(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 1 760 028 B1

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention of the grant of the patent:
22.07.2009 Bulletin 2009/30

(51) Int Cl.:
B66B 11/00 *(2006.01)*

(21) Application number: **05425623.5**

(22) Date of filing: **06.09.2005**

(54) **Room-less lifting equipment for persons and goods**

Hebeeinrichtung ohne Maschinenraum für Personen und Gütern.

Dispositif de levage sans local de machinerie pour personnes et articles.

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HU IE IS IT LI LT LU LV MC NL PL PT RO SE SI SK TR

(43) Date of publication of application:
07.03.2007 Bulletin 2007/10

(73) Proprietor: **Elex Italia S.r.l.**
26010 Montodine CR (IT)

(72) Inventor: **Romanello, Gianpaolo**
20154 Milano MI (IT)

(74) Representative: **Arena, Giovanni**
Viale Certosa 135
20151 Milano (IT)

(56) References cited:
EP-A- 1 428 784
EP-A- 1 561 720
DE-A1- 19 829 532
US-A1- 2004 182 651

Note: Within nine months of the publication of the mention of the grant of the European patent in the European Patent Bulletin, any person may give notice to the European Patent Office of opposition to that patent, in accordance with the Implementing Regulations. Notice of opposition shall not be deemed to have been filed until the opposition fee has been paid. (Art. 99(1) European Patent Convention).

EP 1 760 028 B1

Description

THE TECHNICAL FIELD

[0001] The present invention relates to a room-less equipment for persons and goods particularly suitable for limited pay-load, speed and car travel.

BACKGROUND

[0002] Nowadays, for a maximum of 1000 kg of pay-load, 0,5 m/s of linear speed, and 12 m of car travel, industry offers lifts where the movement of the car is obtained through a hydraulic ram driven by a pump unit, or by hauling ropes driven by a electric gear.

[0003] All the above cases present shortcomings such as a relatively high energy consumption due to the fact that the load is not partially balanced by a counter-weight, when the motion is obtained by using a hydraulic system, or a lack of safety when a driving a.c. geared motor, currently used for the electric lifts with lifting ropes, is used due to the fact that this technology doesn't allow any automatic rescue operation in case of a power failure, in a economically convenient way.

[0004] Moreover the hydraulic lifts needs an additional space where to locate the pump unit and, as far as the electric lift with lifting ropes is concerning, the geared motor with the traction pulley which has got to have a diameter of 40 times that of the traction ropes, by all the existing codes, requires a considerable reservation of space inside or outside the lift well; last but not least the a.c. geared motor cannot operate in the case of a power failure and, hence, doesn't allow any automatic rescue operation if passengers are trapped in the car because of that.

[0005] In other words, the above technologies, available today from the industry, are energy and space wasting and also with some safety limitation, like the electric traction lift.

[0006] Document EP 1 561 720 A1 discloses a room-less equipment for persons and goods according to the preamble of independent claim 1.

OBJECTS

[0007] The present invention has been developed with the aim of overcoming the above drawbacks of the prior art. In particular the general purpose of present invention is to realize a machine room-less lifting equipment having the following improved characteristics:

- considerable economy of energy consumption;
- considerable economy of space occupied by the equipment;
- possibility to supply the equipment either by a single phase power supply or a dc voltage feeder.

SUMMARY OF THE INVENTION

[0008] The room-less lifting equipment for persons and goods, according to the invention, comprises:

- a hoistway,
- a load car,
- a car hoisting machine,
- a counterweight,
- hauling cables supporting both the car and the counterweight,
- traction pulleys driving the hauling cables,
- guide tracks guiding the movement of the car-rack frame and counterweight, located near a same wall of the hoistway,
- a fixed frame supporting the hoisting machine and the traction pulley, positioned upon said guide tracks and discharging the overall load force on the same guide tracks, and is characterized in that:

- the car hoisting machine and said fixed frame are enterely allocated inside the top of the hoistway,
- the car hoisting machine consists of a brushless D.C. motor with permanent magnets, fed by a low voltage, driving an epicyclical gear system,
- the hauling cables are toothed belts,
- the traction pulleys are toothed pulleys.

DRAWINGS

[0009] Preferred embodiments of present invention are described in the following with the aid of the annexed drawings, which show:

Fig.1a: vertical cross section front view of a hoistway with a relevant room-less lifting equipment according to the invention;
Fig.1b: vertical cross section side view of the hoistway of Fig.1a;
Fig.2a: horizontal cross section view of the above equipment and hoistway, according to the section A-A of figs. 1a, 1b;
Fig.2b: horizontal cross section view of the above equipment and hoistway, according to the section B-B of figs. 1a, 1b;
Fig.3a: schematic enlarged view of the belts of fig. 1a making more clear their arrangement;
Fig.3b: a variant of the arrangement of the belts of fig. 1a;
Fig.4: schematc view of a preferred embodiment of the above belts;
Fig.5: perspective enlarged view displaying the upper and lower parts of the lifting equipment of figs. 1a-1b in more details;
Figs.6a, 6b, 6c: side view of the fastening device 11 of Fig.5, in different positions;
Fig.7: belt guard bar installed over the traction pulleys.

PREFERRED EMBODIMENTS

[0010] In the figs. 1a, 1b, 2a, 2b, 3a, the marked parts have the following meaning:

1a: a brushless D.C. motor with permanent magnets, fed by a low voltage,
1b: an epicyclical gear system driven by motor 1a,
2: two toothed traction pulleys,
3: two toothed hauling belts,
4: a double action disc brake (as usually used in traction lifts);
5: a speed governor (as usually used in traction lifts);
6: a fixed frame supporting the hoisting machine and the traction pulleys, positioned upon said guide tracks and discharging the overall load force on the same guide tracks,
9: a load car (cabin),
12a: a counterweight,
7a, 7b: guide tracks guiding the movement of the car-rack frame, located near a wall of the hoistway,
8a, 8b: guide tracks guiding the movement of the counterweight, located near the same wall of the hoistway,
10: diverting toothed pulleys supporting the load car;
12b: diverting toothed pulleys supporting the counterweight,
13: external doors of the equipment,
14: door of the load car,
16: fixed plate to which the ends of the toothed belts are attached,
17: upper console-wise beam holding the metal frame of the load car and incorporating the driving pulleys 10.

[0011] It should be clear that according to the belt arrangement pointed out in Fig.3a a clockwise rotation of pulley 2 causes the descent of the load car, while a counterclockwise rotation causes its ascent.

[0012] A room-less lifting equipment according to the invention, as above described, with:

- the car hoisting machine and relevant fixed frame entirely allocated inside the top of the hoistway,
- the car hoisting machine consisting of a brushless D.C. motor with permanent magnets, fed by a low voltage, with a speed control incorporated, driving an epicyclical gear system,
- toothed hauling belts and traction pulley, entails the following advantages:

- it does not require a separate room for the hoisting machine,
- lifting the pay-load by means of hauling toothed belts, in a counter-weighted arrangement, driven through a toothed traction pulleys, allows the use of traction and diverting pulleys having a primitive diameter from 80 mm to 100 mm, so making extremely compact the space reservation for the traction machinery, inside the hoistway; moreover, being the traction pulleys and the transmission belts toothed, any slip between the traction pulleys and the transmission belts is made impossible and the movement synchronisation of the two traction belts is assured;
- employing an epicyclical gear system, driven from a brushless D.C. motor with permanent magnets, fed by a low voltage, consents an absorption of power which represents one fourth of the power which is so far absorbed by a equivalent hydraulic and two third of that absorbed by a electric traction lift, and allows the load car motion by either an a.c. single phase power supply and/or a rechargeable battery, in case of a power failure, which is a by-product of this low voltage driving technology and which represents a new state-of-art, compared with the other existing similar products.

[0013] As can be desumed by figs. 1a, 1b, and 3a the cabin and its frame form a compact structure having as upper side a console-wise beam 17, which holds the total load.

[0014] This compact structure consents to minimize both its weight and the depth of the pit (indicated with 19 in Fig. 1b), so allowing the access to the car from the lower floor through a ramp (indicated with 20 in Fig.1b) not higher e.g. than 50 mm from the basement floor, being 50 mm the depth of the pit.

[0015] In particular the self-supporting, cantilever type, chassis consists of a bolted metal frame where the upper console-wise beam holds the loading platform through four uprights which represent the four corners of the car-cage. The upper beam incorporates the idle pulleys on which the total load is hauled by the traction belts. The two uprights in correspondence of the car guide rails are fitted with shoes which guide the car along the hoistway on the relevant guide rails.

[0016] Fig.4 shows a preferred embodiment of the two hauling belts 3.

[0017] According to this preferred embodiment any belt comprises a polyurethane covering embedding a number of metal wires 23 positioned parallel to the sides of the belt and connected in serial at the two ends of the belt.

[0018] As far as the traction force is concerned, the number of metal wires and their diameter are calculated in accordance with the indication of EN81-1, which represents the European code for the lifts.

[0019] With the purpose of matching the most rigorous principle of safety, the integrity of the metal wires, embodied into the toothed belt, is permanently monitored by a detecting circuit.

[0020] In fact the two terminals of the metal wires series are serially connected to a voltage feeder 24 and to a detector circuit 25. If the wire chain becomes interrupted by a broken wire, the detector emits alarm signals and switches off the traction motor.

[0021] Fig.5 is a perspective enlarged view displaying the upper and lower parts of the lifting equipment of figs. 1a-1b in more details. In this figure 15 represents a tensioner, a device which is normally associated to a speed governor (see speed governor 5), while 11 (even isolately represented in Fig.5a for a better comprehension) represents a fastening device 11 which ensures the anchoring of the diverting pulleys 10 to the upper beam 17 of the load car.

[0022] According to a preferred embodiment of the fastening device 11, every diverting pulleys 10 is supported by a rocker bearing 18 which can pivot on a shaft 21, fixed to the upper beam 17. A spring device prevents an excessive pivoting of the rocker bearing caused by value variations of the load, as long as the value of the load supported by the pulley remains in a regular range. As soon as a slack of the belt or a over-load occurs the rocker bearing pivots in clockwise or counterwise direction activating one of two different switches, which immediately prevents the gear motor from moving.

[0023] Figs.6a, 6b, 6c show side views of fastening device 11 displaying the position of the rocker bearing 18 in case of normal load (Fig.6a), or in case of belt slack (Fig.6b), or in case of overload (Fig.6c).

[0024] Another preferred embodiment is represented in Fig.7. This figure shows a bar 22 installed over the traction pulleys near the hauling belts. This bar represents a safety provision foreseen in order to prevent possible slippings of the belts out of the pulleys due to possible shocks whatsoever caused during the car motion.

[0025] The above preferred embodiments of the present invention have been given by way of non-limiting example, many obvious variants being possible.

[0026] A variant could concern the number of the hauling belts which could be more than two.

[0027] Another variant could e.g. concern the arrangement of the belts which instead the one of Fig.3a could be the one of Fig.3b, i.e. without the diverting pulleys 10 and 12b, being the ends of the belts directly attached to the load car and to the counterweight (this means, for a same speed and a same load of the car, a sliding speed of the belts which is an half the one of Fig.3a and a load of the belts which is twice).

Claims

1. Room-less lifting equipment for persons and goods comprising:

   - a hoistway,
   - a load car (9),
   - a car hoisting machine (1a, 1b),
   - a counterweight (12a),
   - hauling cables (3) supporting both the car and the counterweight,
   - traction pulleys (2) driving the hauling cables,
   - guide tracks (7a,7b,8a,8b) guiding the movement of the car-rack frame and counterweight, located near a same wall of the hoistway,
   - a fixed frame (6) supporting the hoisting machine and the traction pulley, positioned upon said guide tracks and discharging the overall load force on the same guide tracks,
   - the car hoisting machine and said fixed frame are entirely allocated inside the top of the hoistway, **characterized in that**
   - the car hoisting machine consists of a brushless D.C. motor (1 a) with permanent magnets, fed by a low voltage, driving an epicyclical gear system (1b),
   - the hauling cables are toothed belts (3),
   - the traction pulleys are toothed pulleys (2),
   - the cabin and and the frame of the load car form a compact structure having as upper side a console-wise beam (17), which holds the total load of the car.

2. Room-less lifting equipment as set forth in previous claim 1 **characterized in that** any toothed belt comprises a polyurethane covering embedding a series of metal wires (21) positioned parallel to the sides of the belt and connected in serial at the two ends of the belt, and ulteriorly **characterized by** the fact that the integrity of the metal wires is permanently monitored by a detecting circuit, being the two terminals of the metal wires series serially connected to a voltage feeder (24) and to a detector circuit (25), which emits alarm signals and switches off the traction motor when the wire chain becomes interrupted by a broken wire.

3. Room-less lifting equipment as set forth in previous claim 2 **characterized in that**:

   - the load of the car is supported by first diverting pulleys (10) anchored to the upper beam (17) while the load of the counterweight is supported by second diverting pulleys (12b);
   - every one of the first diverting pulleys (10) is supported by a rocker bearing (18) which can pivot on a shaft (19) fixed to the upper beam (17);
   - a spring device prevents an excessive pivoting of the rocker bearing caused by value variations of the load, as long as the value of the load supported by the pulley remains in a regular range, and on the contrary, as soon as a slack of the belt or a over-load occurs, it allows the rocker bearing to pivot in clockwise or counterwise direction for activating one of two different switches, which prevents the gear motor from moving.

4. Room-less lifting equipment as set forth in previous claim 3 **characterized in that** a bar (20) is installed over the traction pulleys (2) near the hauling belts (3) in order to prevent possible slippings of the belts

on the traction pulleys due to possible shocks whatsoever caused during the car motion.

Patentansprüche

1. Hebeeinrichtung ohne Maschinenraum für Personen und Güter umfassend:

   - einen Aufzugsschacht,
   - einen Förderwagen (9),
   - eine Wagenhebevorrichtung (1a, 1b)
   - ein Gegengewicht (12a),
   - sowohl den Wagen als auch das Gegengewicht tragende Förderstränge (3),
   - Förderrollen (2) zum Antreiben der Förderstränge,
   - Führungsschienen (7a, 7b, 8a, 8b) zur Führung der Bewegung des Wagenrahmes und des Gegengewichts, angeordnet nahe einer gleichen Wand des Aufzugsschachts,
   - einen die Wagenhebevorrichtung und die Förderrollen tragenden stationären Rahmen (6), der auf den besagten Führungsschienen angeordnet ist und der die gesamte Belastungskraft in ebendiese Führungsschienen einleitet,
   - die Wagenhebevorrichtung und der besagte stationäre Rahmen sind vollständig im Innern am oberen Ende des Aufzugsschachts angeordnet,
   - die Wagenhebevorrichtung besteht aus einem bürstenlosen Gleichstrommotor (1a) mit Permanentmagneten, gespeist durch eine niedrige Spannung, welche ein epizyklisches Getriebesystem (1b) antreibt,
   - die Förderstänge sind als Zahnriemen (3) ausgebildet,
   - die Förderrollen sind als gezahnte Rollen (2) ausgebildet,
   - die Kabine und der Rahmen des Förderwagens bilden eine kompakte Struktur, die als Oberseite einen konsolenartigen Ausleger (17) aufweist, die die vollständige Last des Wagens trägt.

2. Hebeeinrichtung ohne Maschinenraum gemäß Anspruch 1,
   dadurch gekennzeichnet,
   dass jeder Zahnriemen eine Hülle aus Polyurethan umfasst, in die eine Reihe von Metalldrähten (21) eingebettet sind, und zwar parallel zu den Seiten des Riemens und in Serie an den beiden Enden des Riemens verbunden, und jenseitig **dadurch gekennzeichnet, dass** die Integrität der Metalldrähte permanent durch eine Erkennungsschaltung überwacht wird, bestehend aus den beiden Anschlüssen der Metalldrähteserie, die seriell mit einer Spannungsquelle (24) und mit einem Erkennungsschaltkreis (25) verbunden ist, welche ein Alarmsignal abgeben und den Antriebsmotor abschalten, wenn die Drahtkette von einem gebrochenen Draht unterbrochen wird.

3. Hebeeinrichtung ohne Maschinenraum gemäß Anspruch 2,
   dadurch gekennzeichnet, dass

   - die Last des Wagens durch die ersten Ablenkrollen (10) getragen ist, die am oberen Ausleger (17) verankert sind, während die Last des Gegengewichts von zweiten Ablenkrollen (12b) getragen ist;
   - jede der ersten Ablenkrollen (10) von einem Gelenklager (18) getragen ist, das sich um einen am oberen Ausleger (17) befestigten Schaft (19) drehen kann;
   - eine Federvorrichtung eine durch Wertänderungen der Last bedingte übermäßige Drehung des Gelenklagers verhindert, und zwar so lange, wie der von den Rollen getragene Wert der Last in einem regelmäßigen Bereich verbleibt, und im Gegensatz dazu, sobald ein Schlupf des Riemens oder eine Überladung auftritt, dem Gelenklager erlaubt sich im Uhrzeigersinn oder im Gegenuhrzeigersinn zu drehen, um einen von zwei verschiedenen Schaltern zu betätigen, welcher den Getriebemotor von einer Bewegung abhält.

4. Hebeeinrichtung ohne Maschinenraum gemäß Anspruch 3,
   dadurch gekennzeichnet,
   dass ein Balken (22) oberhalb den Förderrollen (2) nahe den Förderströngen (3) angeordnet ist, um ein mögliches Rutschen der Riemen, bedingt durch mögliche, wie auch immer bei der Wagenbewegung entstandene Erschütterungen auf den Förderrollen, zu verhindern.

Revendications

1. Dispositif de levage sans local de machinerie pour des personnes et des marchandises :

   - une gaine,
   - une cabine de charge (9),
   - une machine d'actionnement de la cabine (1 a, 1 b),
   - un contrepoids (12a),
   - des câbles de manoeuvre (3) supportant à la cabine et le contrepoids,
   - des poulies de traction (2) entraînant les câbles de traction,
   - des rails de guidage (7a, 7b, 8a, 8b) guidant le mouvement du châssis support de cabine et du contrepoids, placés près d'une même paroi de la gaine,

- un châssis fixe (6) supportant la machine de levage et la poulie de traction, placés sur lesdits rails de guidage et déchargeant la force globale de charge sur ces mêmes rails de guidage,
- la machine d'actionnement de la cabine et ledit châssis fixe sont entièrement situés à l'intérieur du dessus de la gaine,

caractérisé en ce que:

- la machine d'actionnement de la cabine se compose d'un moteur à courant continu sans balais (1a) avec des aimants permanents, alimentés par une tension basse, entraînant un système de transmission épicycloïdale (1 b),
- les câbles de manoeuvre sont des courroies crantées (3),
- les poulies de traction sont des poulies crantées (2),
- la carlingue et le châssis de la cabine de charge forment une structure compacte ayant, en tant que côté supérieur, une poutre en forme de console (17), qui supporte la charge totale de la cabine.

2. Dispositif de levage sans local de machinerie selon la revendication précédente 1, **caractérisé en ce que** chaque courroie crantée comporte une bande en polyuréthane enrobant une série de fils en métal (21) placés parallèlement aux côtés de la courroie et reliés en série aux deux extrémités de la courroie, et
caractérisé par le fait que l'intégrité des fils en métal est surveillée de manière permanente par un circuit de détection, constitué par les deux parties terminales de la série de fils en métal reliées en série à un dispositif d'alimentation en tension (24) et à un circuit de détecteur (25), qui émet des signaux d'alarme et commute le moteur de traction en position d'arrêt lorsque la chaîne de fil devient interrompue par la rupture d'un fil.

3. Dispositif de levage sans local de machinerie selon la revendication précédente 2, **caractérisé en ce que** :

- la charge de la cabine est supportée par des premières poulies de détournement (10) fixées à la poutre supérieure (17) tandis que la charge du contrepoids est supportée par des deuxièmes poulies de détournement (12b) ;
- chacune des premières poulies de détournement (10) est supportée par un support pivotant (18) qui peut pivoter sur un axe (19) fixé à la poutre supérieure (17) ;
- un dispositif à ressort empêche un pivotement excessif du support pivotant provoqué par des variations du poids de la charge, tant que le poids de la charge supportée par la poulie demeure dans une plage nominale, et, au contraire, dès lors que se produit un relâchement de la courroie ou une surcharge, permet au support pivotant de pivoter dans le sens horaire ou dans le sens anti- horaire pour actionner un commutateur d'un ensemble de deux commutateurs différents, qui empêche le pignon moteur de se déplacer.

4. Dispositif de levage sans local de machinerie selon la revendication précédente 3, **caractérisé en ce qu'**une barre (20) est installée au-dessus des poulies de traction (2) près des courroies (3) d'actionnement afin d'empêcher des glissements possibles des courroies sur les poulies de traction dues à de possibles chocs quelquonques survenant pendant le déplacement de la cabine.

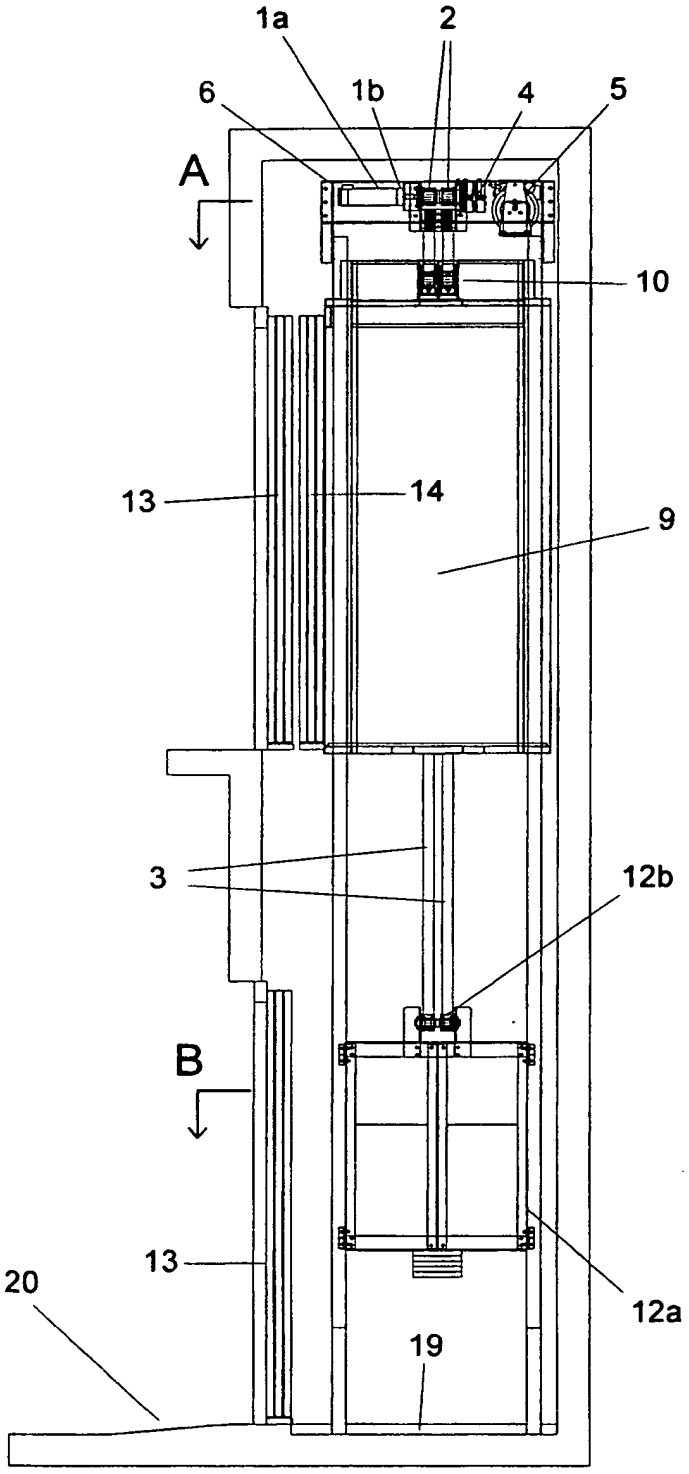


Fig. 1b

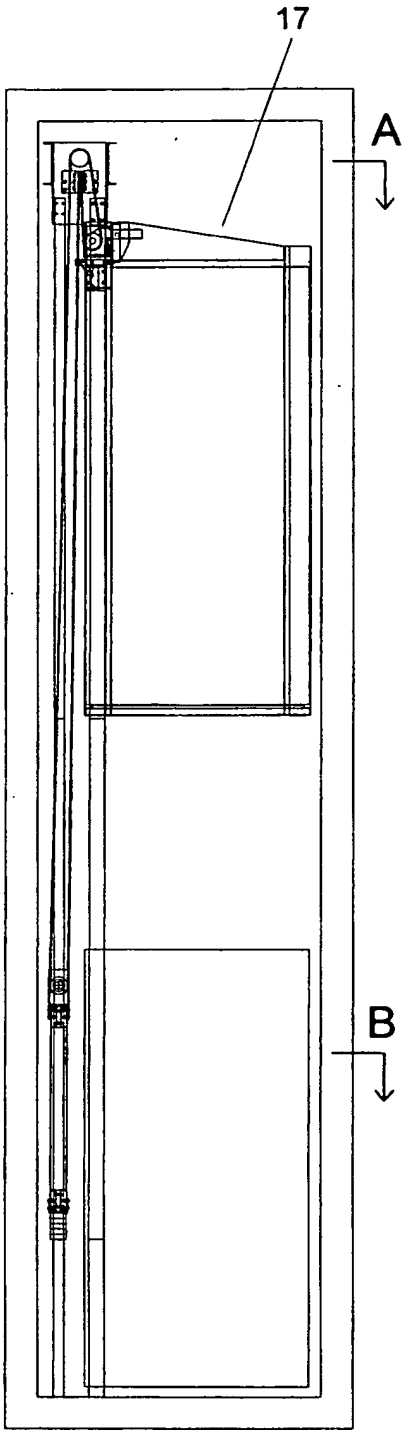


Fig. 1a

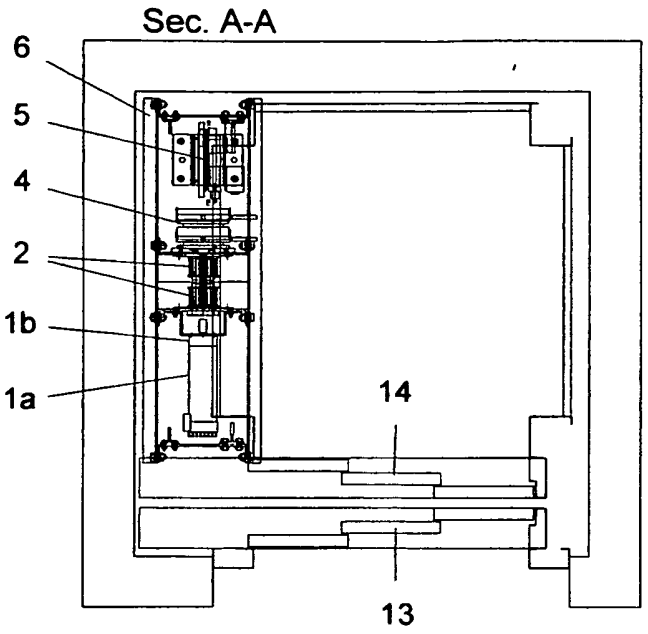


Fig. 2a

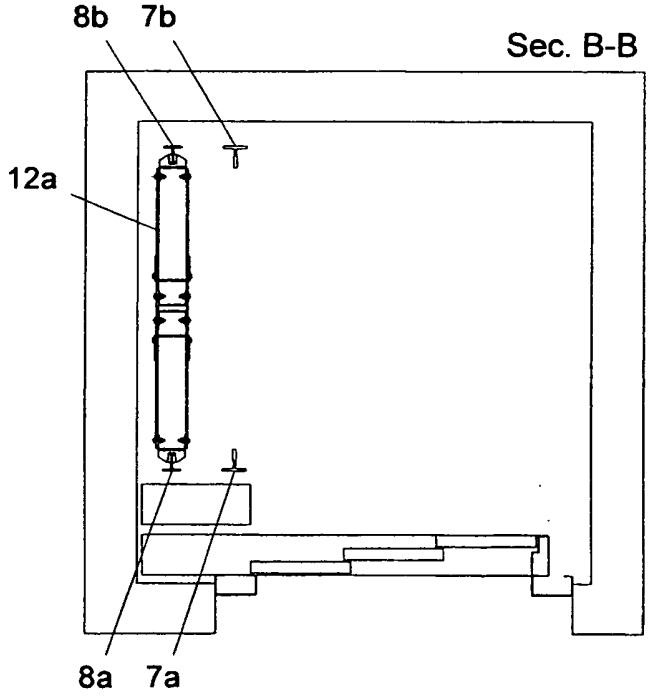


Fig. 2b

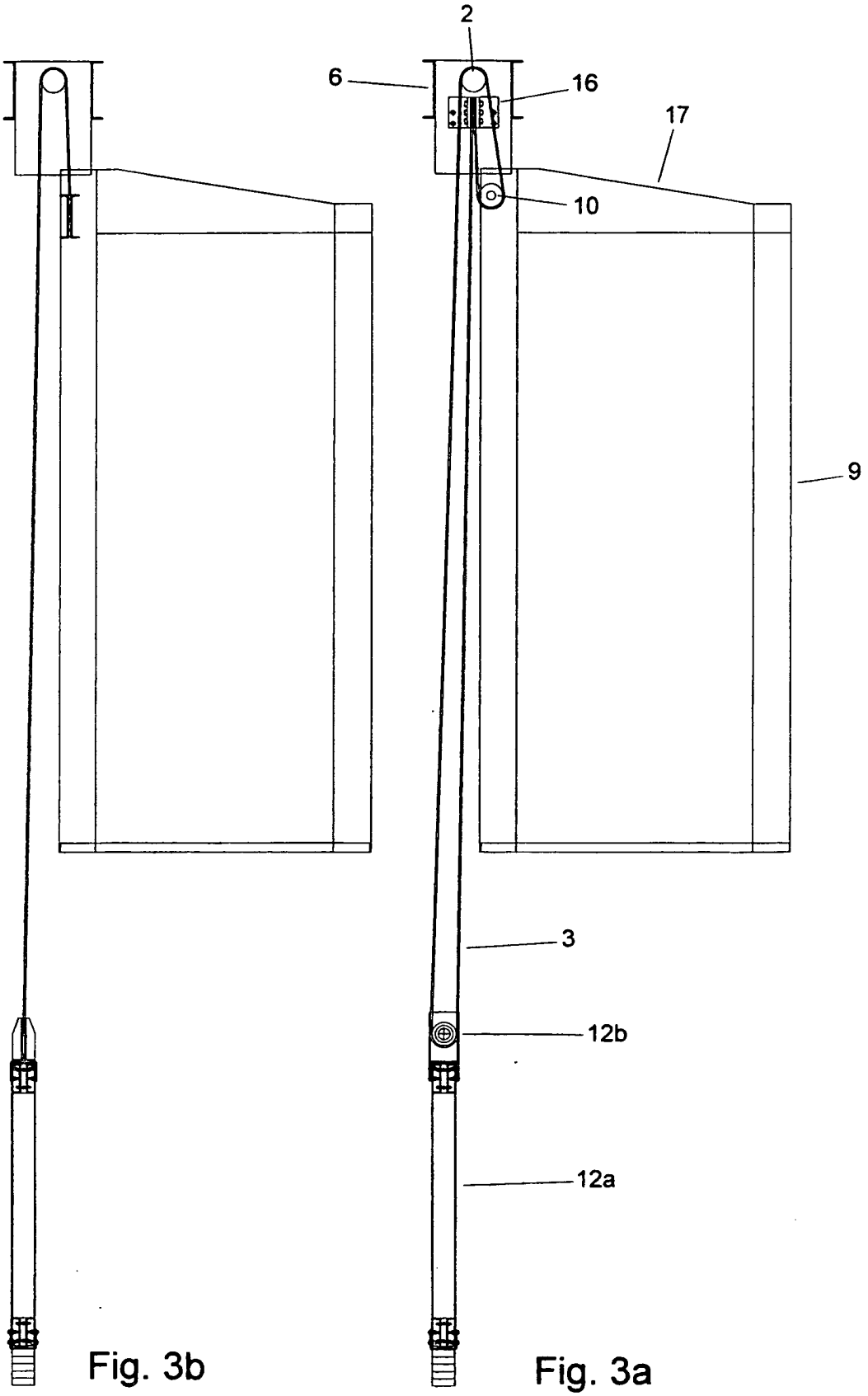


Fig. 3b

Fig. 3a

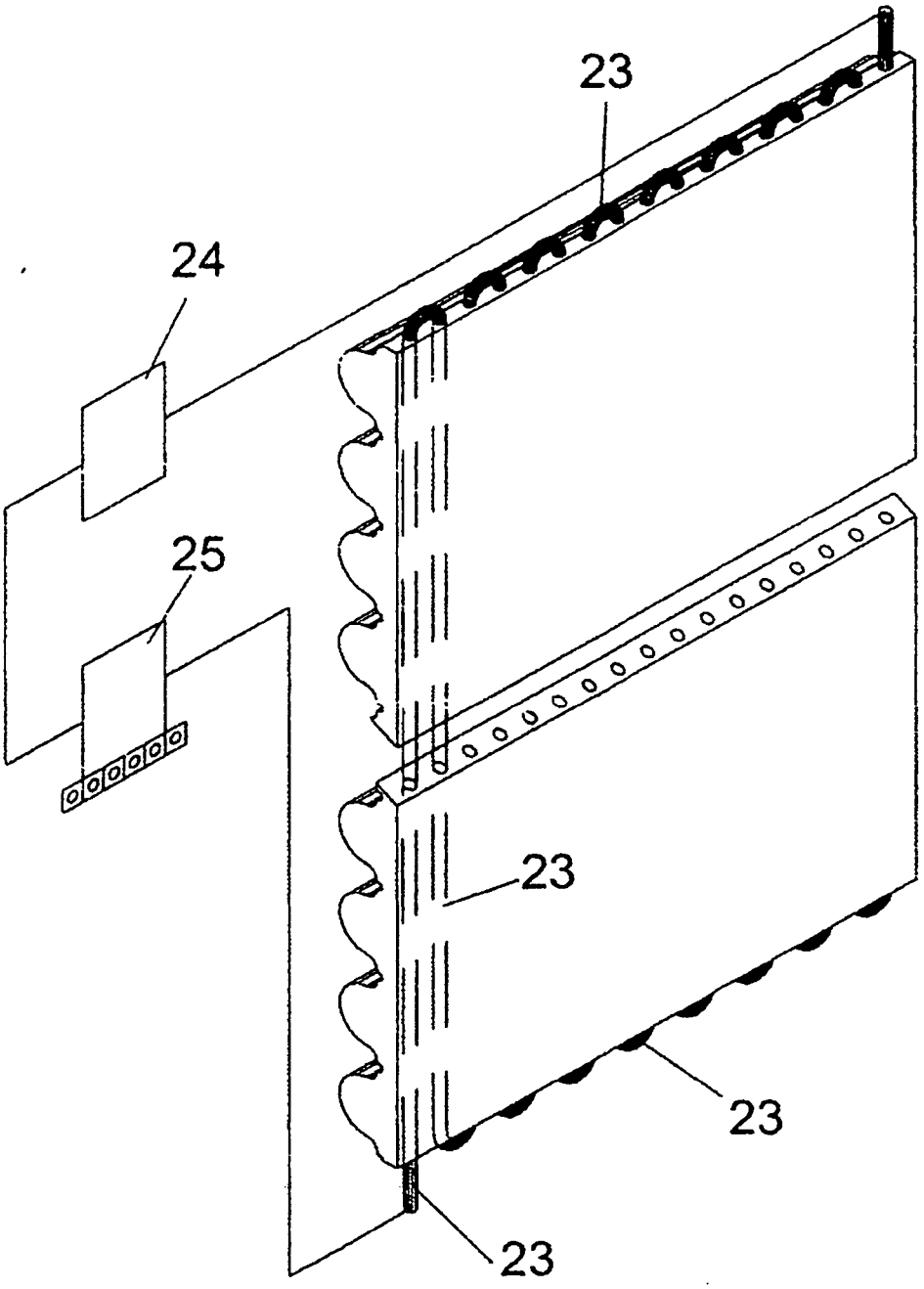


Fig. 4

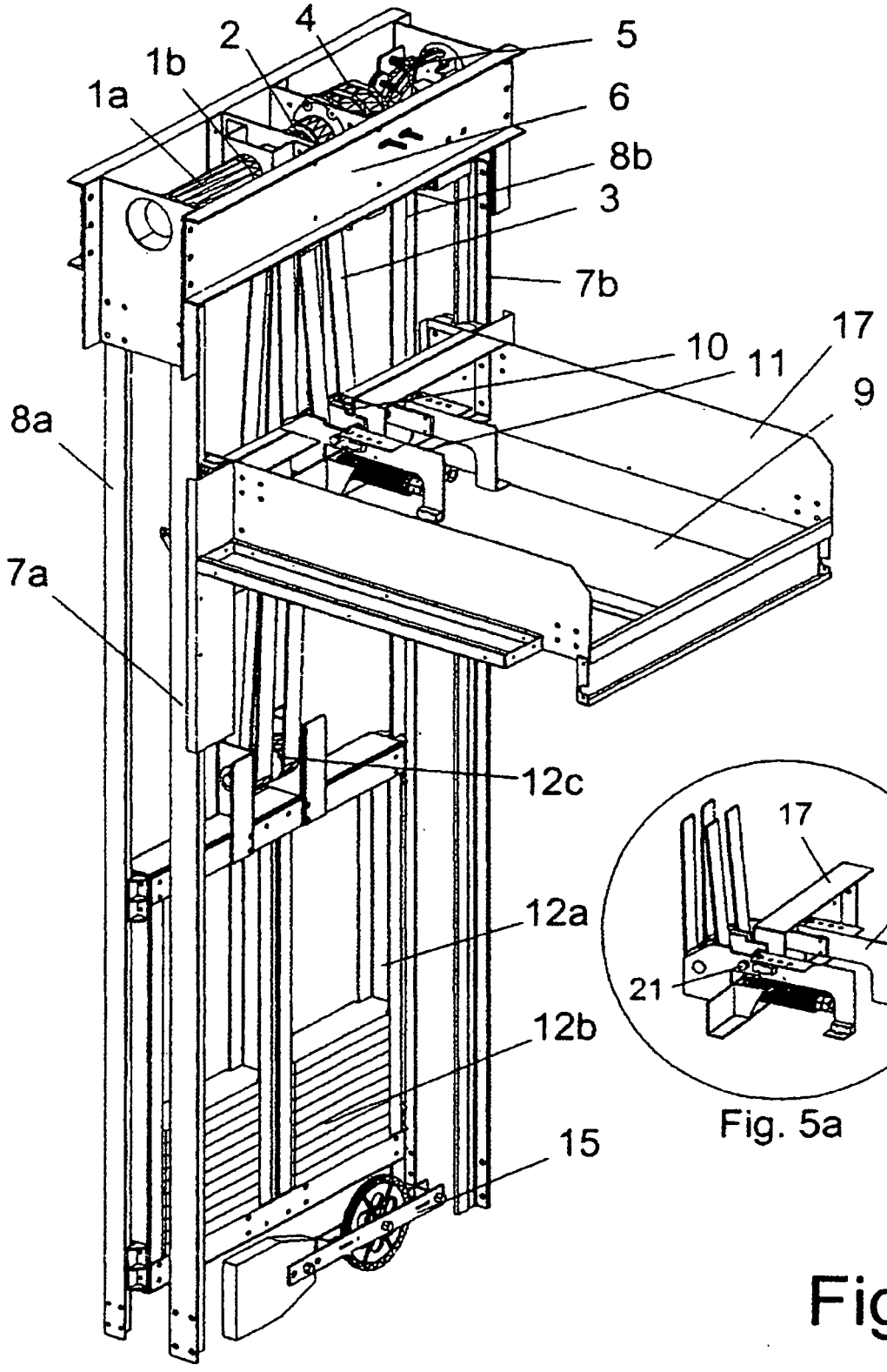


Fig. 5a

Fig. 5

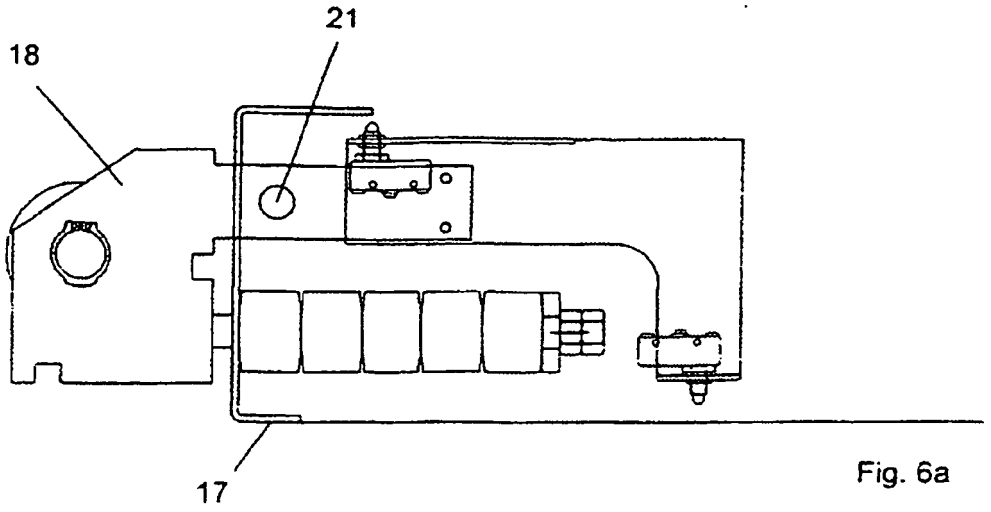


Fig. 6a

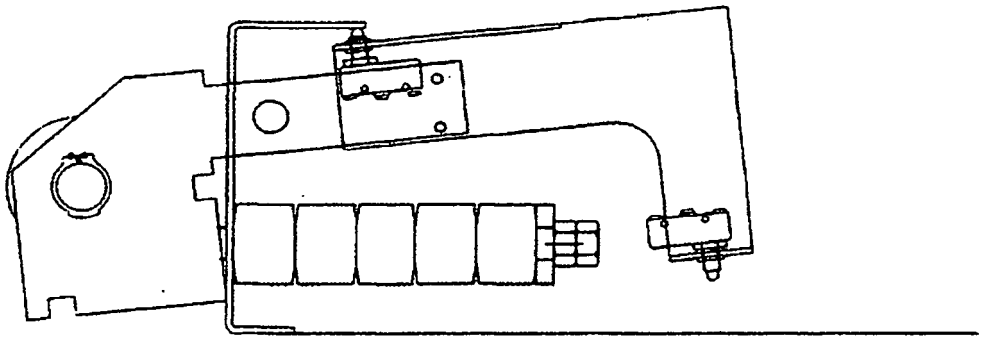


Fig. 6b

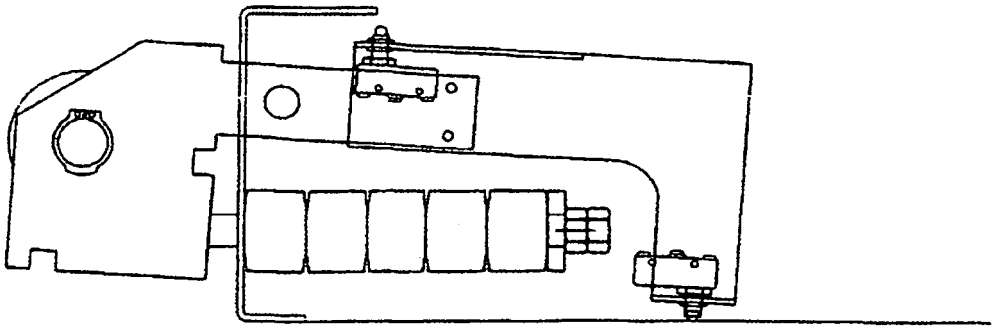


Fig. 6c

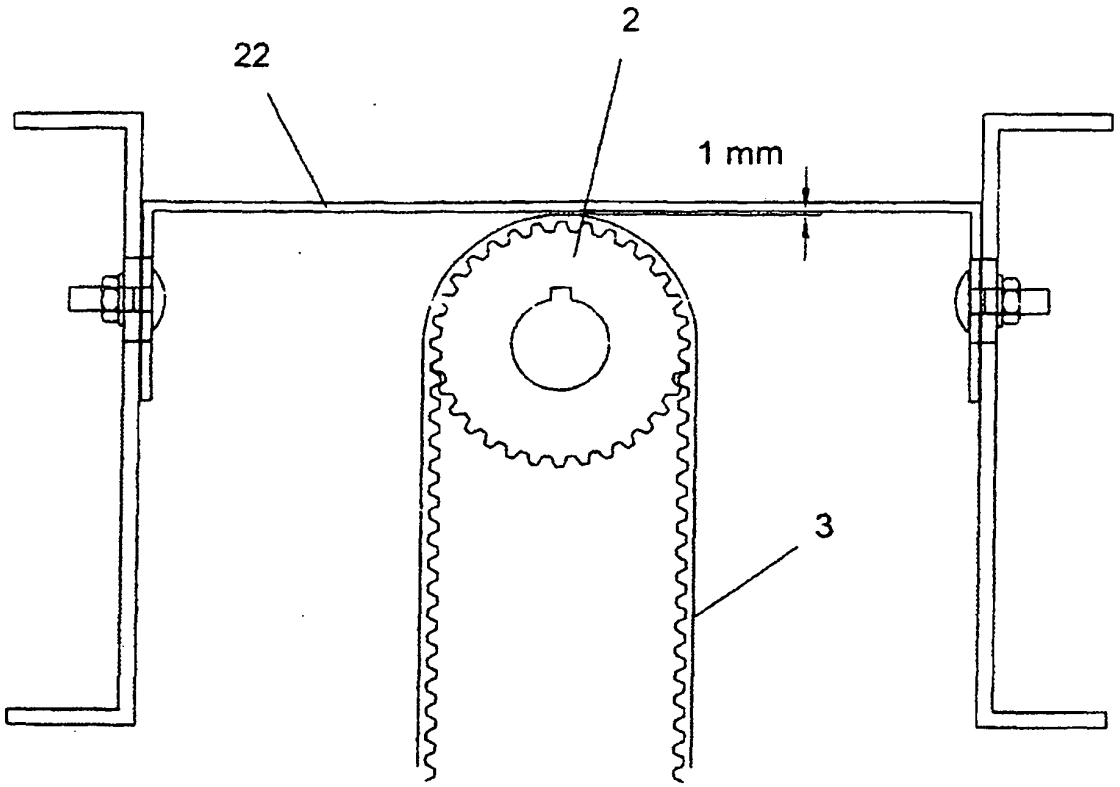


Fig. 7

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- EP 1561720 A1 **[0006]**