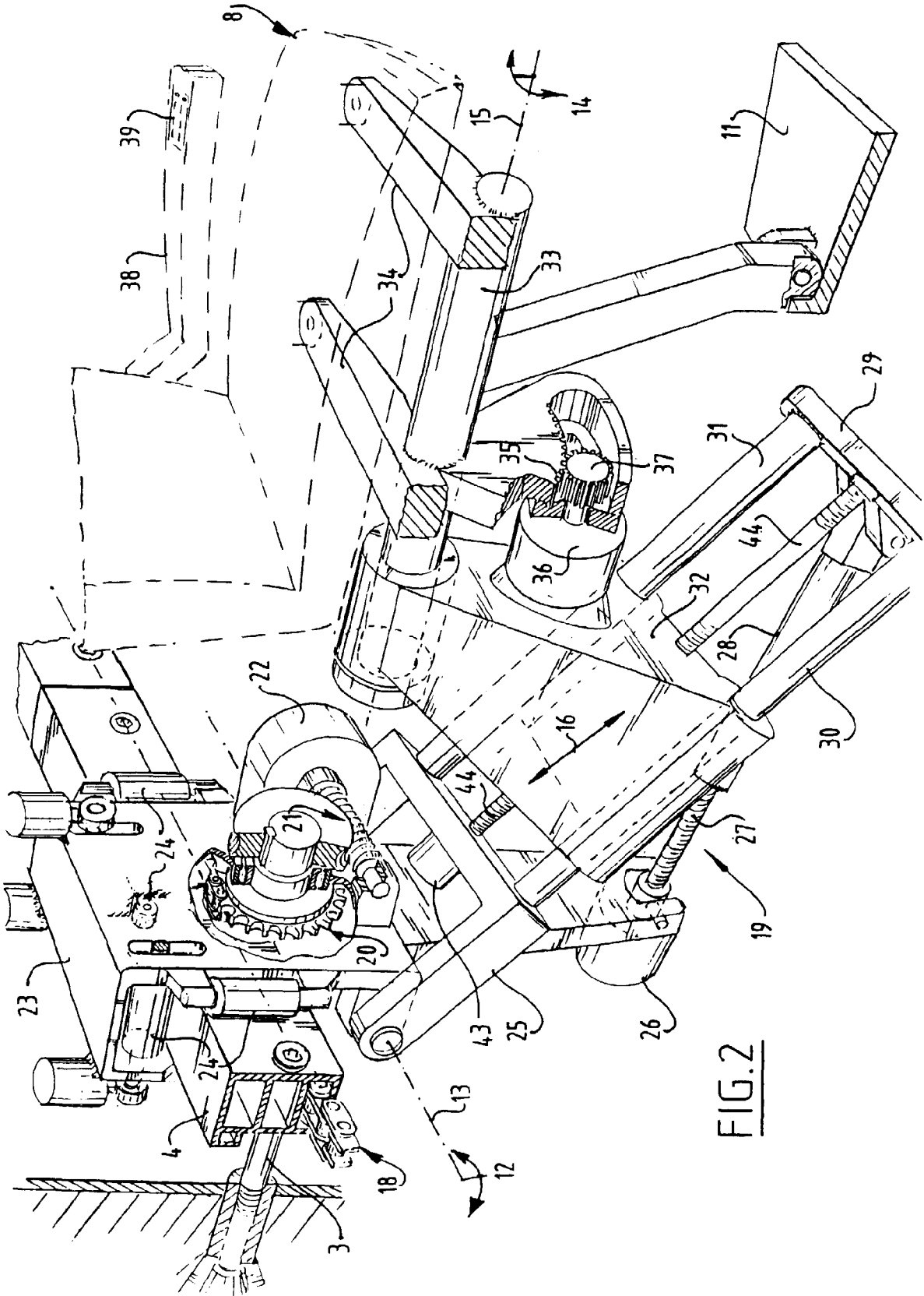


FIG. 2