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(54) A movable footrest and a chair unit for a chair lift provided with such a footrest

(57) A movable footrest (1) for a chair comprising a frame (2), which footrest (1) can be moved between an inoperative position and a substantially horizontal operative position, comprises moving means, which move the free end (3') of the footrest (1) in a path in a substantially horizontal plane when the footrest (1) is being moved. The movement which the footrest makes when being moved requires little space, as a result of which the accessibility of the chair, in particular of a chair unit for a chair lift, and the ease of operation of the footrest are improved.

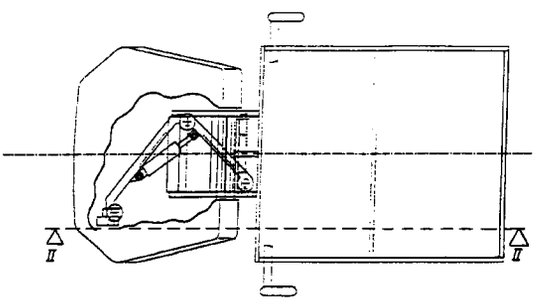

Fig. 3

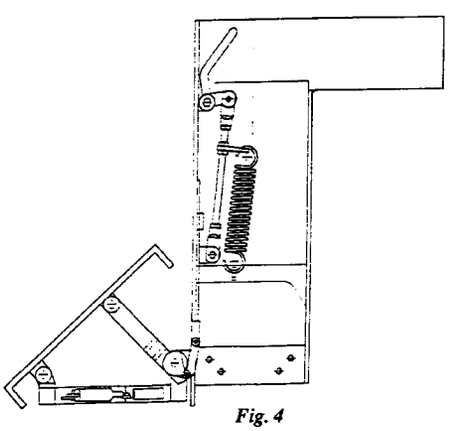

Fig. 4

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Description

The invention relates to a footrest for a chair comprising a frame, in particular for a chair unit for a chair lift, which footrest can be moved by moving means between an inoperative position and a substantially horizontal operative position.

A footrest of the above type, in particular for a chair unit for a chair lift, is for example known from NL-A-9200437.

Chair lifts are used for moving in particular handicapped people in seated position on the chair unit between various floors of buildings. Chair lifts are in particular installed along the staircase of existing houses when one of the occupants has difficulty walking or becomes handicapped.

The known footrest serves to support the feet of a person to be conveyed, and in addition to that functions to prevent said person from sliding off the seat while being conveyed. The footrest can be pivoted between a horizontal operative position and a vertical inoperative position by means of a hinge construction, which is secured to the frame of the chair unit. During the pivoting movements of the footrest the free end thereof describes a quarter circle.

A considerable advantage of making the footrest capable of hinging movement is that when the chair lift is not being used, swinging back the footrest into a substantially vertical position will result in a widened stairway passage for the other occupants. Generally this passage is considerably reduced as a result of the presence of the chair lift.

The known construction also has a number of drawbacks, however. In the first place the accessibility of the chair to a handicapped person is limited. The handicapped person must first swing down the footrest before being able to sit down on the chair. In order to do so he must assume an uncomfortable bending position from a position in front of or beside the chair and bend forwards or sideways until he can operate the control mechanism of the footrest, or straddle uncomfortably while standing in front of the chair, so that the footrest can move between his lower legs. These are difficult positions for users of chair lifts of this type. When straddling there is the additional problem that when the footrest is swung back, the handicapped person's clothes may get stuck between the footrest and the chair. This may for example happen when users wear a skirt or a dress.

The object of the present invention is to eliminate the above drawbacks and provide a footrest whose construction does not interfere with the accessibility of the chair and which provides an enhanced ease of operation of the footrest.

According to the invention these objectives are accomplished by providing a footrest of the type referred to above, which is characterized in that the moving means move the free end of the footrest in a path in a substantially horizontal plane when the footrest is being moved.

Since the free end of the footrest has a substantially horizontal component of movement, the ease of operation for the user is considerably enhanced. The user no longer needs to assume uncomfortable positions in order to move the footrest between the inoperative position and the operative position.

A first movement which can be made by the footrest under the influence of the moving means is a sliding or rotary movement of the entire footrest in a horizontal plane, whereby the inoperative position is a horizontal position under the frame of the chair or between the upright elements of said frame.

With the chair lifts now being used the space available for receiving the footrest under and within the frame of the chair unit is limited, as the driving and control units of the chair units are provided there.

In one preferred embodiment of the footrest according to the invention, wherein the footrest is substantially contiguous to the frame and wherein the inoperative position is a substantially vertical position along the frame, the moving means comprise first and second moving means, which each act on the footrest and the frame in different points of application and which cooperate with each other when moving the footrest, in such a manner that the end of the footrest located near the frame of the chair in the operative position moves substantially vertically along the frame and the other, free end of the footrest moves in a substantially horizontal direction.

In this manner the movements which the footrest makes when being moved from one position to the other require only relatively little space in comparison with the amount of space required for the quarter circle movement of the known footrest. As is the case with the above-described embodiment of the footrest according to the invention, this embodiment enables the person to be conveyed to assume a comfortable position in order to operate the footrest by means of a control mechanism. Furthermore it is possible for the said person to sit down on the chair first and then move the footrest to the operative position. In that case the footrests moves behind that person's legs and under his feet, so that the person to be conveyed only needs to lift his feet a little. This lifting movement is moreover facilitated by the "scooping" movement of the footrest.

It will be appreciated that when the supporting surface of the footrest is not contiguous to the frame, the substantially vertical movement of the side directed towards the frame will likewise comprise a substantial horizontal component of movement.

In one simple embodiment of the footrest according to the invention said first moving means comprise a hinge construction, which construction comprises a first hinged arm, whose one end is secured to a substantially horizontal first pivot axis positioned at the bottom of the frame of the chair, and whose other end is connected with a second arm, in such manner as to be capable of pivoting movement about a second horizontal pivot axis, to which second arm the footrest is secured.

(The Dutch word 'scharnieras' will be translated in the English text by 'pivot axis', however it also has the meaning of 'pivot pin'.)

In one preferred embodiment of this hinge construction the footrest itself constitutes the second arm of the hinge construction of the first moving means.

In order to facilitate tilting of the footrest about the second horizontal pivot axis and to conceal the hinge construction behind the footrest in the inoperative position, the length of the footrest between the second horizontal pivot axis and the free end of the footrest is greater than the length of the first hinged arm. Thus the tilting movement of the footrest about the second horizontal pivot axis is supported by the self-weight of the footrest.

In a first embodiment of the second moving means said second moving means comprise a hinge construction comprising a third hinged arm, whose one end can pivot about a vertical pivot axis positioned near the frame and whose other end is pivotally connected, by means of a fourth vertical pivot axis, with the one end of a fourth hinged arm, the other end of said fourth hinged arm being pivotally connected with the footrest by means of a fifth vertical pivot axis and a sixth horizontal pivot axis. When the footrest is being moved the second moving means of the footrest according to the invention thus guide and direct the free end of the footrest in a path which lies in a horizontal plane. In most cases a substantially horizontal movement of the free end will be required, since the height available for the movement is limited by the presence of the floor, whilst it is advantageous for the person to be conveyed that said free end does not move upwards too much during the movement from the operative position to the inoperative position and vice versa. In addition to this said second moving means function to support the footrest in the operative position, so that it will not tilt about the second horizontal pivot axis under the influence of its own weight and/or the weight of the user. Of course the hinge constructions will be adapted to the safety requirements.

In order to further support this supporting function of the hinge construction and to be able to stow away the hinge construction behind the footrest in the inoperative position, the third and fifth vertical pivot axis of the hinge construction of the second moving means are advantageously positioned in the area between the longitudinal axis and one side of the footrest.

Furthermore the third and fourth hinged arms of this hinge construction are advantageously locked in the operative position by locking means. A simple embodiment thereof comprises a piston/cylinder assembly, the piston of said assembly being connected with one hinged arm and the cylinder of said assembly being connected with the other hinged arm.

In another, constructionally simple embodiment of the second moving means said moving means comprise a finite length of material, which is stretched between a first point of attachment, which does not move with respect to the frame, and a second point of attachment, which does not move with respect to the footrest, whereby the distance between said first point of attachment and the point of application of the first moving means on the footrest, and the distance between the second point of attachment and the point of application of the first moving means on the frame do not change when the footrest is being moved. The finite length of material, for example a length of chain or a cable, is stretched between two points of attachment, in such a manner that when the footrest is being moved the free end thereof will move in a substantially horizontal plane. In addition to that said finite length of material functions to keep the footrest horizontal in the operative position, transmitting the forces exerted thereon to the frame.

In order to maintain the tension in the length of material said finite length of material is stretched between the two points of attachment in such a manner that when the footrest is being moved from the operative position to the inoperative position, the end of said length of material connected with the footrest winds up on a pulley mounted on the second horizontal pivot axis and that the end of said material connected with the frame unwinds from a pulley mounted on the first horizontal pivot axis. If the second horizontal pivot axis of the first moving means is positioned correctly, said winding and unwinding of the finite length of material on and from the respective pulleys during the movement of the footrest will take place under the influence of the self-weight of the footrest. Instead of using pulleys it will of course also be possible to use other means whose axis coincides with the longitudinal axis of the respective pivot axes, such as sleeves, rings and the like.

In another embodiment the footrest may be locked in the operative position by means of a locking mechanism. The first hinged arm and the part of the footrest that is positioned near the hinged arm in the operative position are advantageously provided with locking means, which lock the footrest in the operative position, and the second horizontal pivot axis is positioned in such manner as to be movable in the longitudinal direction of the hinged arm under the influence of pressure means with a view to operating the locking means. In order to be able to release the locking means, the free end will first describe a small part of a circular motion during the movement of the footrest, whereupon the substantially horizontal movement of the free end will take place as soon as the locking engagement has been released. The locking means may for example be a hook secured to the bottom side of the footrest, which hook engages a catch mounted on the hinged arm.

The moving means, in particular the first horizontal hinged arm of the first moving means, are advantageously connected with a control mechanism. This mechanism may be the same mechanism as used with the already existing chair units for chair lifts. A mechanism of this type comprises a grip, which is connected with a system consisting of several rods. Thus the footrest in existing chairs for chair lifts can be readily exchanged for the footrest according to the invention.

The invention furthermore relates to a chair unit for a chair lift, comprising a frame which is movable along guide means, driving means for moving said frame, a seat part and a back support, said chair unit being provided with a footrest according to the invention.

The footrest according to the invention will be explained in more detail hereafter with reference to the accompanying drawing, in which:

Figure 1 is a partially cut-away plan view of one embodiment of the footrest according to the invention in the operative position;
Figure 2 is a cross-sectional view along line I - I in Figure 1;
Figure 3 is a partially cut-away plan view of the footrest shown in Figure 1 in an intermediate position during movement thereof;
Figure 4 is a cross-sectional view along line II - II in Figure 3;
Figure 5 is a partially cut-away plan view of the footrest shown in Figure 1 in the inoperative position;
Figure 6 is a cross-sectional view along line III - III in Figure 5;
Figure 7 is a diagrammatic illustration of another embodiment of the second moving means of the footrest; and
Figure 8 is a diagrammatic illustration of a third embodiment of the footrest, which is provided with a locking mechanism.

Figures 1 and 2 show an embodiment of the footrest according to the invention in side view, whereby the footrest 1 is in the horizontal operative position. The frame of a chair unit for a chair lift is as a whole indicated at 2. The first moving means, which move the end 3 of the footrest 1 positioned near the frame in the operative position substantially vertically along the frame 2 when moving the footrest in cooperation with the second moving means, comprise a first hinged arm 4, whose one end is fixedly connected with a first horizontal pivot axis 5 journalled in the frame 2. This pivot axis 5 is in turn actuated by a control mechanism 6. The construction and operation of said mechanism will not be discussed in detail herein, as they are sufficiently well known from the prior art. The first hinged arm 4 is secured to the footrest 1 by means of a second horizontal pivot axis 7. In this case the footrest 1 forms the second arm of the hinge construction of the first moving means. As is apparent from the Figure, the second horizontal pivot axis 7 is offset from the centre of the footrest 1. In this embodiment the second moving means, which in use support the free end 3' of the footrest 1 and guide said free end 3' when the footrest is being moved, comprise a third hinged arm 8, whose one end can pivot about a third vertical pivot axis 9 located within the frame 2. One end of a fourth hinged arm 10 is secured to the other end of the third hinged arm 8, capable of pivoting movement about a fourth vertical pivot axis 11. A fifth vertical pivot axis 12 journalled in the footrest 1 constitutes, together with a sixth horizontal pivot axis 13, the pivot point for the other end of the fourth hinged arm 10.

As is apparent from Figure 1, the third and fifth vertical pivot axes are journalled in the area between the longitudinal axis of the footrest and one side thereof. Furthermore Figure 1 shows a piston/cylinder assembly 14, which connects the two hinged arms 8 and 10. This assembly locks the hinge construction of the second moving means in the operative position and damps the downward movement of the moving means when the footrest is being moved. Another means suitable for said locking and damping is for example a spring.

Figures 3 and 4 show an intermediate position of the embodiment of the footrest according to the invention shown in Figure 1. These Figures clearly illustrate that the ends 3 and 3' of the footrest describe a substantially vertical movement along the frame 2 and a horizontal movement in the direction of the frame, respectively. Furthermore it is apparent that when the footrest 1 terminates at the horizontal pivot axis 7, for example when the hinged arm is provided with a supporting part, the side of the footrest 1 directed towards the frame 2, which side is in this case positioned near the pivot axis 7, will make a movement which has a substantial horizontal component of movement. Also in that case the free end 3' will move in a horizontal path, however.

Figures 5 and 6 show the inoperative, vertical position of the footrest, whereby the hinge constructions of the first and second moving means are covered by the footrest.

Figure 7 diagrammatically shows a second embodiment of the footrest according to the invention in three different positions. The first moving means of this embodiment, which are identical to those of the embodiment described above, are indicated by the same reference numerals. This second embodiment is characterized by the simplicity of the second moving means in the shape of a finite length of material in the form of a cable 15, which is stretched between points of attachment 16 and 17. Point of attachment 16 is a fixed point with respect to the footrest 1, point of attachment 17 is a fixed point with respect to the frame 2. The distance between point of attachment, the point of application of the cable on the footrest and the point of application of the hinged arm 4 of the first moving means, which coincides with the horizontal pivot axis 7, does not change when the footrest is being moved. Similarly the distance between point of attachment 17 and the first horizontal pivot axis 5 remains the same. At the footrest the cable 15 passes over a pulley 18 having a radius R, which is mounted on the second horizontal pivot axis 7. The other end of the cable 15 passes over a pulley 19 having a radius 2R. In the operative position the footrest 1, which is inclined to tilt about the second horizontal pivot axis 7 under the influence of its self-weight, is retained in a horizontal position by the cable 15. The cable 15 passes over a quarter of the circumference of the pulley 18. When the first hinged arm 4 of the first moving means is lifted by the control mechanism (not shown

in this Figure), the self-weight of the footrest 1 causes the cable 15 to wind up on the pulley 18. A quarter of the circumference of disc 19 will unwind when the footrest is being moved, which length is wound up on half the circumference of disc 18.

Figure 8 shows a footrest corresponding with the one shown in Figure 7, whereby the footrest 1 is locked in the operative position by means of a hook 20 mounted under the footrest 1, said hook engaging a catch 21 present on the first hinged arm 4. The various positions of the footrest 1 during its movement are diagrammatically illustrated. In the embodiment shown in this Figure the horizontal pivot axis 7 is movably accommodated in a slot 22 in the first hinged arm 4, in order to be able to release the hook 20. In order to control the movement of the horizontal pivot axis 7 in the slot 22 a compression spring 23 is provided between a fixed point on the hinged arm 4 and the pivot axis 7. Furthermore the compression spring 23, in cooperation with the cable 15, keeps the footrest 1 horizontal in the operative position. During the movement of the footrest 1 from the operative position to the inoperative position the free end 3' will first describe a small part of a circular motion in order to release the locking engagement between the footrest 1 and the hinged arm 4, after which the footrest 1 can pivot about the horizontal pivot axis 7. During the remaining part of the movement of the footrest the free end 3' will describe the substantially horizontal movement towards the frame (not shown).

A characterizing feature of the footrest according to the invention is the movement substantially made with a horizontal component of movement of the free end of the footrest when changing the position of the footrest.

In a further preferred embodiment the length of the footrest between said second horizontal pivot axis 7 and the free end 3' of the footrest 1 is greater than the length of said first hinged arm 4.

In a further preferred embodiment the third and fifth vertical pivot axes 9,12 of the hinge construction of said second moving means are positioned in the area between the longitudinal axis and one side of the footrest 1.

In a further preferred embodiment the third and fourth hinged arms 8,10 of the hinge construction of the second moving means are locked in the operative position by locking means.

In a further preferred embodiment said locking means comprise a piston/cylinder assembly 14, the piston of said assembly being connected with one hinged arm and the cylinder of said assembly being connected with the other hinged arm.

In a further preferred embodiment said moving means are actuated by a control mechanism 6.

Claims

1. A footrest (1) for a chair comprising a frame (2), in particular for a chair unit for a chair lift, which footrest (1) can be moved by moving means between an inoperative position and a substantially horizontal operative position, characterized in that said moving means move the free end (3') of the footrest (1) in a path in a substantially horizontal plane when the footrest (1) is being moved.

2. A footrest according to claim 1, **characterized in that** said moving means move the end (3) of the footrest (1) located near the frame (2) of the chair in a substantially vertical direction along the frame (2).

3. A footrest according to claim 1 or 2, **characterized in that** said moving means comprise first and second moving means, which each act on the footrest (1) and the frame (2) in different points of application and which cooperate with each other when moving the footrest (1), in such a manner that the end (3) of the footrest (1) located near the frame (2) of the chair in the operative position moves substantially vertically along the frame (2) and the other, free end (3') of the footrest (1) moves in a substantially horizontal direction.

4. A footrest according to any one of the preceding claims, **characterized in that** said first moving means comprise a hinge construction, which construction comprises a first hinged arm (4), whose one end is secured to a substantially horizontal first pivot axis (5) positioned at the bottom of the frame (2) of the chair, and whose other end is connected with a second arm, in such manner as to be capable of pivoting movement about a second horizontal pivot axis (7), to which arm the footrest (1) is secured.

5. A footrest according to claim 4, **characterized in that** the footrest (1) itself constitutes the second arm of the hinge construction of said first moving means.

6. A footrest according to any one of the claims 2 - 5, **characterized in that** said second moving means comprise a hinge construction comprising a third hinged arm (8), whose one end can pivot about a vertical pivot axis (9) positioned near the frame (2) and whose other end is pivotally connected, by means of a fourth vertical pivot axis (11), with the one end of a fourth hinged arm (10), the other end of said fourth hinged arm (10) being pivotally connected with the footrest (1) by means of a fifth vertical pivot axis (12) and a sixth horizontal pivot axis (13).

7. A footrest according to any one of the preceding claims, **characterized in that** said second moving means comprise a finite length of material (15), which is stretched between a first point of attachment (16), which does not move with respect to the frame (2), and a second point of attachment (17), which does not move with respect to the footrest,

whereby the distance between said first point of attachment (16) and the point of application of said first moving means on the footrest (1), and the distance between said second point of attachment (17) and the point of application of said first moving means on the frame (2) do not change when the footrest (1) is being moved.

8. A footrest according to claim 7, **characterized in that** said finite length of material (15) is stretched between said two points of attachment (16, 17) in such a manner, that when the footrest (1) is being moved from the operative position to the inoperative position, the end of said length of material connected with the footrest (1) winds up on a pulley (18) mounted on said second horizontal pivot axis (7) and that the end of said material connected with the frame (2) unwinds from a pulley (19) mounted on said first horizontal pivot axis (5).

9. A footrest according to claim 7 or 8, **characterized in that** said first hinged arm (4) and the part of the footrest (1) positioned near said hinged arm (4) in the operative position are provided with locking means (20, 21), which lock the footrest (1) in the operative position, and that said second horizontal pivot axis (7) is positioned in such manner as to be movable in the longitudinal direction of the hinged arm (4) under the influence of pressure means (23) with a view to operating the locking means (20,21).

10. A chair unit for a chair lift, comprising a frame which is movable along guide means, driving means for moving said frame, a seat part and a back support, said chair unit being provided with a footrest according to any one of the claims 1 - 9.

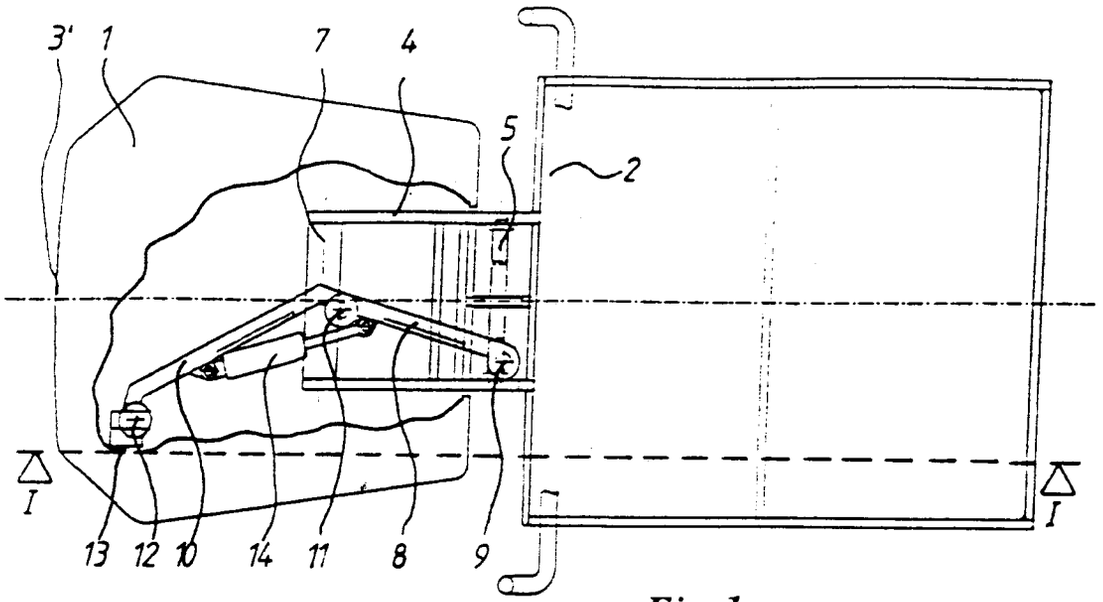

Fig. 1

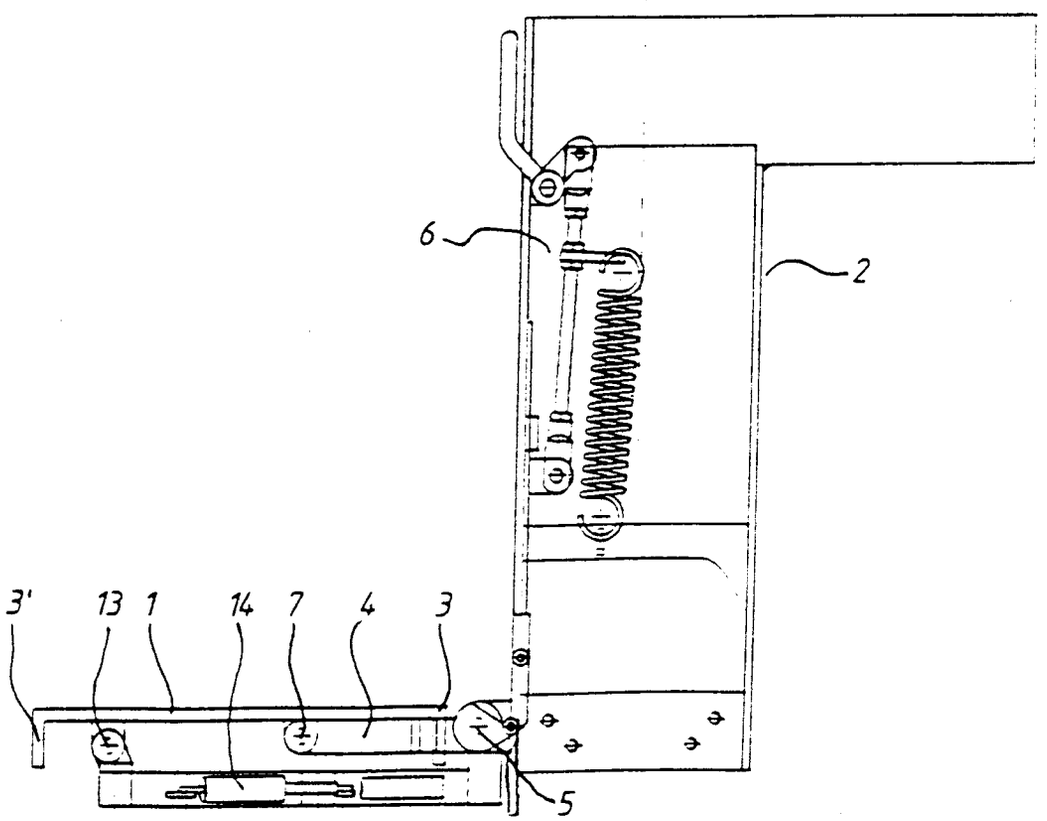

Fig. 2

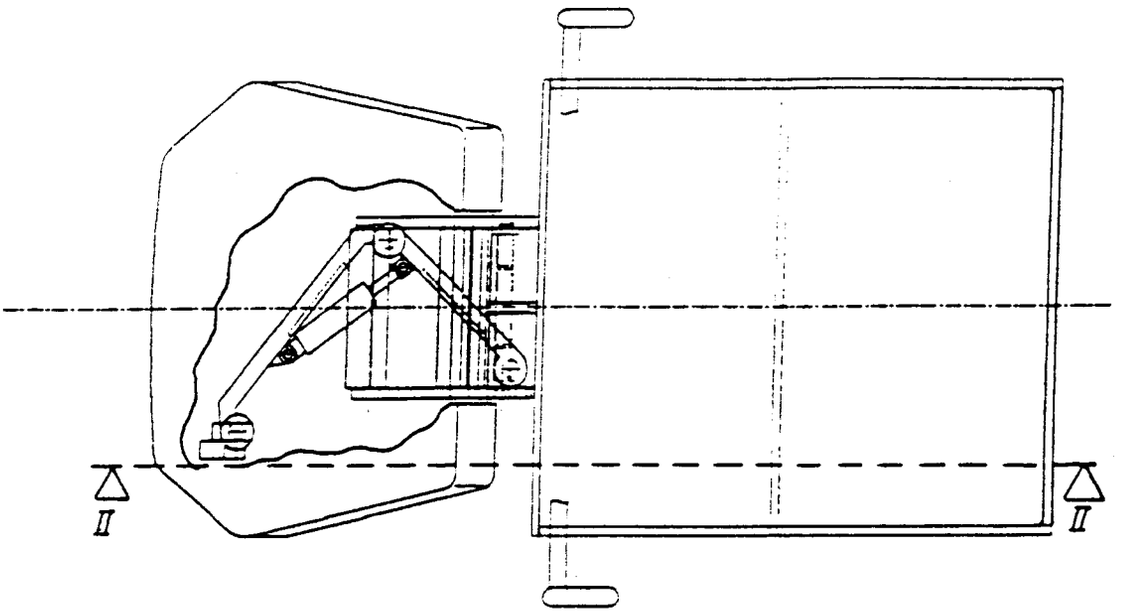

Fig. 3

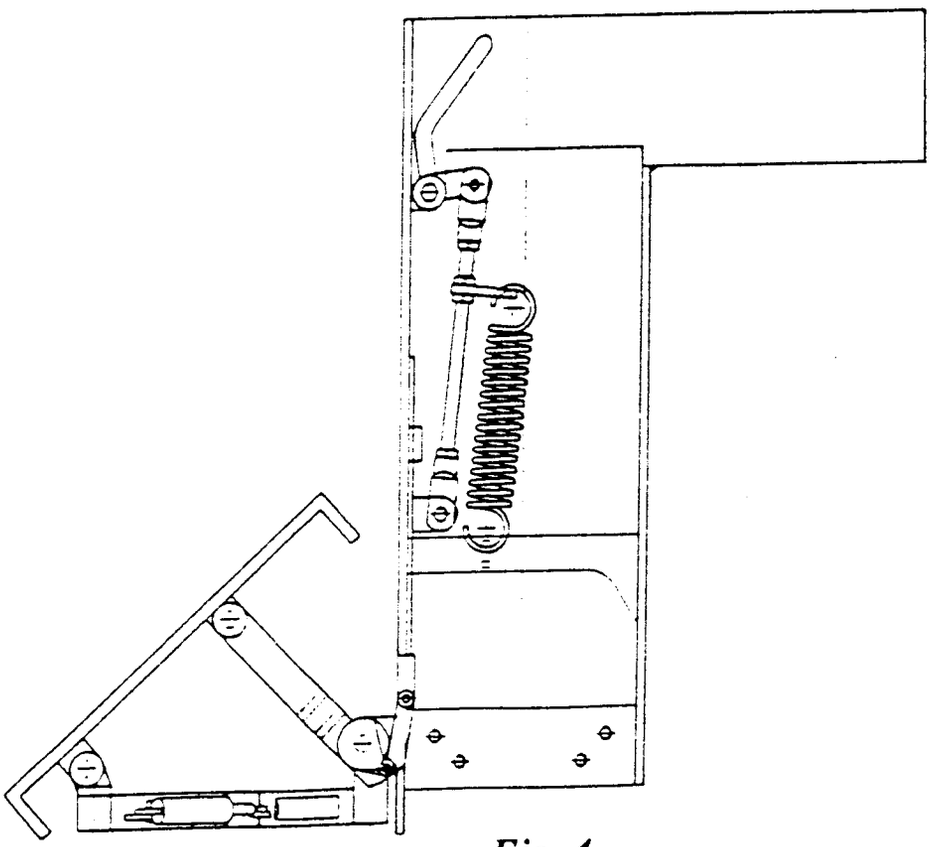

Fig. 4

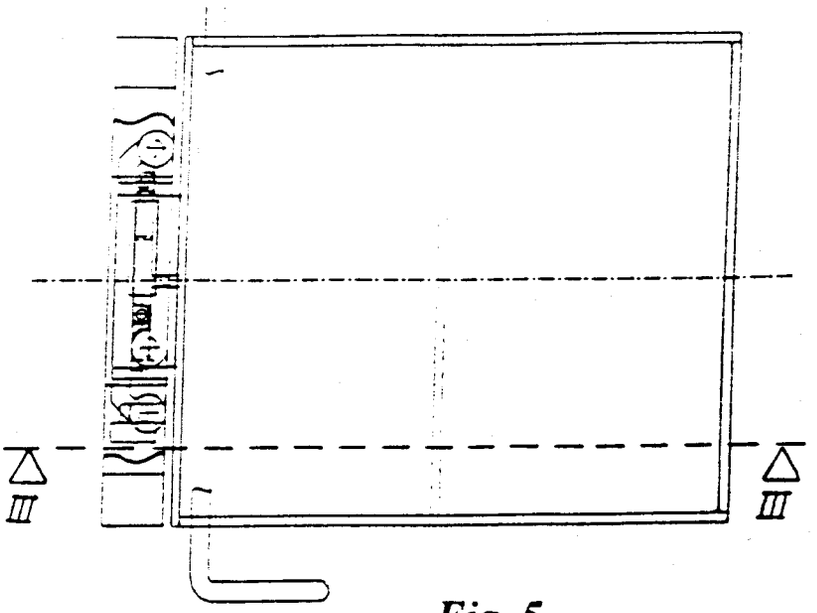

Fig. 5

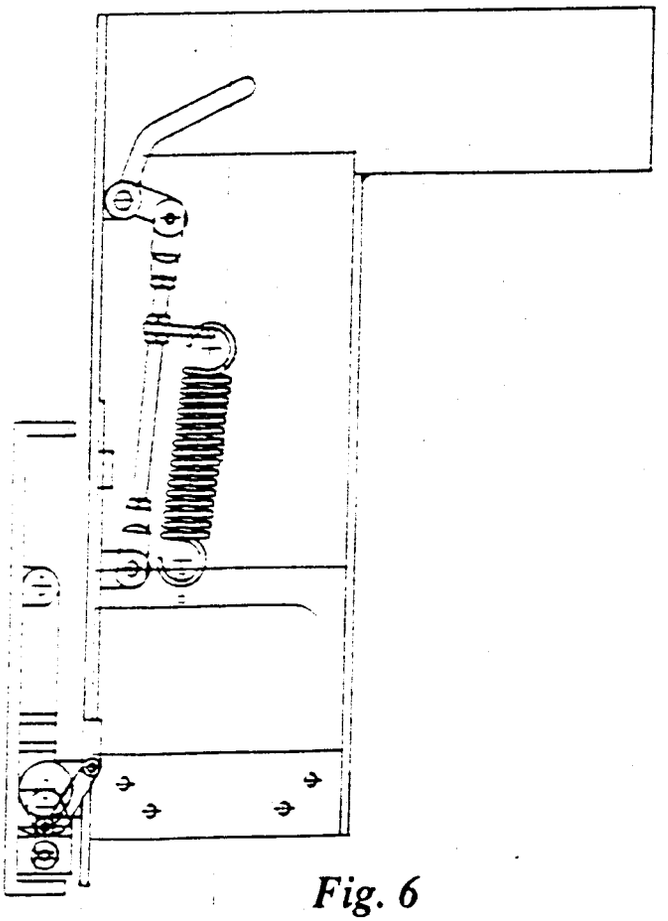

Fig. 6

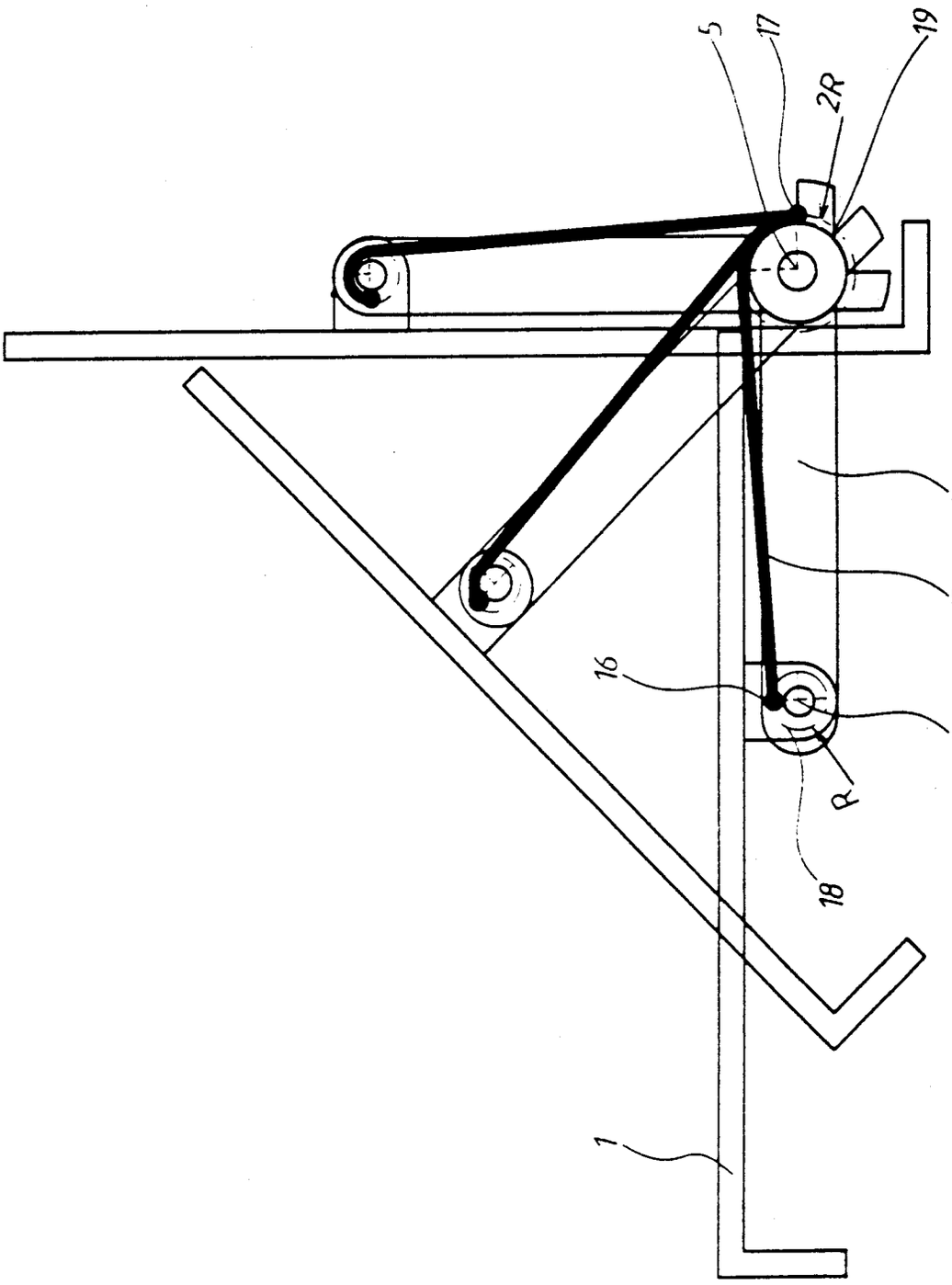

Fig. 7

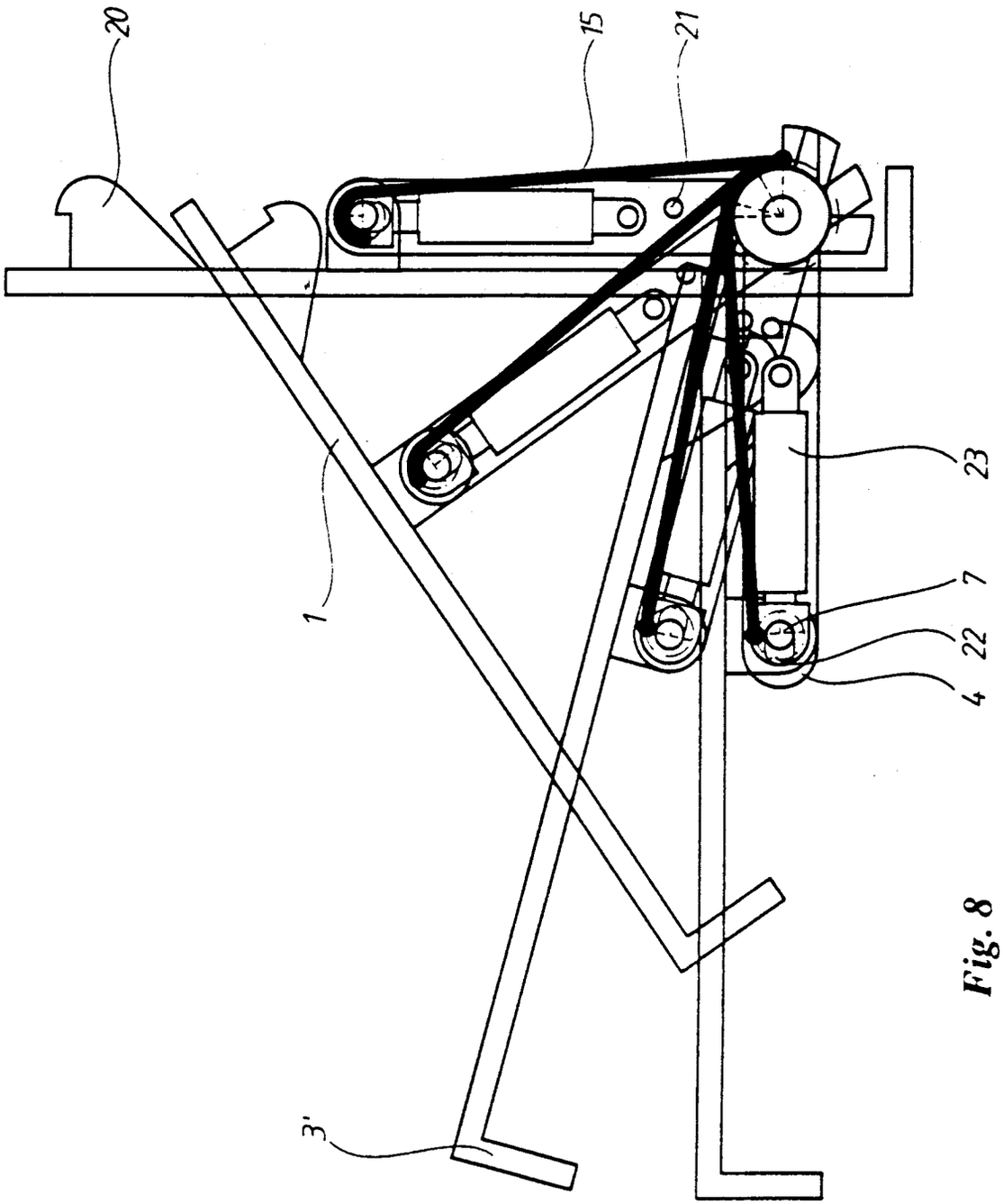

Fig. 8

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 95 20 2035

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
X	DE-U-91 13 047 (SANITÄTSHAUS WALTHER L.C. MÜLLER GMBH) 27 February 1992 * page 7, paragraph 2; figure 2 *	1,10	B66B9/08 A61G5/10 A47C7/50
X	US-A-3 794 381 (CALDEMEYER) 26 February 1974 * abstract; figure 1 *	1,10	
A	DE-A-34 24 284 (TAKARA CO.) 14 March 1985 * abstract; figures 2-4 *	1-10	
A	DE-A-42 01 349 (CASALA-WERKE CARL SASSE GMBH) 22 July 1993 * column 2, line 23 - line 30; figure 4 *	1-10	
A	US-A-4 678 229 (RYAN) 7 July 1987 * abstract; figures 3,4 *	7,8	

TECHNICAL FIELDS SEARCHED (Int.Cl.6)

B66B
A61G
A47C

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	6 November 1995	Sozzi, R

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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EPO FORM 1503 03.82 (P04C01)