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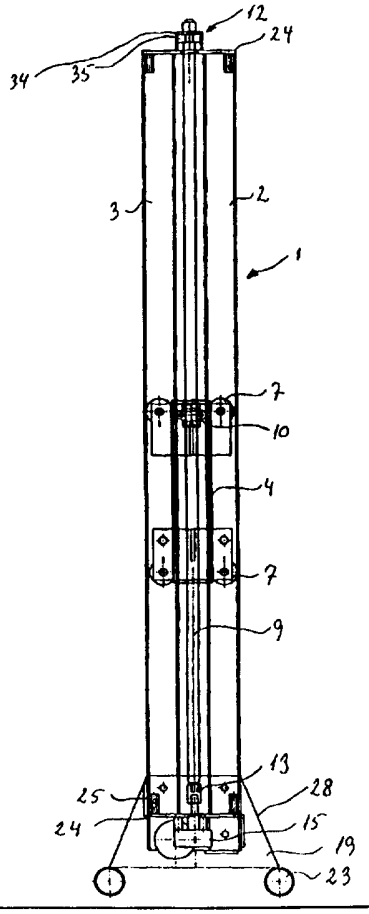
(57) Abstract

A lifting tower (1) comprising a carriage (4) for the mounting of handling tools (18), said carriage (4) having rotatable elements (7) in the form of ball bearings, wheels, rollers or the like mounted in each end of the carriage (4), and a first profile (2), and where the lifting tower also comprises a second profile (3) lying parallel with the first profile (2), said profiles lying opposite each other, and in which profiles (2, 3) the rotating elements for the carriage (4) are placed. There is hereby achieved a rigid and stable construction which is self-stabilizing when stressed, and which does not need to be so strongly dimensioned as the known constructions.



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LIFTING TOWER AND USE OF THE LIFTING TOWER

The invention concerns a lifting tower comprising a carriage for the mounting of handling tools, said carriage having rotable elements in the form of ball bearings, wheels, rollers and the like mounted in each end of the carriage, and a first profile, also the use of the lifting tower.

When transporting handicapped or sick people, it is normal to use a mobile person lifter, possibly a stationary person lifter, on which there is mounted a form of handling tool, which can be a toilet harness or a lifting arrangement. The known lifting towers which are used in this connection comprise a carriage/a telescopic piece which can slide in a single profile piece. As a consequence of the movement of the carriage/the telescopic piece and the one-sided mounting of the handling tool on the one surface of the carriage/the telescopic piece, there occurs a strong and inexpedient stress effect on the lifting tower, which will bend in towards the patient, i.e. there where the stress effect takes place. In order to counter this, it is thus necessary to undertake an overdimensioning of the lifting tower and the profile associated herewith. This results in a heavy construction which is inconvenient for helpers to transport around with, and also an unstable and insecure feeling for the patient.

Such a mobile person lifter is known, for example, from EP-A-0,236,284 and DE-A-3504972.

When lifting heavy items from one level to another, and in the configuration of tables which are adjustable in height, it is similarly expedient to use a lifting tower which is stable and possibly adjustable.

It is the object of the invention to provide a lifting tower which does not have the disadvantages of the known lifting towers.

This is achieved with a lifting tower of the kind disclosed in the preamble, and where a lifting tower also comprises a second profile lying parallel with the first profile, said profiles being disposed opposite each other, and in which profiles the rotating elements for the carriage are placed.

In that the carriage which must be moved up and down in the lifting tower is mounted in two profiles lying opposite each other, a greater torsional stability is achieved during operation, and also a more rigid system which need not be dimensioned as strongly as is known from other systems, and which moreover can be produced in lighter materials. Furthermore, it functions in a self-stabilizing manner when exposed to stress, in that the profiles, for example during the lifting of a heavy load, will be pressed in towards each other and are pressed towards the carriage, which increases the stability of the construction, in that the two bending moments are directed towards each other. This is the opposite of that of the known systems, where the carriage will be bent in the profile itself and also transfer a bending force to the profile. As a consequence of the self-stabilization achieved with the construction according to the invention, jolting and noise will be minimal.

By providing a lifting tower according to the invention as disclosed in claim 2, an expedient and optimizing distribution of the forces is achieved.

By providing a lifting tower according to the invention as disclosed in claim 3, it is achieved that the risk of getting pinched or squeezed in the groove where the tool

runs is minimized, in that unlike the known parts, this groove not only faces away from the patient but also comprises two surfaces.

By providing a lifting tower according to the invention as disclosed in claims 4, 5 and 6, a very stable mounting of the handling tool is achieved, which in the known constructions is found to be mounted only on a single surface, which results in an inexpedient stress effect in the form of a bending, while the force in connection with the present invention is distributed more symmetrically due to the mounting of the carriage in two profiles lying opposite each other.

By providing a lifting tower according to the invention as disclosed in claim 7, it is achieved that the risk of injury in the recesses where the handling tool runs is further minimized, while at the same time it is more difficult for dirt and pollution to gain access to the construction.

By providing a lifting tower according to the invention as disclosed in claim 8, there is achieved an expedient configuration of the profile, which provides the desired rigidity and results in a stable surface/abutment for the rotating elements.

By providing a lifting tower according to the invention as disclosed in claim 9, there is achieved an expedient mobility of the carriage, which lies in a stable manner in its slide bearing.

By providing a lifting tower according to the invention as disclosed in claim 10, there is achieved an expedient way of securing the movement of the carriage.

By providing a lifting tower according to the invention

as disclosed in claim 11, with this assembly in the top instead of in the bottom where it is commonly-known to mount the spindle, it is achieved that the stress manifests itself as tractive forces in the spindle, and not as pressure forces as is the case in the known constructions. The result of this tractive force will thus be that the thread on the spindle is not exposed to the usual compressions. The possibility is hereby optimized of avoiding the usual noise and jolting which are normally experienced in connection with the movement of the carriage in the known systems. Moreover, the spindle can be of smaller dimensions than when the bedding is effected in the bottom.

By providing a lifting tower according to the invention as disclosed in claim 12, a friction-free movement of the carriage is achieved during its movements in the profile.

The invention also concerns the use of a lifting tower, where it is envisaged that this is used primarily on mobile or stationary person lifters as disclosed in claim 13. A mobile person lifter is thus understood to be where the lifting tower is placed on a movable under-frame, so that the lifting tower can be brought to wherever the patient may have use for it. This can be to a toilet/-shower area or it can be in connection with the removal of a patient from a bed. The lifting tower can also be envisaged for stationary use, i.e. where it is mounted either on the floor, the ceiling or a wall, and in this connection is used in rooms where a certain function is undertaken again and again.

The invention will now be described in more detail with reference to the drawing, where

fig. 1 shows a lifting tower seen in section from the side and mounted on a mobile underpart,

fig. 2 shows a cross-section of the carriage with securing elements mounted,

fig. 2a shows a second example embodiment of a lifting tower seen in section through the carriage and with a securing element mounted,

fig. 3 shows an enlargement of the carriage part from fig. 1,

fig. 4 shows the lower mobile underpart from fig. 1 in detail,

fig. 5a shows a stylized, mobile lifting apparatus seen from the rear,

fig. 5b shows the stylized, mobile lifting apparatus in fig. 5a seen from the side,

fig. 6 shows a second cross-sectional drawing of a second embodiment of the carriage according to the invention.

Fig. 1 shows a lifting tower 1 consisting of a centre part, a spindle 9 on which a carriage 4 mounted with rotating elements 7 is disposed, said rotating elements in the form of ball bearings, wheels, rollers or the like being housed in a first C-profile 2 and a second C-profile 3, said C-profiles comprising a part of the lifting tower 1. The C-profile is characterized by having three surfaces which are closed, and the fourth surface being wholly or partly open, in that in this opening there is passage for connection elements for the carriage 4 or also for the end surfaces of the carriage itself. Each profile comprises at least one wall parallel with the axis of the rotating elements.

The two oppositely-lying C-profiles 2, 3 are fastened to each other at the top and the bottom by means of plates 24 which are either secured or welded to the profiles.

In this connection, a carriage 4 is understood to be that part which supports the handling tool, and which is movable in the upwards and downwards direction in the lifting tower 1.

When the spindle rotates, said rotation being effected by means of a motor 15 housed in the lower part, and which via a coupling 13 transfers the turning force to the spindle, this rotation will result in movement of the carriage in the upwards or downwards direction in the lifting tower 1, in that the inside of the carriage 4 is provided with a fixed nut 10, secured for example by welding. The nut is lifted vertically by the rotation of the spindle, in that the spindle is also suspended in the upper part 12.

The lifting tower 1 is seen mounted on a mobile underpart 19 which is provided with wheels 23. The lifting tower 1 is expediently fastened to the underpart 19 by means of nuts 25, in that this makes a mobile lift easier to transport, since the lifting tower and the underpart can thus be assembled in situ. The two C-profiles 2 and 3 are fastened to each other at the top and the bottom, or in the upper and the lower part of the lifting tower by means of plates 24 which are welded to the ends of the two C-profiles. The profiles are thus parallel with each other and lie opposite each other.

A cross-section of the lifting tower 1 with carriage 4 is seen in fig. 2 and fig. 2a, which show two oppositely-lying C-profiles 2 and 3, between which the carriage 4 is disposed. The carriage 4 is a square or rectangular box

open at both ends, i.e. at the top and the bottom for the passage of the spindle 9, and is made of aluminium or steel, and which is connected to the two C-profiles by means of flanges or plates which terminate in the C-profiles, and through the end parts of which there extends an axle 6 having rotating elements 7 in the form of wheels, ball bearings or the like mounted on its ends. The carriage 4 can, however, also be welded directly on the axles 6, and where the rotation thus takes place between the axle 6 and the rotating element 7. In each C-profile there is thus disposed four rotating elements 7. The C-profiles can have different configurations. There can be special cutouts, and there can be reinforcements provided in the profile. Moreover, the rotating element 7 itself can be cut off at an angle, and a corresponding inclined surface can be formed in the C-profiles 2, 3, thus providing the rotating elements with a higher degree of support and the prevention of jolting in the tower.

It can be expedient for the end surfaces of the rotating elements, which are in contact with the inner surfaces of the C-profiles, to be provided with a friction-free coating, for example teflon 14, in order to reduce the friction. As discussed earlier, the side surfaces 27 of the carriage 4 lie between the two C-elements. As shown in fig. 2, to these side surfaces 27 there can be welded metal plates 16 at right angles and in the longitudinal direction away from the actual carriage. On the ends of these metal plates 16 there are welded tubular elements 17 which are hollow, so that handling tools in the form of lifting arrangements, slings, canvas and the like can be mounted in these elements. As will be seen in fig. 2a, the handling tool can also be fastened to a U-section 16^1 which is similarly fastened to the side surfaces 27 along each its longitudinal part of the U, but on the forwardly-directed surfaces of which there are welded fixing elements for the handling tool 17^1. This results in

another and more expedient loading of the system.

Between the two C-profiles there are provided rubber/-plastic flaps or brushes 5 in which the metal plates 16 can pass, so that a covering of the inside of the carriage is effected, hereby reducing the risk of dirt and dust and the like gaining ingress to the insides. At the same time, the construction from the design point of view appears more delicate.

In connection with the use of the lifting tower for height-adjustable tables, the "auxiliary tool" can be a horizontal table plate, and where the lifting tower itself can possibly be mounted on that frame which comprises parts of the table, or merely on a stand-plate.

Fig. 3 is a detail drawing of the carriage seen from the side, and shows the two C-profiles 2, 3 opposite each other with a carriage 4 arranged between them, said carriage 4 being a rectangularly extending tube with a plate 27 mounted on its upper and lower surfaces, said plates entering into the opening in the C-profiles and having a hole in the front part through which the axle 6 extends for the mounting of the rotating elements 7. On the inside of the carriage there is mounted a nut 10, this being fastened to the carriage by means of screw arrangements or by welding. The spindle 9, which rotates in the nut 10, extends for the full extent of the lifting tower 1. The tubular element 17 for the mounting of tools will also be seen to extend vertically from the upper to the lower part to an extent which corresponds to the vertical extent of the carriage. The tubular element 17 is fixed to the carriage 4 by means of flat tubes 16.

When the spindle is made to rotate, this rotation will be transferred to the nut 10 which will be displaced in the upwards or the downwards direction. Since the nut 10 is

fastened to the carriage, the result is that the carriage is driven, via the rotating elements which are mounted in the C-profiles, in the upwards or downwards direction in the tracks arranged for this purpose. Since the carriage thus has contact in eight places as well as being disposed between the two C-profiles, a particularly stable movement of the carriage is achieved, and without any jolting or the like as is known from the existing systems.

It can be expedient to mount the lifting tower 1 on a mobile underpart 19, and as shown in more detail in fig. 4. The lifting tower 1 is mounted on the under-carriage 19 by means of bolts, nuts or screws 25. The lower part itself also comprises a leg-spreading mechanism 29 for the adjustment of the wheels 23 which are placed in pairs opposite each other, so that the distance between the wheels can be increased, herewith increasing the stability of the mobile lifting tower.

Under the spindle 9 there is provided a baseplate 30 below which a motor 15 is mounted, and which effects rotation of the spindle. The spindle 9 and the motor 15 are coupled together in a commonly-known manner by means of a coupling 13.

The under-carriage 19 is suitably covered with plates 28, so that the motor and leg-spreading mechanism etc. lie concealed.

A stylized version of a mobile lifting arrangement, consisting of an under-carriage 19 on which a lifting tower 1 is mounted, is shown as seen from the rear in fig. 5a and seen from the side in fig. 5b. On the lifting tower 1 there is a handle 32 for better control of the lift. In the centre of the lifting tower is seen the spindle 9 which is covered by rubber flaps or brushes 5,

between which there is a slot 33 in which the securing element's flat plate part 16 can slide. A tool 18 in the form of a yoke is provided in the tubular element 17, said yoke extending in a double-sided manner, in that according to the invention there are two oppositely-lying tubular elements 17 in which the yoke can be mounted. Due to the double fastening of the tool to the lifting tower 1, there is achieved a much more stable transportation of the patient. Moreover, since the mounting is effected on the side of the lifting tower, and the carriage is also covered by means of rubber flaps or brushes, the risk of injury is minimal, for example in the form of pinching or squeezing during the sliding movement of the carriage up and down the spindle 9.

A box 31 is seen mounted on the rear of the carriage, this box containing batteries, control items and the like. The spindle itself is suspended in an upper housing 12, which will now be described in more detail with reference to fig. 1.

The spindle is fastened to a plate 34 which rests on a bearing 35, preferably a ball bearing, on the upper side of the plate. The spindle is thus suspended from the top, whereby the forces which arise in the lifting tower and are transferred as pressure forces on the ball bearing 35 give rise to tractive forces in the spindle 9. Compared with the known systems, this is an unusual assembly, in that the spindle 9 is usually mounted at the bottom, so that the bearing which is exposed to pressure forces is also provided at the bottom, and whereby the spindle is thus exposed to pressure forces. The advantage of having tractive forces on the spindle is that the spindle thread is thus not pressed together, but rather drawn apart, which results in a better sliding of the carriage when this moves up and down, and also with less noise and without the jolting which is otherwise commonly known.

Moreover, the spindle can be of smaller dimensions.

Finally, fig. 6 shows a second cross-sectional possibility for the carriage 4 and the profiles, and shows reinforcement ribs 36 inside the actual C-profile, which makes the C-profile more stable. The cross-section is shown without connection elements 16, 17. These reinforcement ribs 36 can also be disposed in such a way that to a higher degree they lie up towards the rotating elements 7, with the result that these extend in a more stable manner. As will be seen here, the axle 6 can also be welded directly to the carriage instead of using the earlier mentioned plate connections 27. The rubber flaps 5 can be mounted with a thickened part in a groove provided for this purpose on the inner surfaces of the C-profiles. The C-profiles can be expediently configured in aluminium, but can also be made of steel and other materials. The advantage of aluminium, however, is that this is a lighter material, and due to the double C-profile a choice of material comprising aluminium is sufficiently strong, unlike the known constructions where use is made of steel or consequently over-dimensioned contructions in light alloys.

The dimensions of the lifting tower will, for example, be 120-140 mm x 120-140 mm, where the breadth of a C-profile will be 50 mm and the distance between two C-profiles about 40 mm.

The carriage 4 itself can be configured in many ways, e.g. as an elongated square or rectangular profile piece which is wholly or partly open in the "bottom" and "cover", and where in the upper and lower parts there are mounted four wheels, i.e. eight in all, which roll in pairs in each their profile piece 2, 3. The carriage can also be configured so that each upper and lower piece is box-shaped and with the wheels mounted, and where the up-

per and lower piece is connected with a profile piece with another shape and other dimensions. The distance thus created between the upper and the lower set of wheels optimizes the stability.

The drive mechanism for the upwards and downwards movement of the carriage in the lifting tower, i.e. the spindle system described, can be replaced by other systems, e.g. mechanisms which are driven hydraulically.

C L A I M S

1. Lifting tower (1) comprising a carriage (4) for the mounting of handling tools (18), said carriage (4) having rotatable elements (7) in the form of ball bearings, wheels, rollers and the like mounted in each end of the carriage (4), and a first profile (2), **c h a r a c t e r i z e d in that** the lifting tower also comprises a second profile (3) lying parallel with the first profile (2), said profiles lying opposite each other, and in which profiles (2,3) the rotating elements for the carriage (4) are placed.

2. Lifting tower according to claim 1, **c h a r a c t e r i z e d in that** each profile wholly or partly surrounds the free surfaces of the rotating elements which are housed in the profile.

3. Lifting tower according to claim 1 or 2, **c h a r a c t e r i z e d in that** the surfaces of the carriage lying between the two ends comprise two substantially plane surfaces (27), both of which are wholly or partly accessible and face away from the person who is to be handled, and on which the handling tool (18) is directly or indirectly mounted.

4. Lifting tower according to any of the foregoing claims, **c h a r a c t e r i z e d in that** the surfaces (27) lying between the two ends are each provided with at least one connection element ($16,17,16^1,17^1$) for the mounting in a removable manner of the handling tool (18).

5. Lifting tower according to claim 4, **c h a r a c t e r i z e d in that** the connection elements comprise a first connection element (16), preferably in the form of a flat piece fastened to the carriage in the vertical

direction and approximately at right-angles hereto, and that at the first connection element's free end there is mounted a second connection element (17), preferably a vertically-extending tubular element.

6. Lifting tower according to claim 4, **characterized in that** the connection element comprises a first connection element in the form of a U-shaped yoke (16^1), each free end of which is mounted on its plane surface (27), and on the forwardly-directed part of which there is mounted at least a second connection element (17^1).

7. Lifting tower according to any of the foregoing claims, **characterized in that** the surfaces (27) are covered with elastic flaps (5), preferably rubber/plastic flaps or brushes, said flaps or brushes (5) being mounted on each their profiles (2, 3), and for each covered surface preferably comprising two flaps lying opposite each other.

8. Lifting tower according to any of the foregoing claims, **characterized in that** the profiles (2, 3) are configured in such a manner that three of the surfaces are closed and the fourth is wholly or partly open, preferably in a C-shape, through which opening the two end surfaces of the carriage (4) or the connection elements to the carriage can pass, and on the inside of which the rotating elements (7) are driven.

9. Lifting tower according to any of the foregoing claims, **characterized in that** the rotating elements (7) comprise four wheels, ball bearings or the like in each their profile (2, 3).

10. Lifting tower according to any of the foregoing claims, **characterized in that** the carriage is

moved in the profiles by means of a spindle (9) which extends throughout the whole vertical extent of the lifting tower (1), said spindle passing through the inside of the carriage (4), the inner surface of which is fixed to a nut or the like (10) which surrounds the spindle (9).

11. Lifting tower according to any of the foregoing claims, **c h a r a c t e r i z e d in that** the spindle (9) is suspended in a rotatable manner in the top (12) of the lifting tower (1), preferably by means of a ball bearing (35).

12. Lifting tower according to any of the foregoing claims, **c h a r a c t e r i z e d in that** the rotating elements (7) are mounted on an axle (6), the free ends of which or parts of the rotating elements are coated with a friction-preventing material, for example teflon or the like.

13. Use of a lifting tower according to any of the foregoing claims for a mobile or stationary lifter for persons.

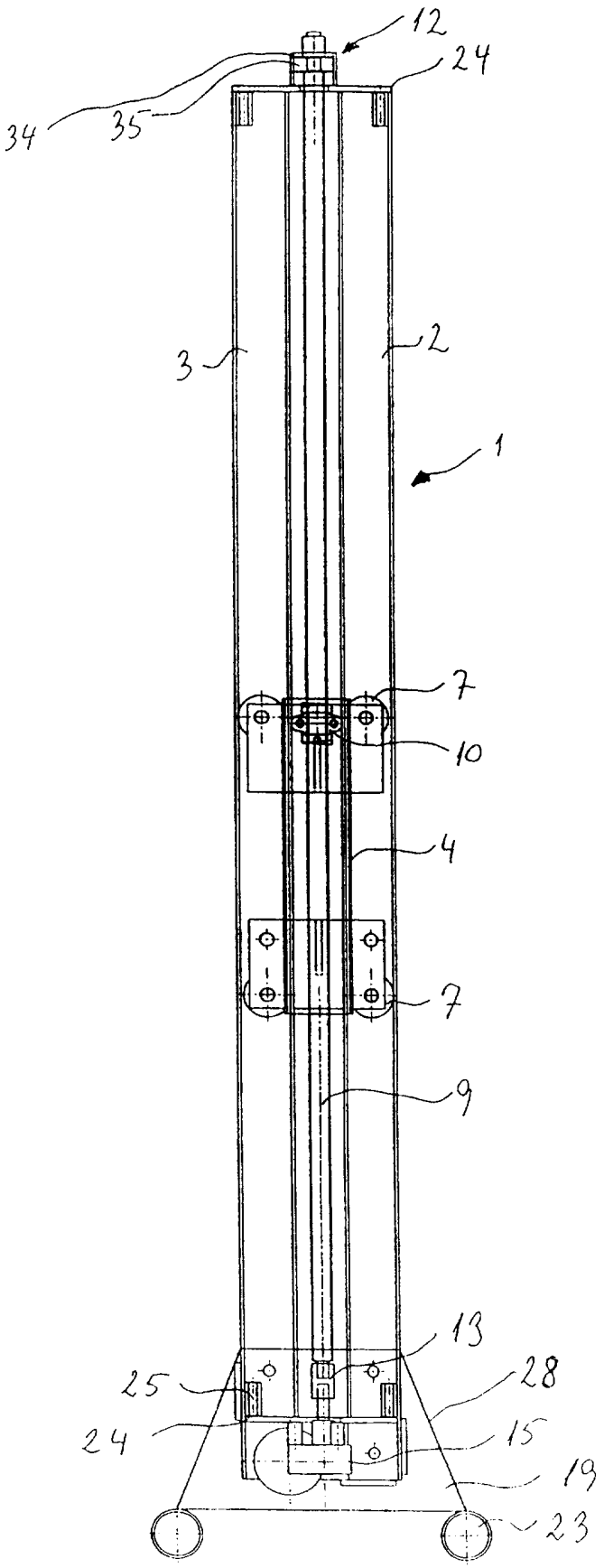

Fig. 1

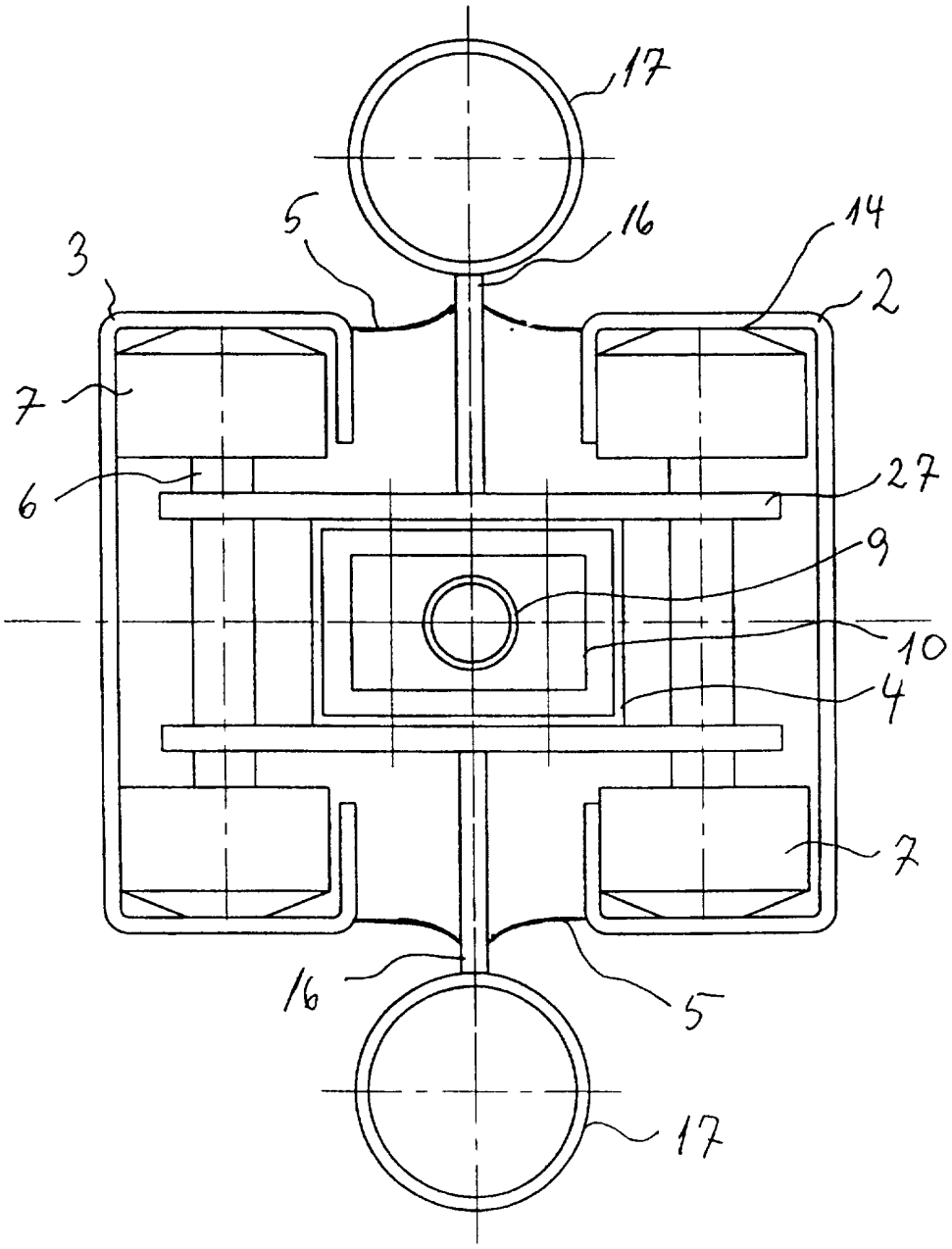

Fig. 2

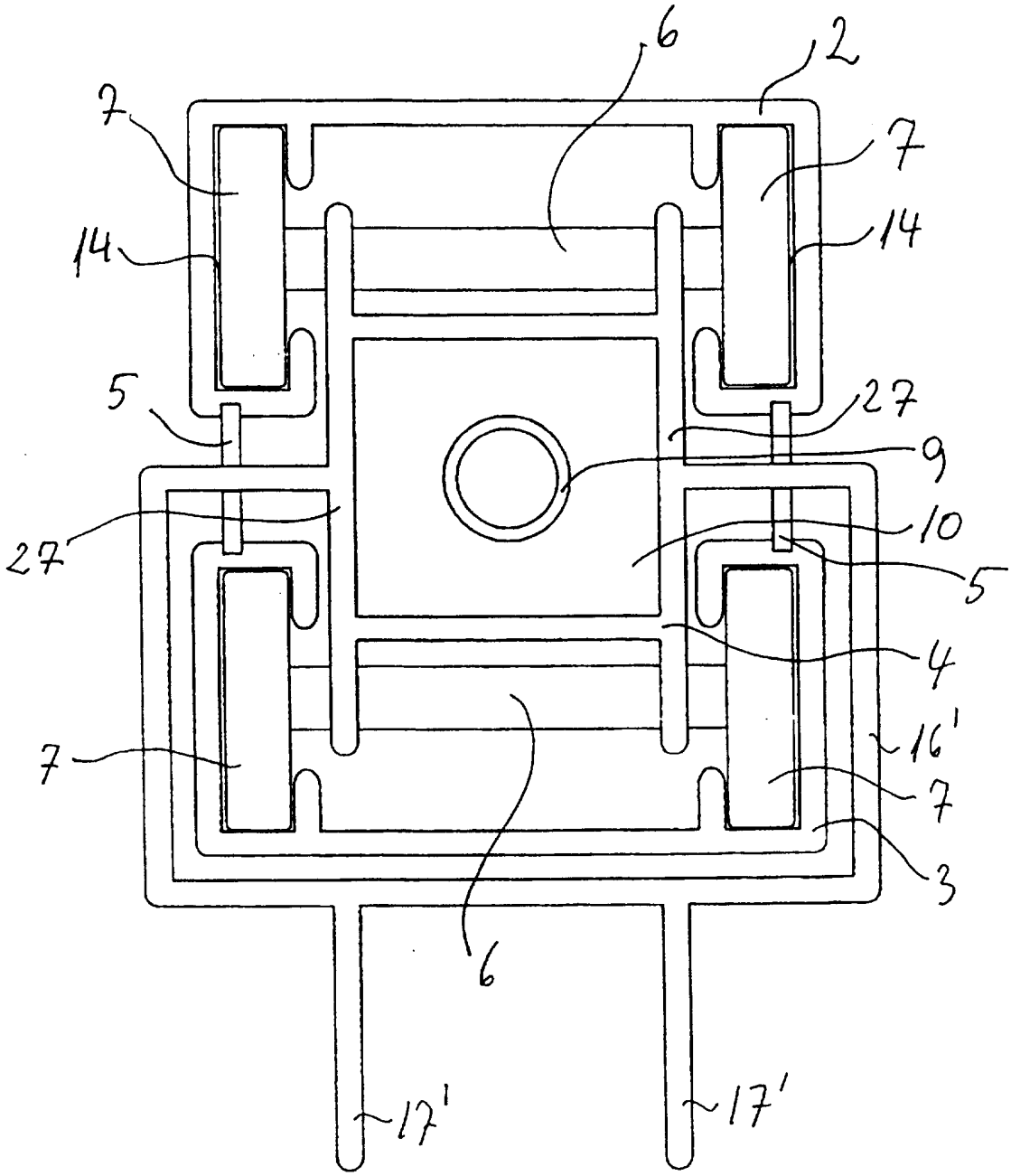

Fig. 2A

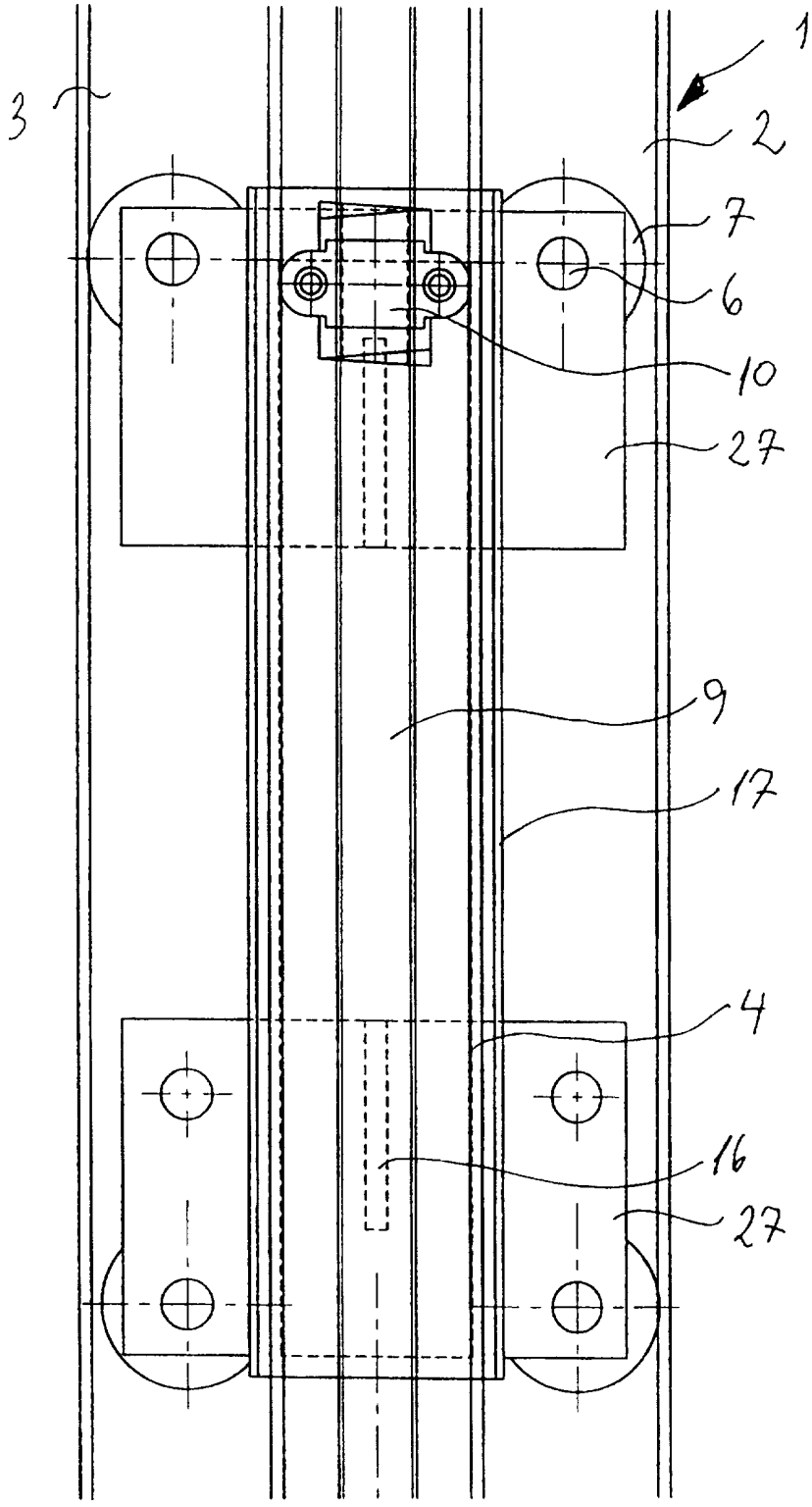

Fig. 3

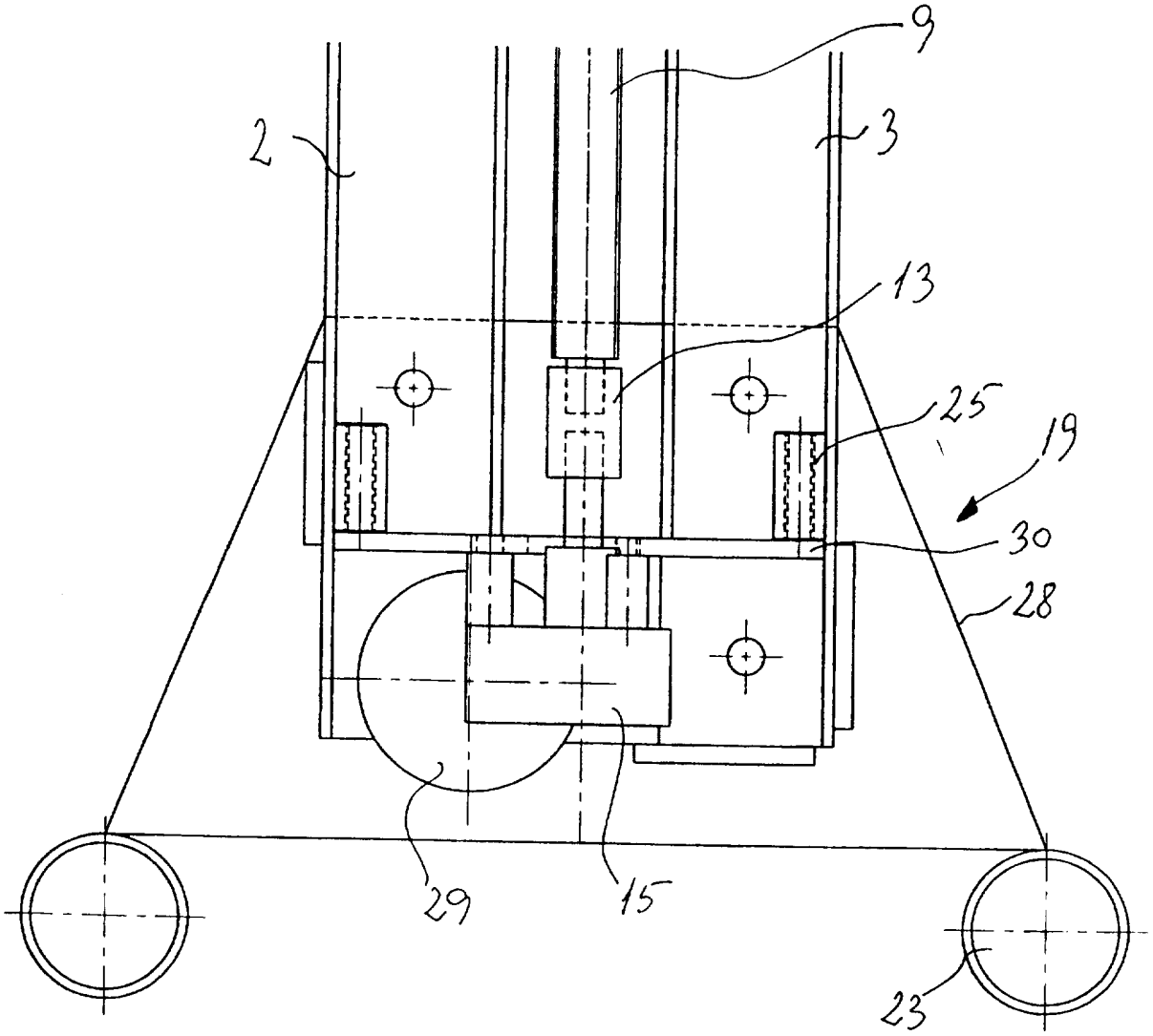

Fig. 4

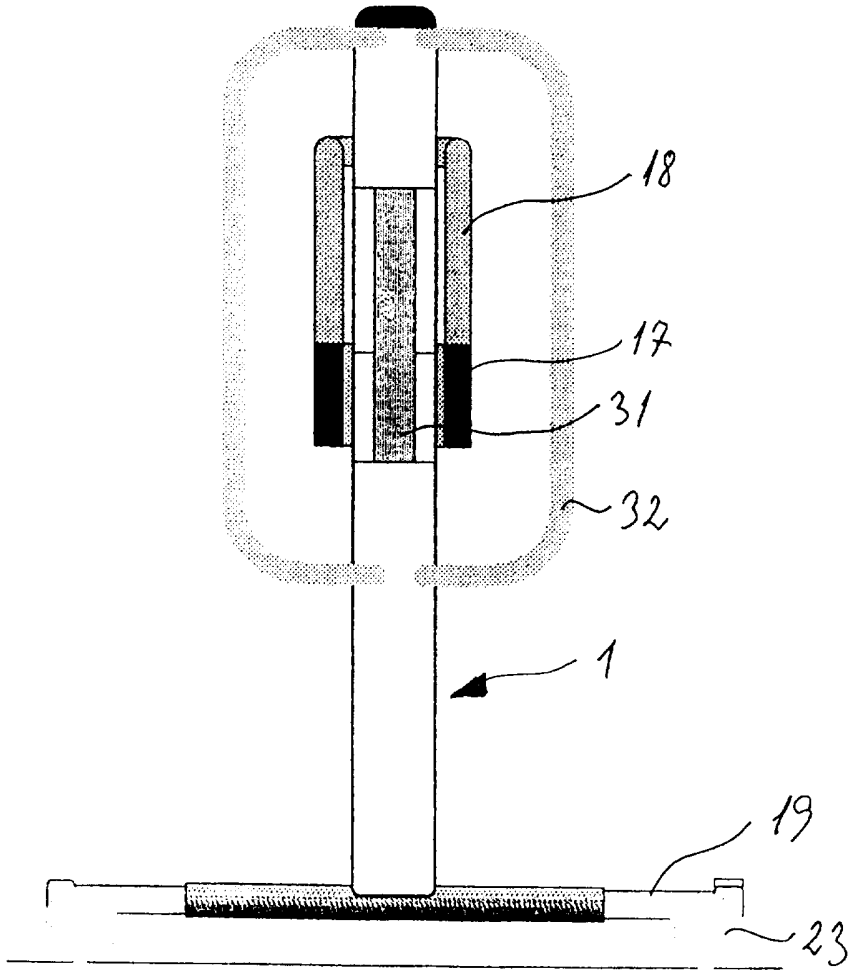

Fig. 5 A

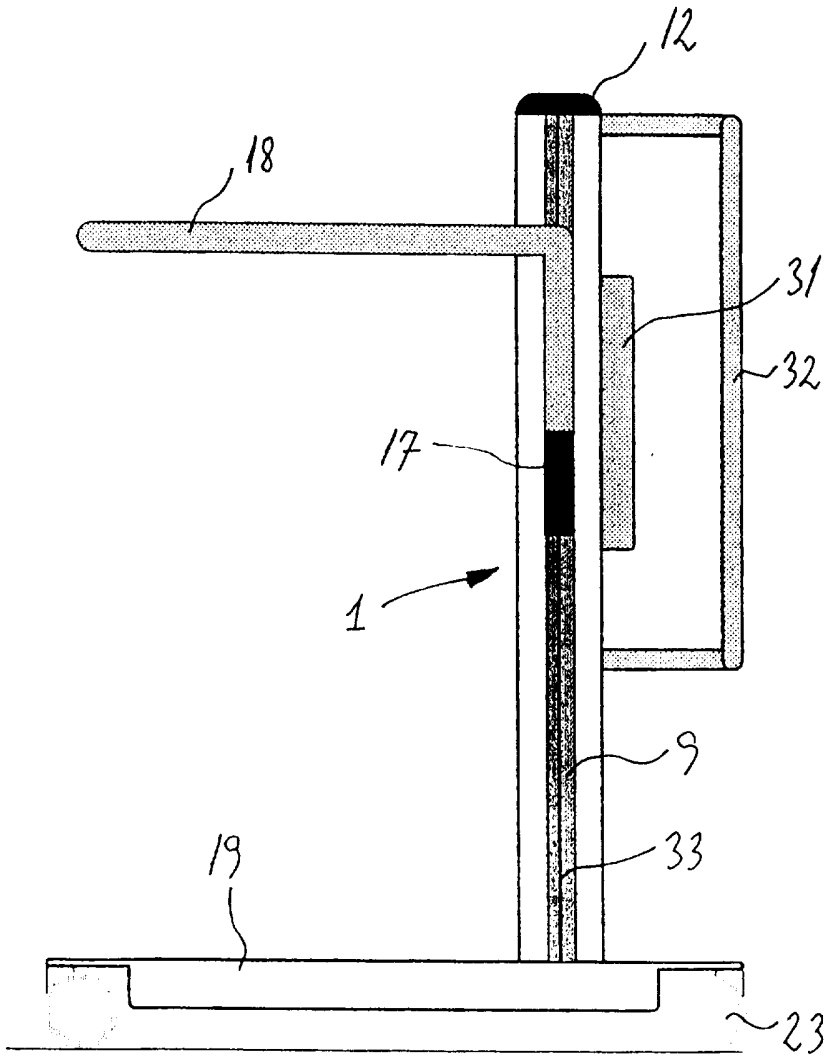

Fig. 5 B

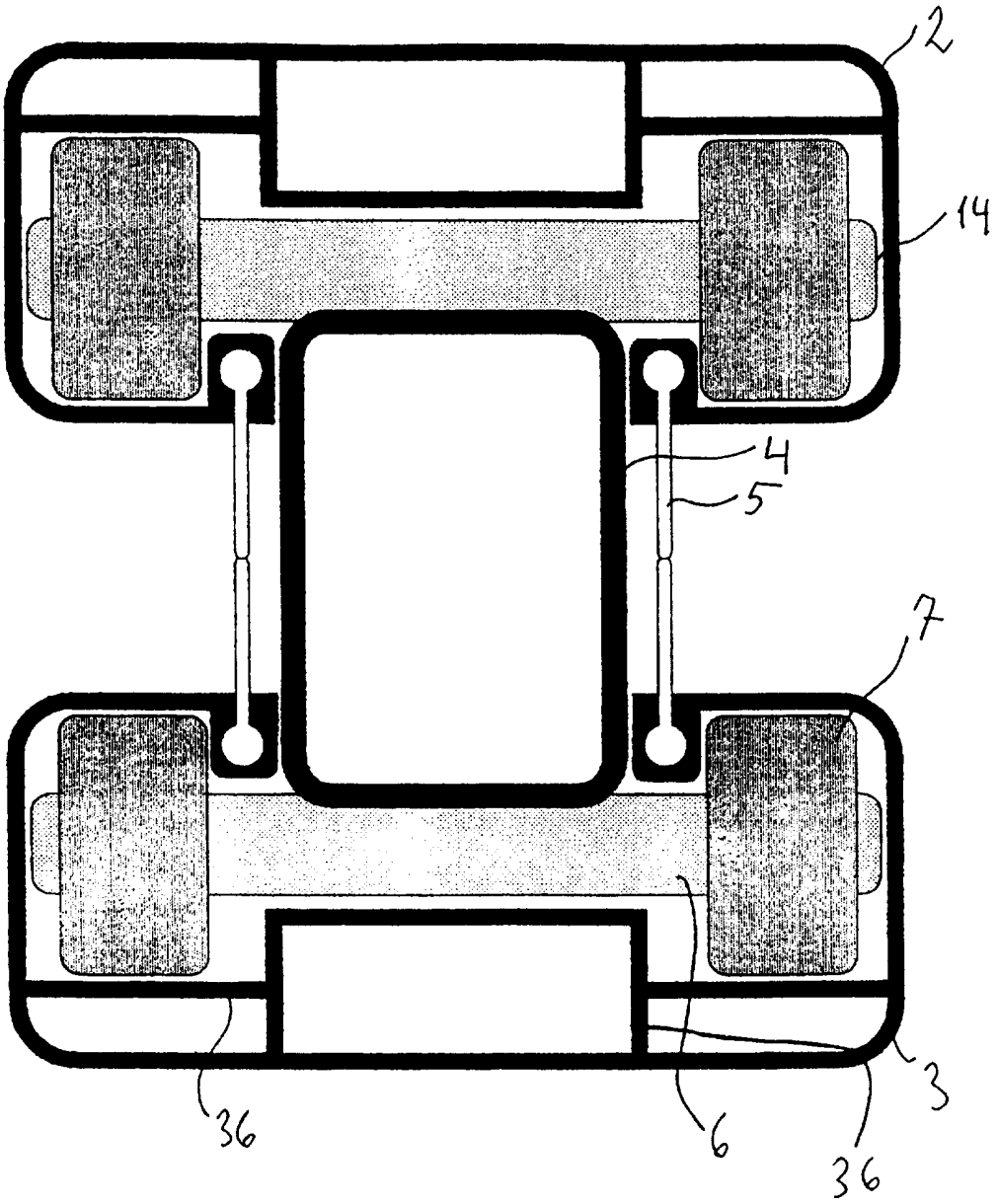

Fig. 6

INTERNATIONAL SEARCH REPORT

International application No.
PCT/DK 97/00269

A. CLASSIFICATION OF SUBJECT MATTER

IPC6: A61G 7/10
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC6: A61G

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	SE 336205 B (C.A. INGEMANSSON), 28 June 1971 (28.06.71), figures 3 and 4	1-4,6-9,12, 13
Y		5,10,11
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☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

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20 October 1997	22-10-1997
Name and mailing address of the ISA/ Swedish Patent Office Box 5055, S-102 42 STOCKHOLM Facsimile No. +46 8 666 02 86	Authorized officer Ingrid Falk Telephone No. +46 8 782 25 00

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INTERNATIONAL SEARCH REPORT

Information on patent family members

01/10/97

International application No.
PCT/DK 97/00269

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