

SUPERINTENDENCIA DE INDUSTRIA Y COMERCIO	
RAD: 14-119485- -5	FECHA: 2015-07-15 18:35:43
DEP: 2020 DIRECCION DE NUEVAS CREACIONES	EVE: 379 FASE NACIONAL INCLUIDO CAPITULO II
TRA: 11 PCT-PATENTE DE INVENCION CAPITULOS I Y II	FOLIOS: 8
ACT: 430 REQUERSOLICITA	

DIRECCIÓN DE NUEVAS CREACIONES

2020
Bogotá, D.C.,

Abogado(a)/Señor(a)
MARGARITA CASTELLANOS ABONDANO

Asunto: Radicación: 14-119485- -5
Trámite: 11
Evento: 379
Actuación: 430
Oficio: 8102
Folios: 8

Patente de Invención	X			Patente de Modelo de Utilidad	
Vía Nacional					
Vía PCT (Fase Nacional)	X	Capítulo I		Capítulo II	X
No. Solicitud Internacional	PCT/EP2012/073674				
Fecha de Presentación Internacional	27/11/2012				

Como resultado del examen de fondo realizado, con fundamento en el Artículo 45 de la Decisión 486 de la Comisión de la Comunidad Andina, se comunica:

1. Documentos estudiados

Descripción:	Rad. N° 14-119485-00000-0000	04/junio/2014
Reivindicaciones:	Rad. N° 14-119485-00000-0000	04/junio/2014
Dibujos:	Rad. N° 14-119485-00000-0000	04/junio/2014
Prioridad:	EP 11192821.3	09/diciembre/2011

2. Análisis de la Prioridad

Se acepta la reivindicación de prioridad porque ésta solicitud fue presentada dentro del plazo establecido (Art. 9 D 486) y su contenido técnico corresponde con el de la prioridad reivindicada.

3. Objeto de la invención

De acuerdo con lo establecido en el numeral 1.2.2.2 del Capítulo Primero del Título X de la Circular Única para efectos del examen de patentabilidad, se tendrá en cuenta la tasa pagada por el solicitante al momento de comenzar el examen para las reivindicaciones adicionales; esto es que cuando la solicitud contenga más de diez (10) reivindicaciones y no se haya pagado la tasa complementaria, sólo se estudiarán las cubiertas por la tasa pagada. Por lo tanto, se estudiarán las reivindicaciones 1 a 12.

Título de la solicitud: "Accionamiento de un freno de seguridad" (Fl. 1).

El problema planteado en esta solicitud, consiste en lograr un freno de seguridad que pueda ser activado por medio de un dispositivo electromecánico, pero que pueda funcionar con una pequeña cantidad de energía.

Para resolver este problema técnico, la solicitud en estudio propone un dispositivo y un método, donde el dispositivo de frenado comprende una carcasa de freno, un primer cuerpo de freno, un prensador y una palanca de presión.

El objeto de la presente solicitud se relaciona con la Clasificación Internacional de Patentes (CIP): B 66 B 5/20.

4. De la solicitud de patente

Reivindicaciones (Art 30 D 486, Art 22 PCT)

El capítulo reivindicatorio no es claro porque:

- Las reivindicaciones 7, 8, 10 y las expresiones: *"...para que sea movable y que se construye para ser movido con la red de frenado (7) cuando entra en contacto con la red de frenado (7) y el movimiento relativo entre la red de frenado (7) y la carcasa de freno (21) tenga lugar y por lo tanto sujetar la red de frenado (7) y tensionar la carcasa de freno (21)..."*, *"...En el que el prensador (25) cuando sea necesario es ajustable en la dirección del primer cuerpo de freno (22) sustancialmente a lo largo de una línea de acción que se extiende perpendicularmente a la red de frenado (7) y el prensador (25) puede ser presionado contra la red de frenado (7)..."*, *"En el que el primer cuerpo de freno (22) se puede poner en contacto con la red de frenado (7) por una fuerza contraria que actúa en la red de frenado (7) debido a la pulsación del botón de presión (25)..."*, *"...y que cuando se requiere actúa sobre el prensador (25) con el fin de prensar este contra la red de frenado (7) para desplazar de modo lateralmente a carcasa de freno (21) para poner en contacto el primer cuerpo de freno (22) en contacto con la red de frenado (7)."* (reivindicación 1), *"...y de modo que el esfuerzo capaz de ser producido por el primer cuerpo de freno (22) de la carcasa de freno hace la red de frenado (7) capaz de ser sujeta entre el primero y segundo cuerpo de freno (30)."* (reivindicación 2), *"...de modo que el segundo cuerpo de freno (30) es ajustable respecto a la red de frenado (7), preferentemente por medio de la placa de presión (28)."* (reivindicación 3), *"...de manera que el perno (26) es ajustable respecto a la red de frenado (7), preferentemente por medio de la palanca de presión (28)"* (reivindicación 4), *"...de manera que el rodillo (27) es ajustable respecto a la red de*

frenado (7), preferentemente por medio de la palanca de presión (28).” (reivindicación 5), “...que es giratoria alrededor de un eje de rotación (24)...”, “...y en la que cuando la excéntrica de esfuerzo (23) se presiona contra la red de frenado (7) de la excéntrica de esfuerzo (23) se hace girar por una fuerza de fricción producida entre la excéntrica de esfuerzo (23) y la red de frenado (7), por lo que la carcasa de freno (21) es presionada hacia atrás y se tensa.” (reivindicación 6), “...que, cuando se requiere, respectivamente actúan sobre las redes de frenado (7) dispuestas a casa lado de la cabina del ascensor (2).” (reivindicación 11); describen funciones, efectos, ventajas o resultados a alcanzar, los cuales no son aspectos susceptibles de patente. Para mayor claridad, el producto reclamado se debe definir técnicamente mediante sus características estructurales. Se sugiere al solicitante eliminar la reivindicación y las expresiones citadas.

- El método descrito en la reivindicación 12 no está planteado correctamente ya que está descrito por medio de las características constructivas de la invención y las funciones o resultados a alcanzar por las mismas características. De igual manera, lagunas expresiones no son claras por la forma como están redactadas.

Por ejemplo, algunas expresiones con falta de claridad en esta reivindicación son: “...y este primer cuerpo de freno (22) como consecuencia del contacto con la red de frenado (7) y un movimiento relativo entre la red de frenado (7) y carcasa de freno (21) se mueve junto con la red de frenado (7) y por lo tanto la red de frenado (7) es sujeta a la carcasa del freno (21) se tensa...” y “...con el propósito de presionar en contra la red de frenado (7) y poner en contacto el primer cuerpo de frenado (22) con la red de frenado (7).”.

Se sugiere al solicitante replantear dicho método describiendo una secuencia ordenada de etapas o pasos de un procedimiento, preferiblemente cada paso comenzando con un verbo en infinitivo.

- La expresión: “por la parte de atrás” (reivindicación 12) es relativa y no permite hacer una comparación con el estado de la técnica. Se sugiere al solicitante utilizar solamente expresiones concretas en las reivindicaciones.
- La expresión: “al menos” (reivindicación 1) precediendo una característica no es limitativo, porque hace opcional a característica y no limita el alcance de la reivindicación. Se sugiere incluir las características opcionales o preferentes en una reivindicación dependiente.
- Los términos: “sustancialmente”, “preferentemente” y “en el que cuando se requiere” (reivindicaciones 1, 3, 4, 12), es impreciso, por lo cual no permite distinguir la invención del estado de la técnica. Se sugiere sustituirlo por un término preciso o un rango concreto.
- No es clara la dependencia entre la reivindicación 9 y las reivindicaciones 1 a 8, debido a que la reivindicación 9 reclama la instalación del ascensor en conjunto con el dispositivo de frenado, mientras que las reivindicaciones precedentes reclaman solamente el dispositivo de frenado. Se sugiere al solicitante reemplazar la expresión “de acuerdo con cualquiera de las reivindicaciones 1 y 8” por las características constructivas del dispositivo de frenado.

5. Determinación del Estado de la Técnica

El estado de la técnica se determinó con base en la fecha de presentación de la solicitud

de prioridad: diciembre 9 de 2011, y se encontraron los siguientes documentos que anticipan el objeto de esta solicitud:

Ítem	Documento	Título	Fecha de Publicación
D1	US 2011/226560	'Elevator breaking element'	22/Septiembre/2011
D2	US 2004/0112683	'Safety device for elevators'	17/Junio/2004

El documento D1¹ divulga un freno de elevador que puede comprender un pie de freno con una forma sustancialmente curva, el pie de freno rota en un soporte. El soporte es montado en una carcasa de freno y puede ser desplazado linealmente (resumen).

El documento D2² divulga un dispositivo de seguridad que frena un elevador que incluye una base que comprende un elemento de retención y un punto de contacto con el riel guía posicionados entre estos (resumen).

6. Examen de Patentabilidad (Art 14 D486)

Novedad (Art 16 D486)

La reivindicación 1 consiste en: *“Un dispositivo de frenado de ascensor para frenar una cabina de ascensor (2) en una red de frenado (7), preferiblemente una red de frenado (7) integrada en un riel guía (6)...”* (Ver página 22 del radicado N° 14-119485-00000-0000).

Comparación de las características técnicas esenciales, con las del estado de la técnica:

Características esenciales	D1
Un dispositivo de frenado que incluye:	Equipo de frenado de un elevador que comprende:
Una carcasa de freno.	Una carcasa de freno (12)
Un primer cuerpo de freno que está dispuesto en la carcasa de freno.	Un primer cuerpo de freno (15) que está dispuesto en la carcasa de freno (Fig. 7).
Un prensador que está dispuesto en la carcasa de freno.	Un prensador (19, 20) que está dispuesto en la carcasa de freno (Fig. 7).
La red de frenado está dispuesta entre el primer cuerpo de freno y el prensador. Hay una separación entre el primer cuerpo de freno y el prensador que corresponde al menos con el espesor de la red de frenado más una tolerancia de paso requerida entre el cuerpo del freno, la red de frenado y el prensador.	La red de frenado (6) está dispuesta entre el primer cuerpo de freno (15) y el prensador (19, 20) (Fig. 7). Hay una separación entre el primer cuerpo de freno (15) y el prensador (19, 20) que corresponde al menos con el espesor de la red de frenado (6) más una tolerancia de paso requerida entre el cuerpo del freno, la red de frenado y el prensador (Fig. 7).
Una palanca de presión, montada de forma pivotante en la carcasa de freno.	La palanca del cuerpo de freno (113) está dispuesta en la carcasa de freno (112) para que

1 <https://www.google.ca/patents/US20110226560?dq=2011226560&hl=es&sa=X&ei=Q1yZVbq8C4HtgwTgk4rQCA&ved=0CB0Q6AEwAA>

2 <https://docs.google.com/viewer?url=patentimages.storage.googleapis.com/pdfs/US20040112683.pdf>

	pivote respecto al eje (126) (Párr. [0095]).
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De acuerdo con la tabla anterior, las características esenciales del dispositivo de la reivindicación 1 habían sido divulgadas previamente en el documento D1, por lo tanto, la materia reivindicada no es nueva.

Asimismo, el documento D1 divulga las características de las reivindicaciones dependientes así:

- Reivindicación 2: Cuerpos de frenado (15, 15a) y (14) (Figs. 5 y 7).
- Reivindicación 3: El prensador se construye como un segundo cuerpo de frenado (14) y este segundo cuerpo de freno está montado en la carcasa de freno (12) por medio de pasadores de tope y esta soportado en relación con la carcasa de freno por medio de elementos de presión (19, 20) (Fig. 7).
- Reivindicación 4: El prensador es un perno que está montado en la carcasa de freno (12) (Figs. 8 y 9).
- Reivindicación 6: Excéntrica de refuerzo (15a) (Figs. 5 y 7).

La reivindicación 12 consiste en: “El método de frenado de una cabina de ascensor de una instalación del ascensor en la que la cabina del ascensor (2) está equipada con un dispositivo de frenado...” (Ver página 23 del radicado N° 14-119485-00000-0000).

Comparación de las características técnicas esenciales, con las del estado de la técnica:

Características esenciales	D1
Un método de frenado de una cabina del ascensor de una instalación del ascensor caracterizado por:	Un método de frenado de una cabina del ascensor caracterizado por:
La cabina del ascensor está equipada con un dispositivo de frenado del ascensor y el dispositivo de frenado del ascensor comprende un dispositivo de presión.	La caja del elevador está equipada con un dispositivo de freno (10) (Párrs. [0058]). Un prensador (19, 20) que está dispuesto en la carcasa de freno (Fig. 7).
El prensador se presiona contra la red de frenado a lo largo de la línea de acción que se extiende perpendicularmente hasta una red de frenado.	Un dispositivo de retracción (16) se engancha con el pie de freno (15) y lleva al pie de freno (15) en una posición horizontal y simultáneamente el carro completo (13) contra un punto de contacto. El punto de contacto está formado por un grupo de resortes (19). Los carros (13) son presionados uno hacia el otro de tal manera que los pies de freno (15) amordazan la red de frenado (Párrs. [0068] a [0071]).
Una carcasa de freno del dispositivo de frenado del ascensor se presiona de nuevo en correspondencia con una fuerza de presión del prensador.	
Un primer cuerpo de freno dispuesto enfrente del prensador en la carcasa de freno se pone en contacto con la red de frenado por la parte de atrás presionando la carcasa de frenado.	
Por medio de una palanca de presión, que está montada de	La palanca del cuerpo de freno (113) está dispuesta en la

forma pivotante en la carcasa de freno, tiene lugar la acción del prensador.	carcasa de freno (112) para que pivote respecto al eje (126). La palanca (113) y el pie de freno (115) pueden ser ajustados respecto al guía por medio del dispositivo (122) (Párr. [0095]).
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De acuerdo con la tabla anterior, las características esenciales del dispositivo de la reivindicación 12 habían sido divulgadas previamente en el documento D1, por lo tanto, la materia reivindicada no es nueva.

Nivel inventivo (Art18 D486)

En cuanto a la reivindicación 5 se tiene que:

Comparación de las características técnicas esenciales, con las del estado de la técnica:

Reivindicaciones	Características esenciales	D1	D2
Reivindicación 1	Un dispositivo de frenado que incluye:	Equipo de frenado de un elevador que comprende:	Dispositivo de seguridad para elevadores caracterizado por:
	Una carcasa de freno.	Una carcasa de freno (12)	Una carcasa de freno (1) (Fig. 1).
	Un primer cuerpo de freno que está dispuesto en la carcasa de freno.	Un primer cuerpo de freno (15) que está dispuesto en la carcasa de freno (Fig. 7).	No menciona.
	Un prensador que está dispuesto en la carcasa de freno.	Un prensador (19, 20) que está dispuesto en la carcasa de freno (Fig. 7).	Un prensador (7) que está dispuesto en la carcasa de freno (Fig. 1; Párr. [0034]).
	La red de frenado está dispuesta entre el primer cuerpo de freno y el prensador. Hay una separación entre el primer cuerpo de freno y el prensador que corresponde al menos con el espesor de la red de frenado más una tolerancia de paso requerida entre el cuerpo del freno, la red de frenado y el prensador.	La red de frenado (6) está dispuesta entre el primer cuerpo de freno (15) y el prensador (19, 20) (Fig. 7). Hay una separación entre el primer cuerpo de freno (15) y el prensador (19, 20) que corresponde al menos con el espesor de la red de frenado (6) más una tolerancia de paso requerida entre el cuerpo del freno, la red de frenado y el prensador (Fig. 7).	No menciona.
	Una palanca de presión, montada de forma pivotante en la carcasa de freno.	La palanca del cuerpo de freno (113) está dispuesta en la carcasa de freno (112) para que pivote respecto al eje (126) (Párr. [0095]).	Un mecanismo de palanca (8), montado de forma pivotante en la carcasa de freno (1) (Figs. 7 a 9; Párr. [0036]).
Reivindicación 5	El prensador es un rodillo de presión montado en la carcasa de freno.	No menciona.	El prensador es un rodillo de presión (7) montado en la carcasa de freno (Fig. 1; Párr. [0034]).

Los documentos D1 y D2 se consideran el estado de la técnica cercano a la invención definida en la reivindicaciones 1 y 5 porque divulgan frenos para elevadores.

La diferencia entre la invención, definida en las reivindicaciones 1 y 5 y el freno de D1 consiste en que el prensador es un rodillo de presión montado en la carcasa de freno.

La diferencia entre la invención, definida en las reivindicaciones 1 y 5 y el freno de D2 consiste en un primer cuerpo de freno que está dispuesto en la carcasa de freno.

El efecto que logra el incluir que el prensador es un rodillo de presión montado en la carcasa de freno es que el prensador puede ser accionado mediante una palanca para ejercer presión sobre la red de frenado.

Por lo tanto, el problema técnico objetivo que pretende resolver esta invención se puede formular así: “¿cómo modificar el freno conocido en D1 para que el prensador pueda ser accionado mediante una palanca para ejercer presión sobre la red de frenado?”.

Sin embargo, un rodillo de presión montado en la carcasa de freno para que dicho prensador pueda ser accionado mediante una palanca para ejercer presión sobre la red de frenado, ya está divulgada en el documento D2 que se enseña que la posición del rodillo (7) puede ser cambiada a lo largo de la guía (11) del mecanismo (8) para ejercer presión sobre la red de frenado (Párr. [0036]).

En consecuencia, la persona del oficio normalmente versada en la materia, incluiría el prensador es un rodillo de presión (7) montado en la carcasa de freno (Fig. 1; Párr. [0034]) del documento D2 en el procedimiento divulgado en el documento D1 para llegar así al objeto de la reivindicación 1 de la solicitud. Por lo cual se considera obvia.

Asimismo, los documentos D1 y D2 divulgan las características de las reivindicaciones dependientes así:

- Reivindicación 8: Posiciones del freno y estados de ajuste pueden ser detectados eléctricamente o por medio de detectores de posición (Párr. [0078]).
- Reivindicaciones 9 y 11: El actuador (30) está dispuesto en la caja de forma horizontalmente movable de tal manera que pueda ser centrado por medio del equilibrio de 2 frenos 11, 11a (Fig. 3; Párr. [0062]).

Las reivindicaciones 7, 8, 10 y 12 fueron afectadas en el numeral 4 de la presente comunicación.

7. Conclusión

Los requisitos de Patentabilidad de la presente solicitud están afectados así:

Ítem	Documento	Reivindicaciones afectadas	Requisito que afecta
D1	US 2011/226560	1, 2, 3, 4, 5, 6, 8, 9, 11, 12	Novedad/Nivel Inventivo
D2	US 2004/0112683	5	Novedad/Nivel Inventivo

En cumplimiento del artículo 45 de la Decisión 486 de la Comisión de la Comunidad Andina, se le indica que debe dar respuesta dentro del término de sesenta (60) días contados a partir del día siguiente de la fecha de notificación de la presente comunicación. En caso de no dar respuesta al presente requerimiento, o si a pesar de la respuesta subsistieran los impedimentos para la concesión, se denegará la patente.

Se invita al solicitante se sirva indicar, si así lo considera, su renuncia al término faltante de sesenta (60) días para dar respuesta a este requerimiento y presentarla por escrito.

Finalmente, se le recuerda al solicitante que si como respuesta a este requerimiento llegara a modificar el capítulo reivindicatorio y éste contenga más de diez (10) reivindicaciones, no pagará la tasa de modificación voluntaria pero sí la correspondiente al pago por reivindicación adicional.

Notifíquese el presente oficio conforme a lo dispuesto en el numeral 5.2, literal e), del capítulo quinto del título primero de la Circular Única No. 10 de 2001.



JOSÉ LUIS SALAZAR LÓPEZ
Director de Nuevas Creaciones (c)

El anterior requerimiento fue notificado por fijación en lista, de fecha 2015-07-21

Elaboró: Monica Andrea Gutierrez Almonacid
Revisó: Sonia Andrea Diaz Pirazan



US 20110226560A1

(19) **United States**(12) **Patent Application Publication**
Husmann(10) **Pub. No.: US 2011/0226560 A1**(43) **Pub. Date: Sep. 22, 2011**(54) **ELEVATOR BRAKING EQUIPMENT**(52) **U.S. Cl. 187/359; 188/67; 188/166**(76) **Inventor: Josef Husmann, Luzern (CH)**(21) **Appl. No.: 13/051,465**(22) **Filed: Mar. 18, 2011**(30) **Foreign Application Priority Data**

Mar. 18, 2010 (EP) 10156865.7

Publication Classification(51) **Int. Cl.****B66B 5/18** (2006.01)**B66B 1/32** (2006.01)(57) **ABSTRACT**

An elevator brake can comprise a brake shoe with a substantially curved shape, the brake shoe being rotatable in a brake shoe support. The brake shoe support is mounted in a brake housing and can be linearly displaced between a readiness setting and an engagement setting. The brake can be actuated by an actuator. The actuator can comprise a brake store for acting on the brake through a connecting point to bring the brake into its engaged setting. A force store in the actuator can be held electromagnetically, and a resetting device enables resetting of the force store and of the actuator into the operating position.

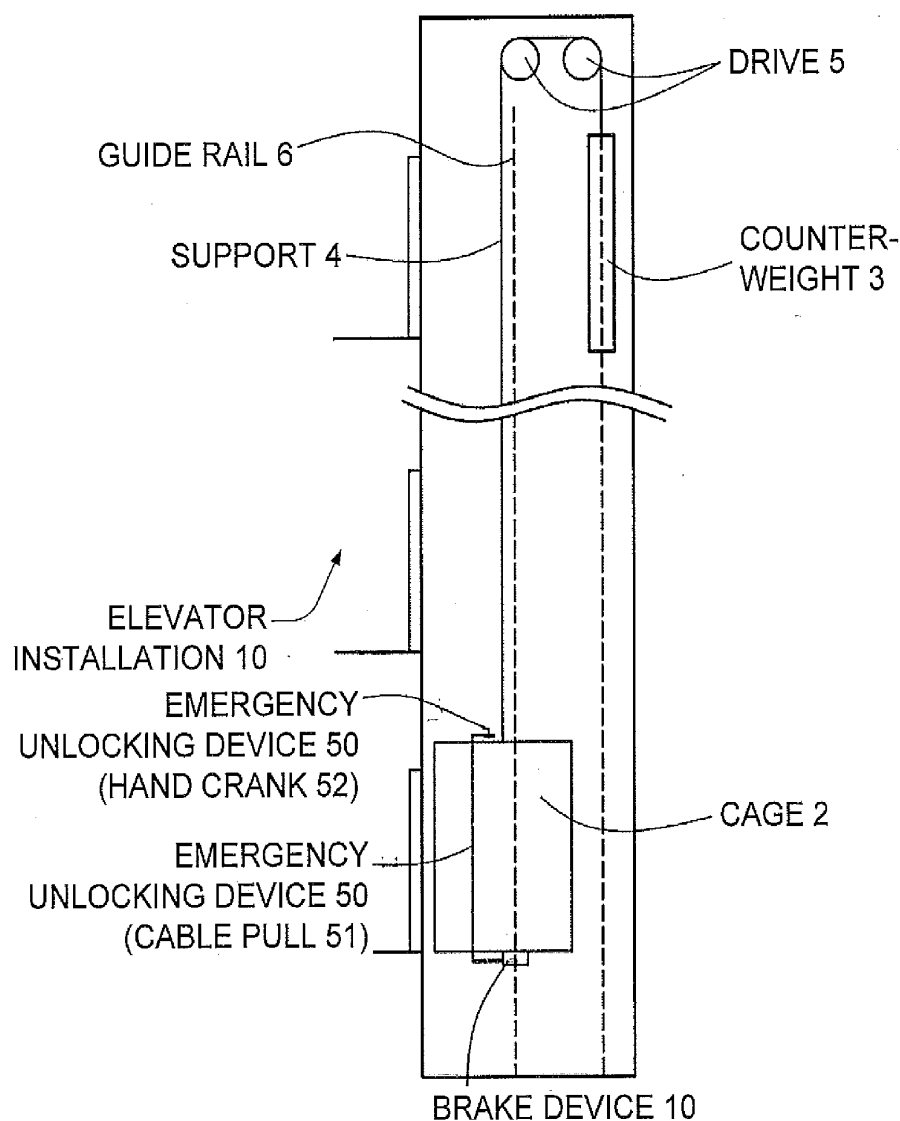


Fig. 1

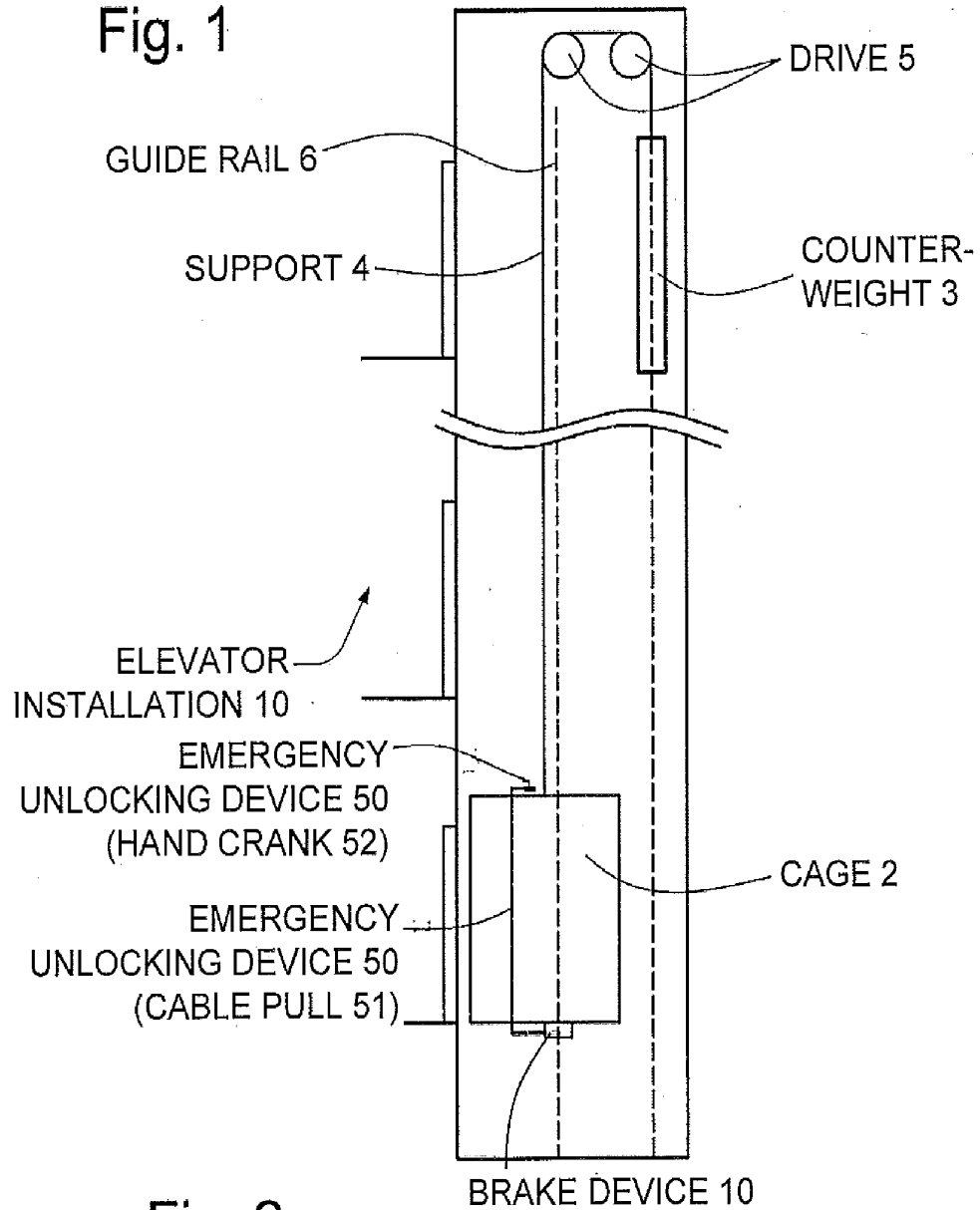


Fig. 2

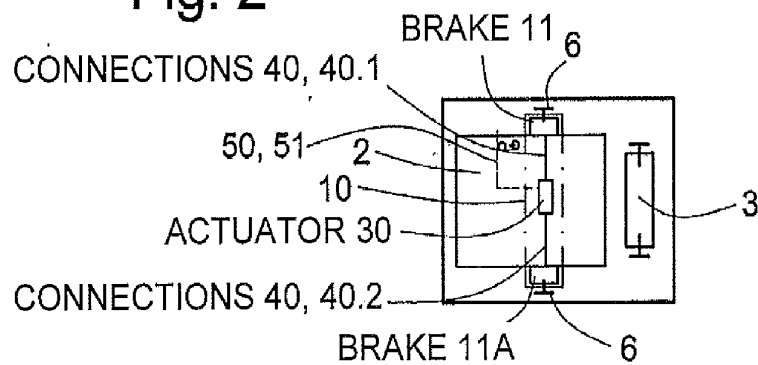
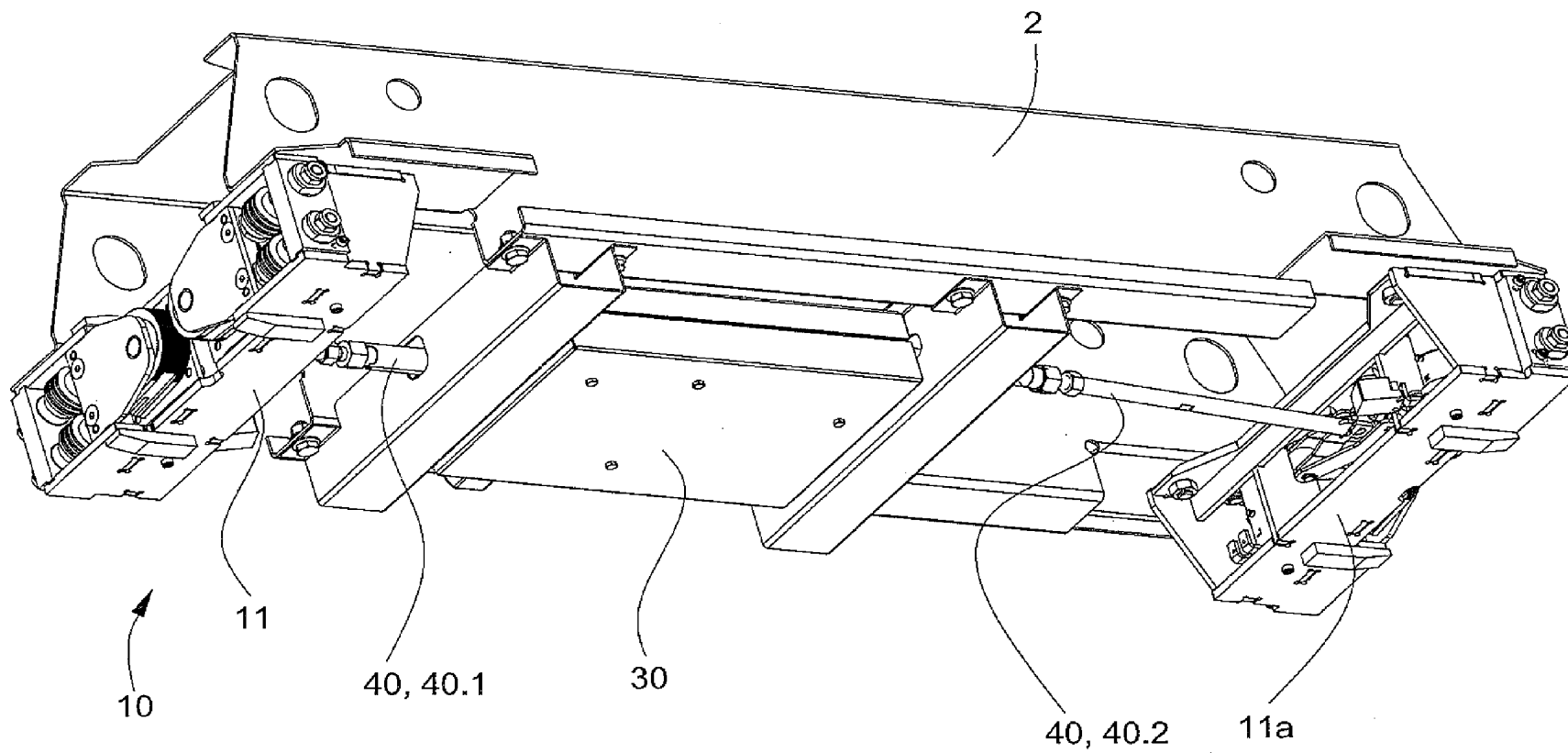
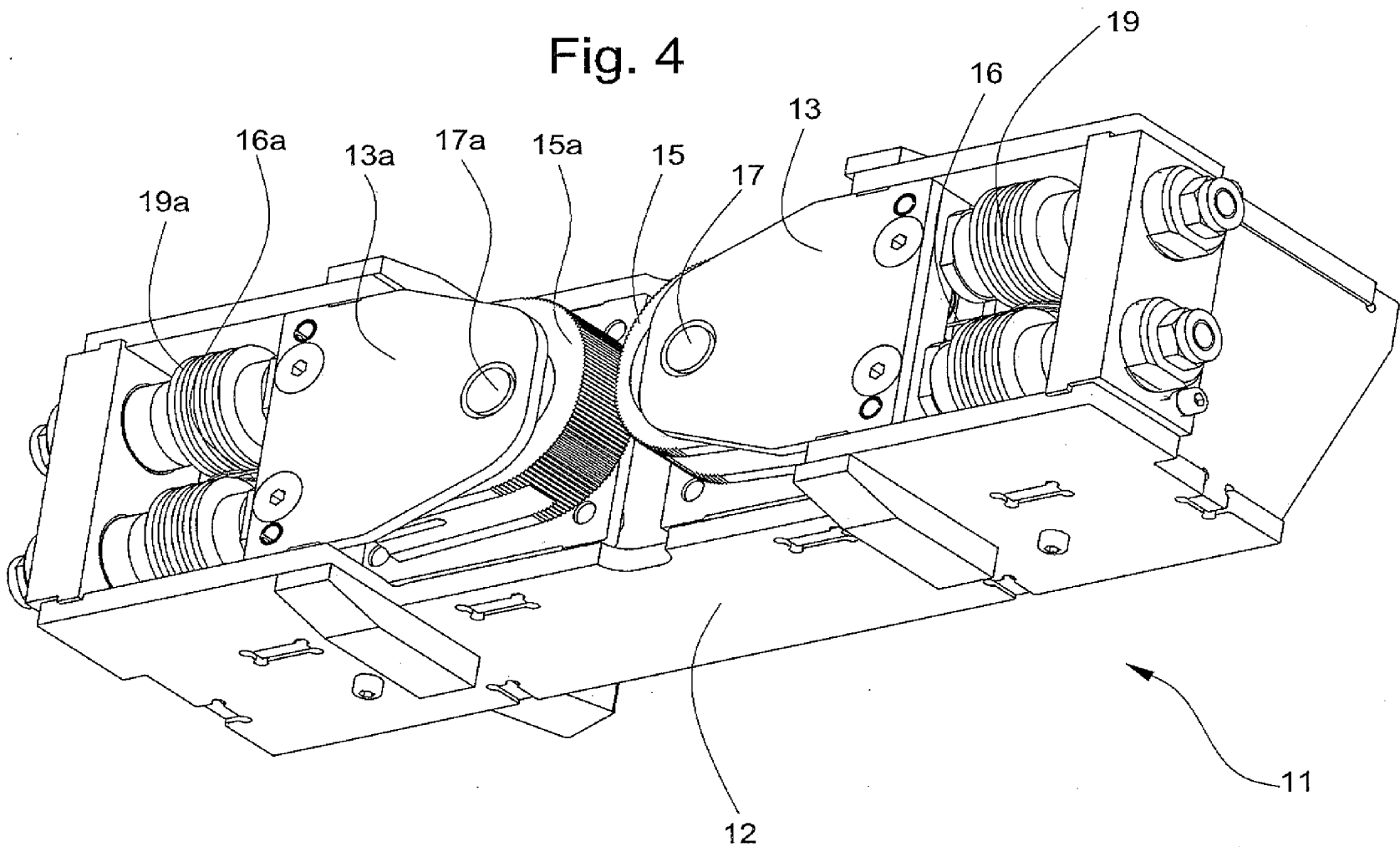


Fig. 3





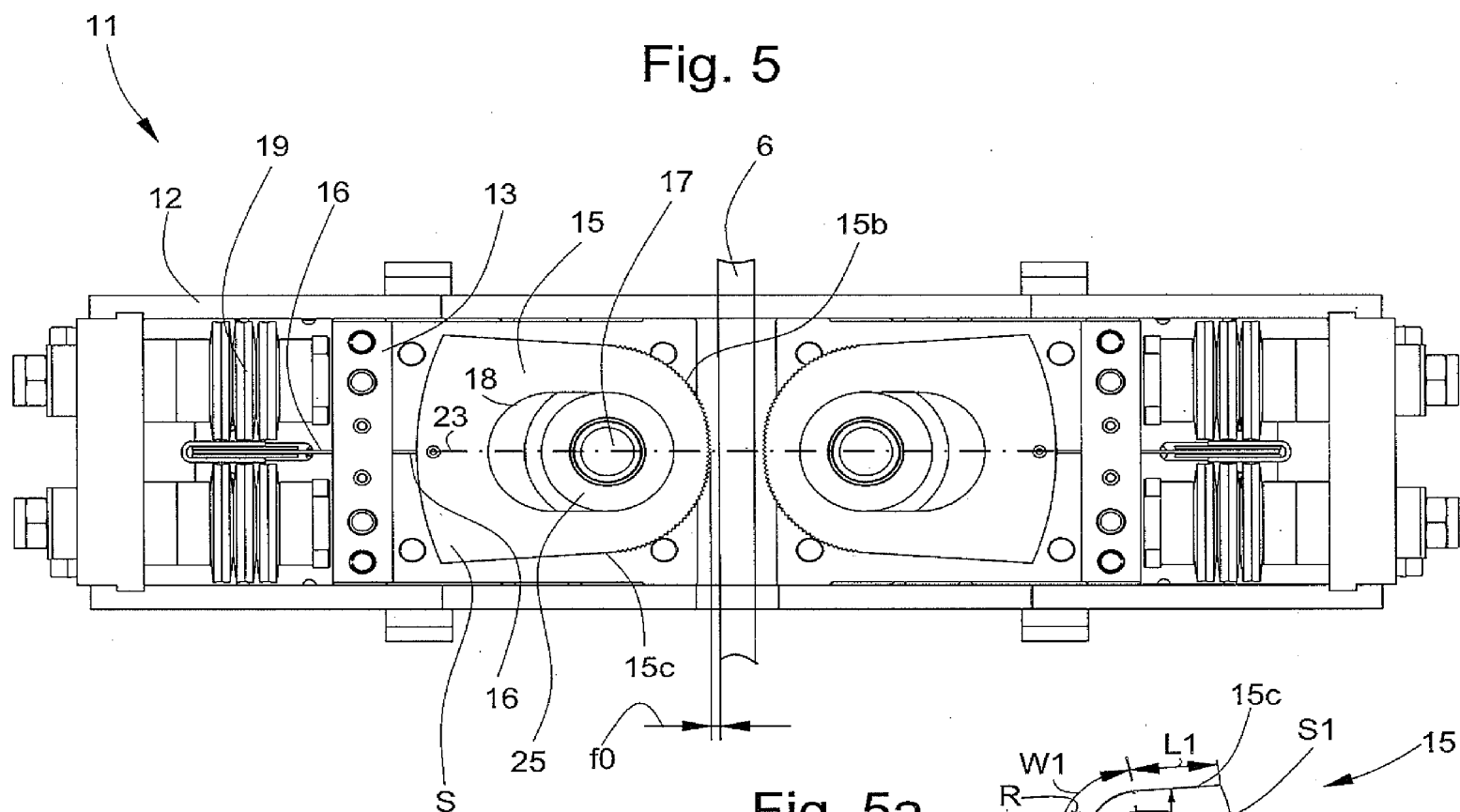
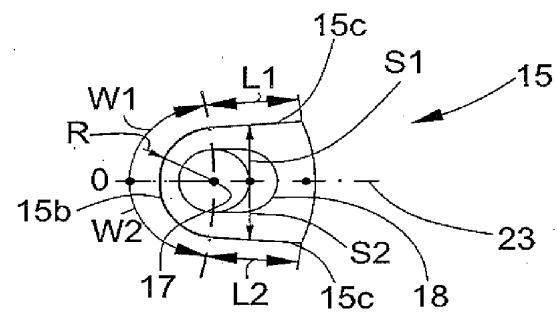


Fig. 5a



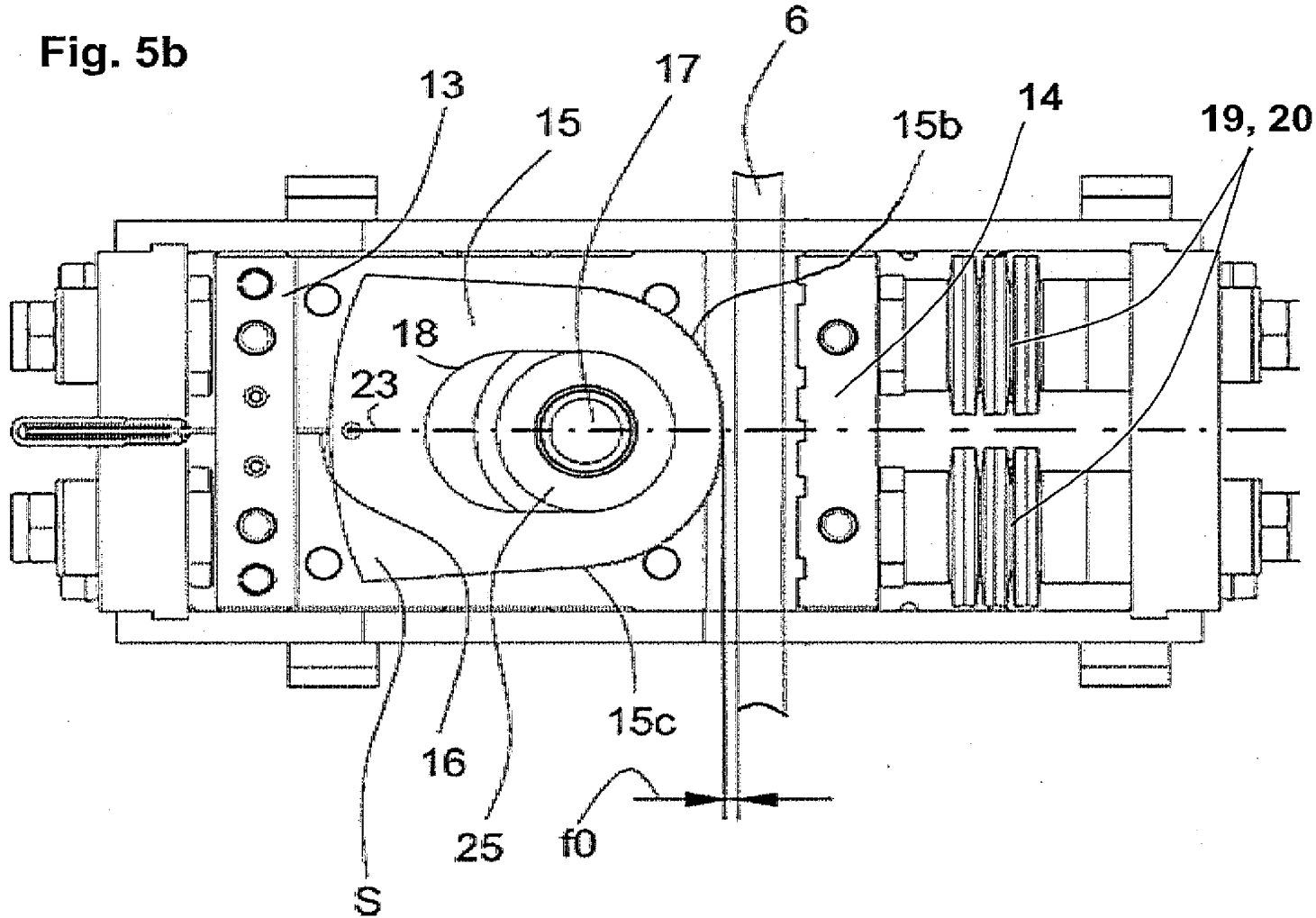


Fig. 6

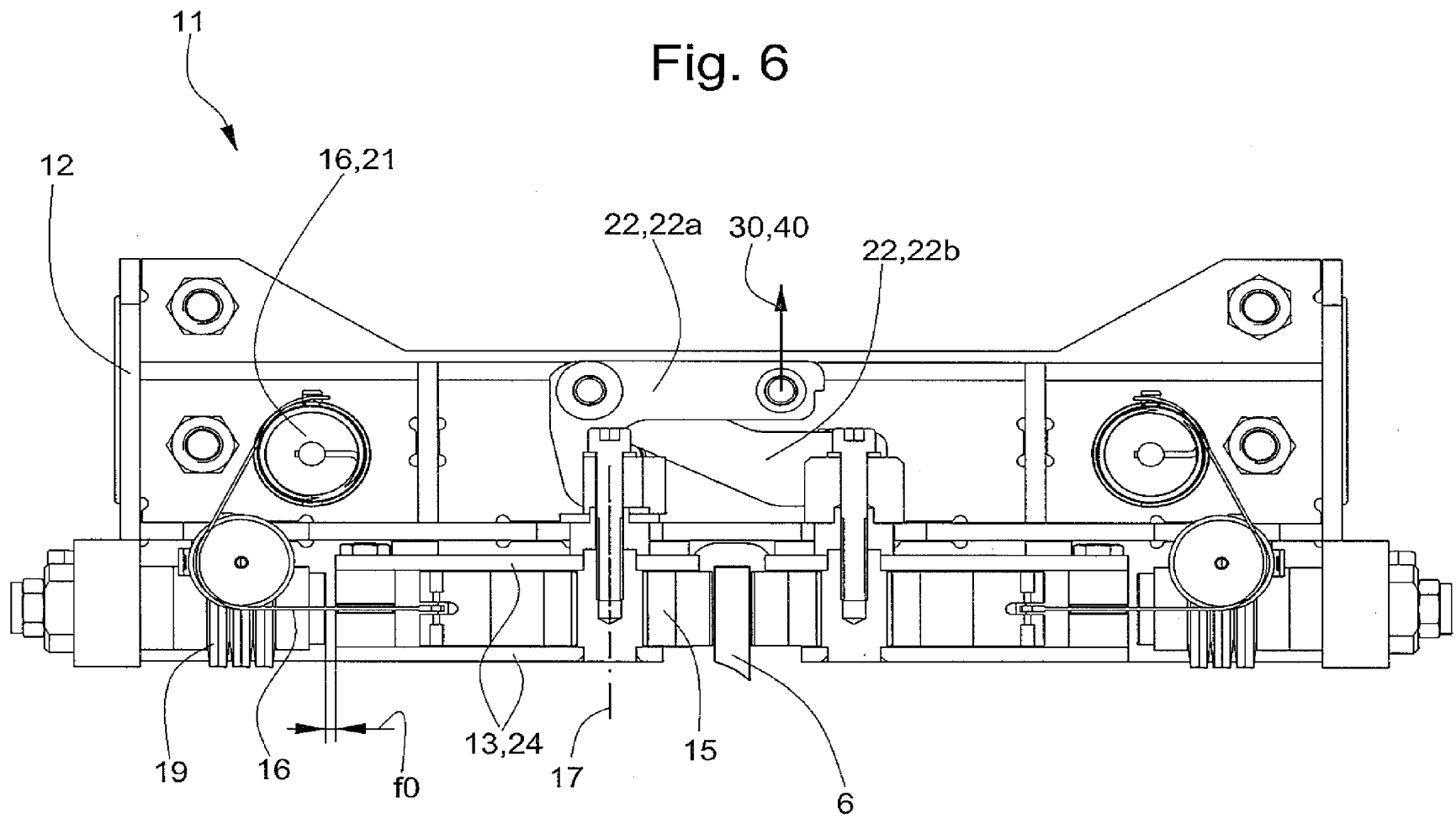


Fig. 7

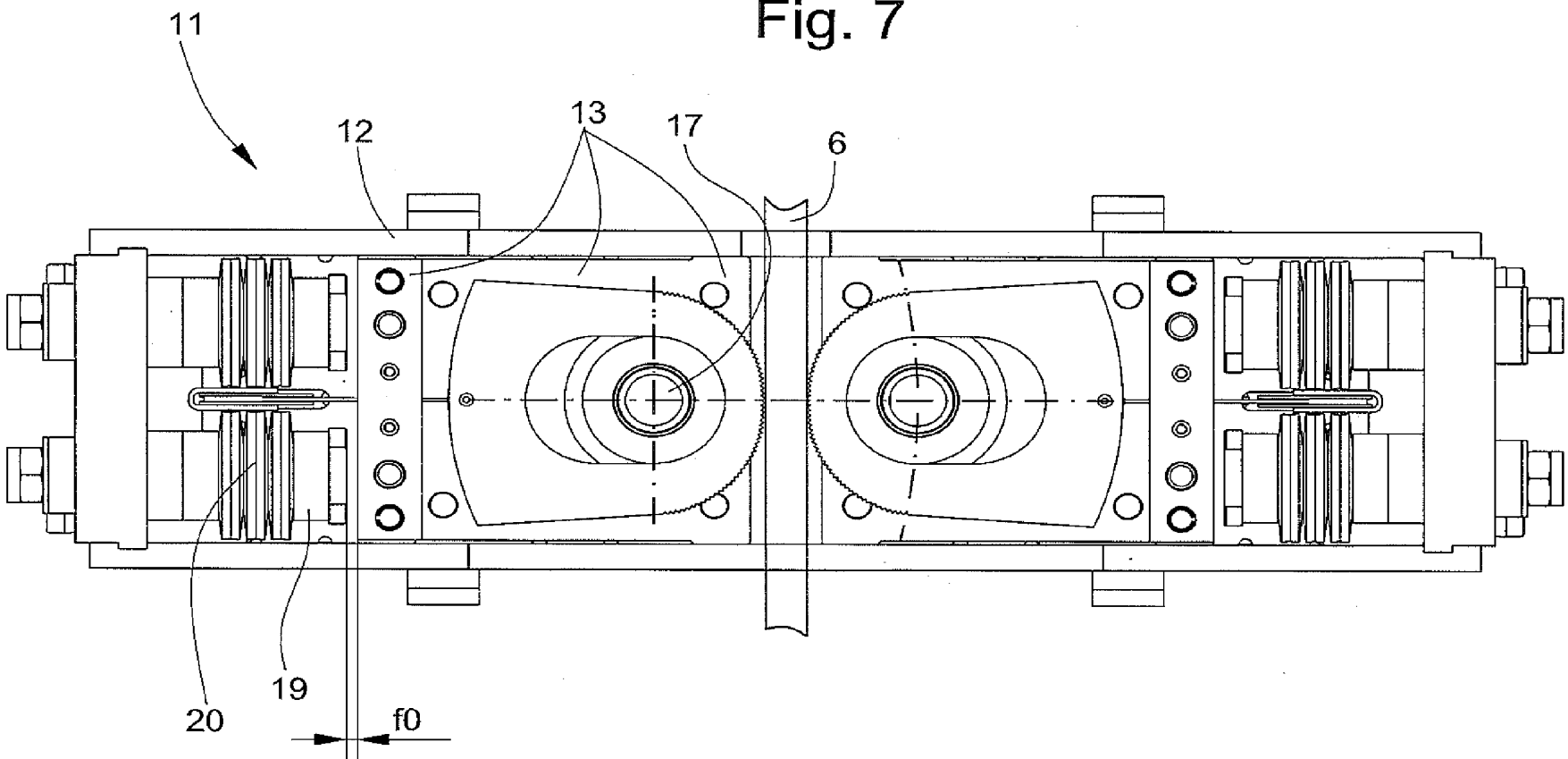


Fig. 8

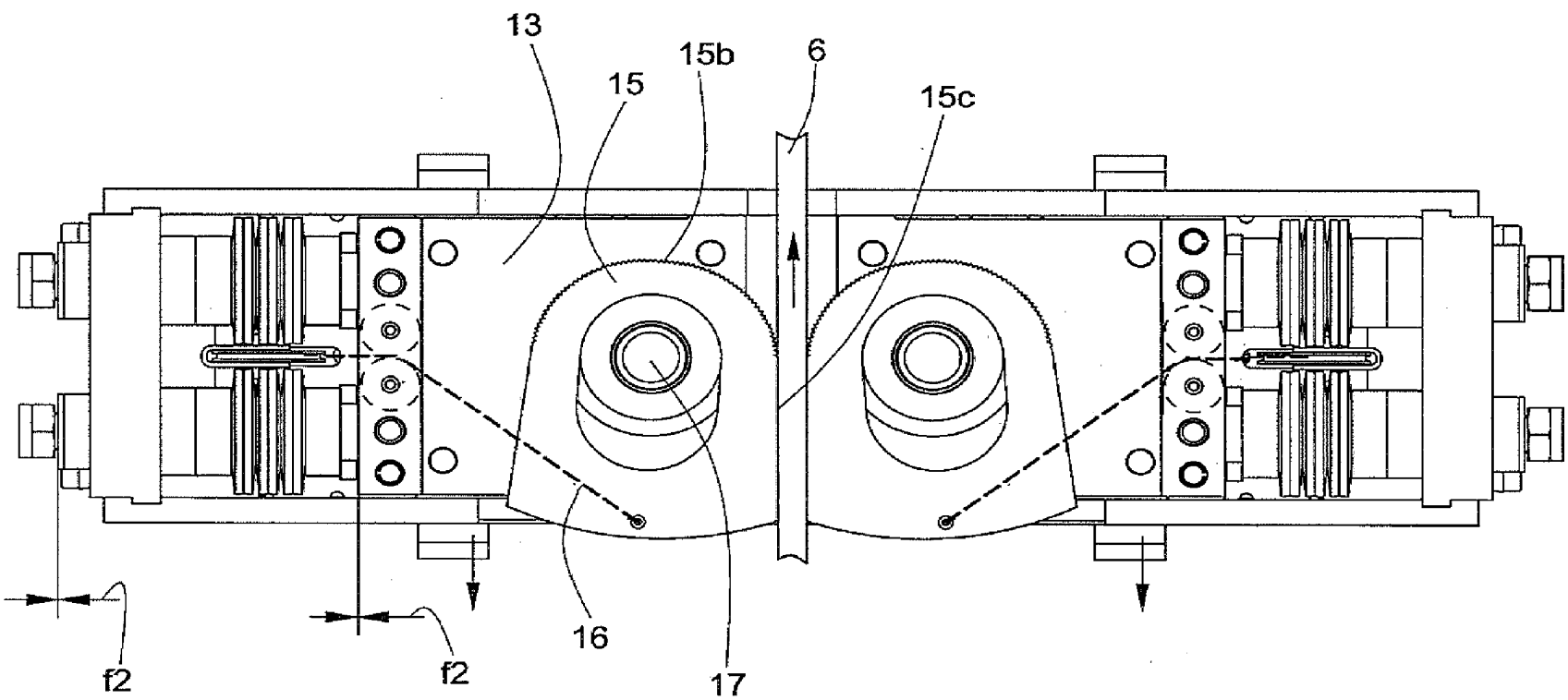
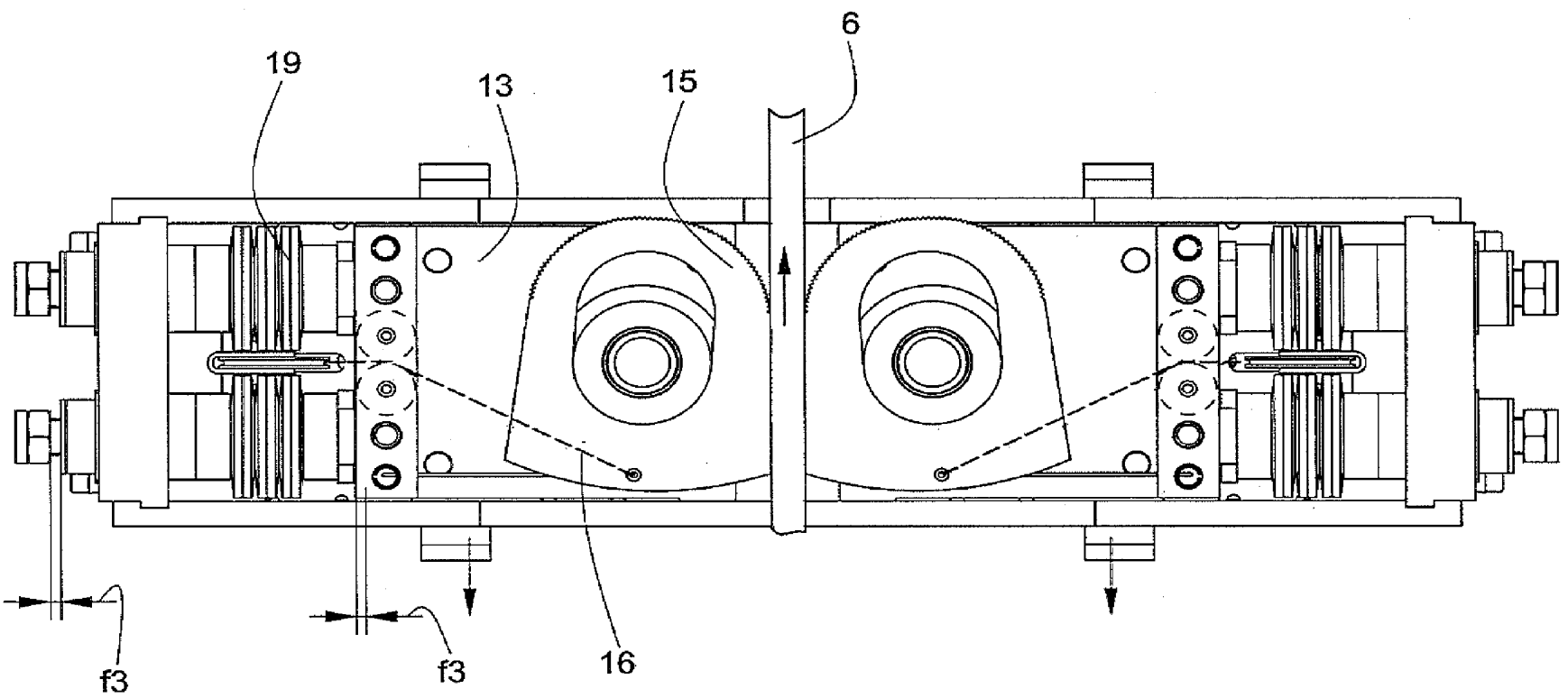


Fig. 9



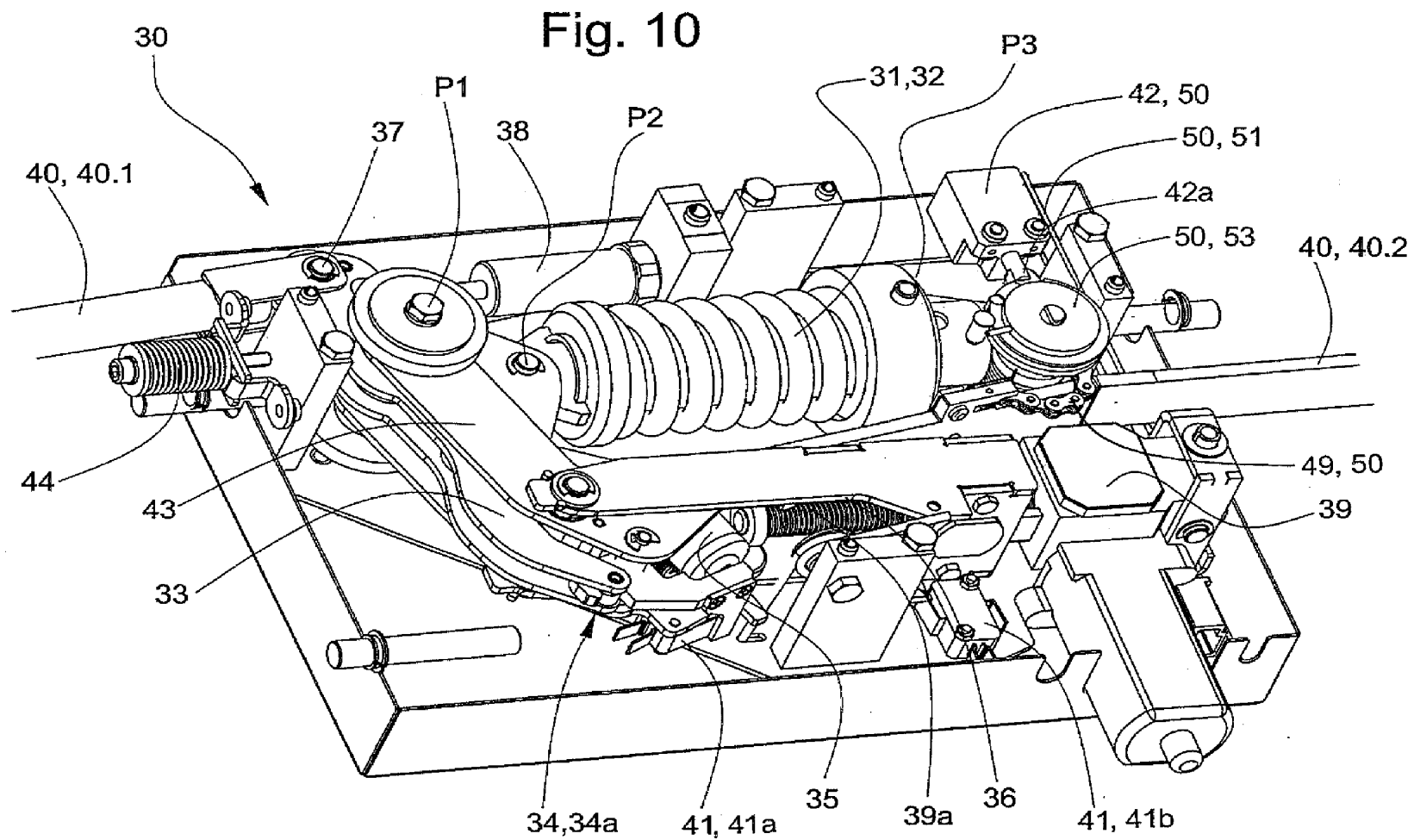


Fig. 11

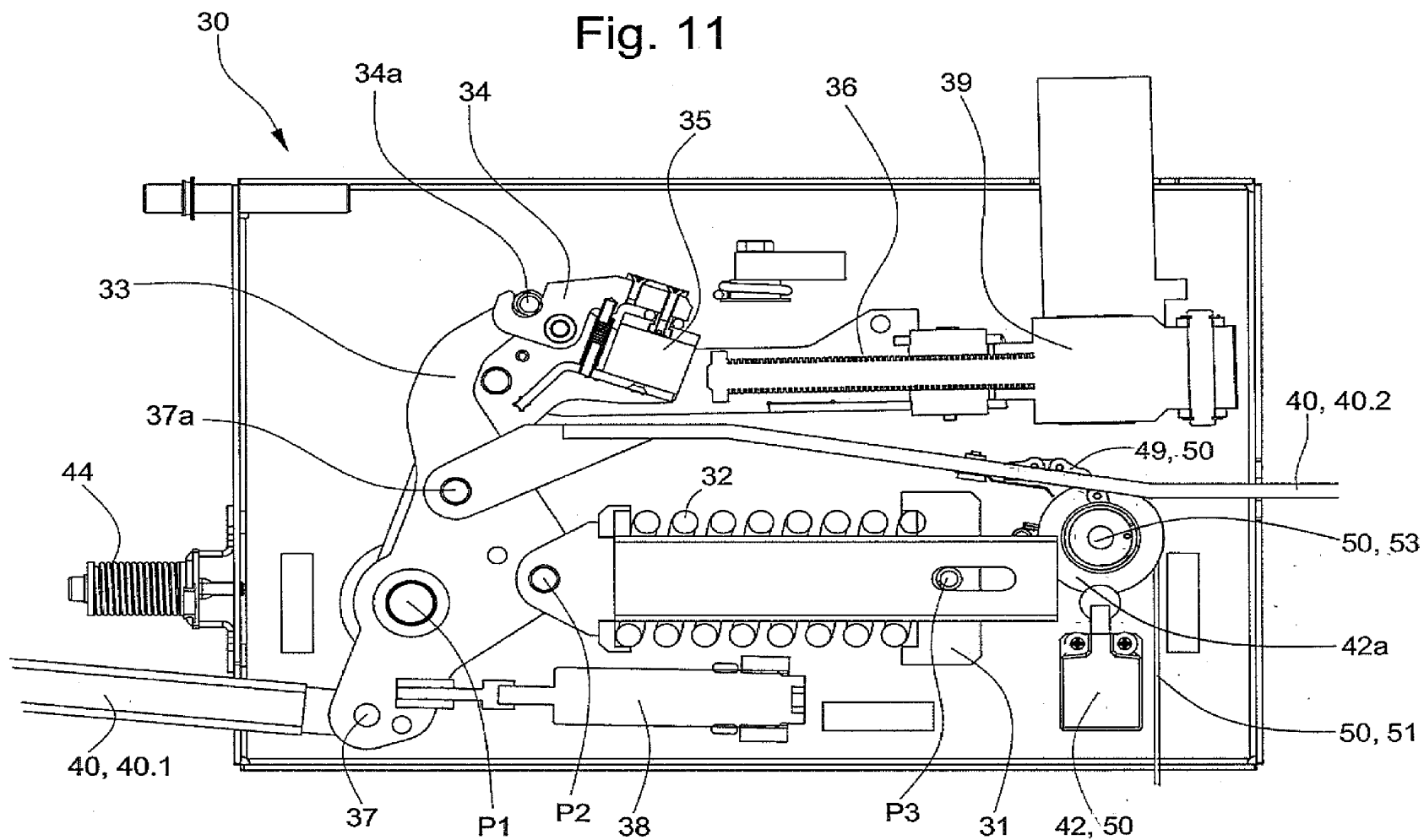


Fig. 12

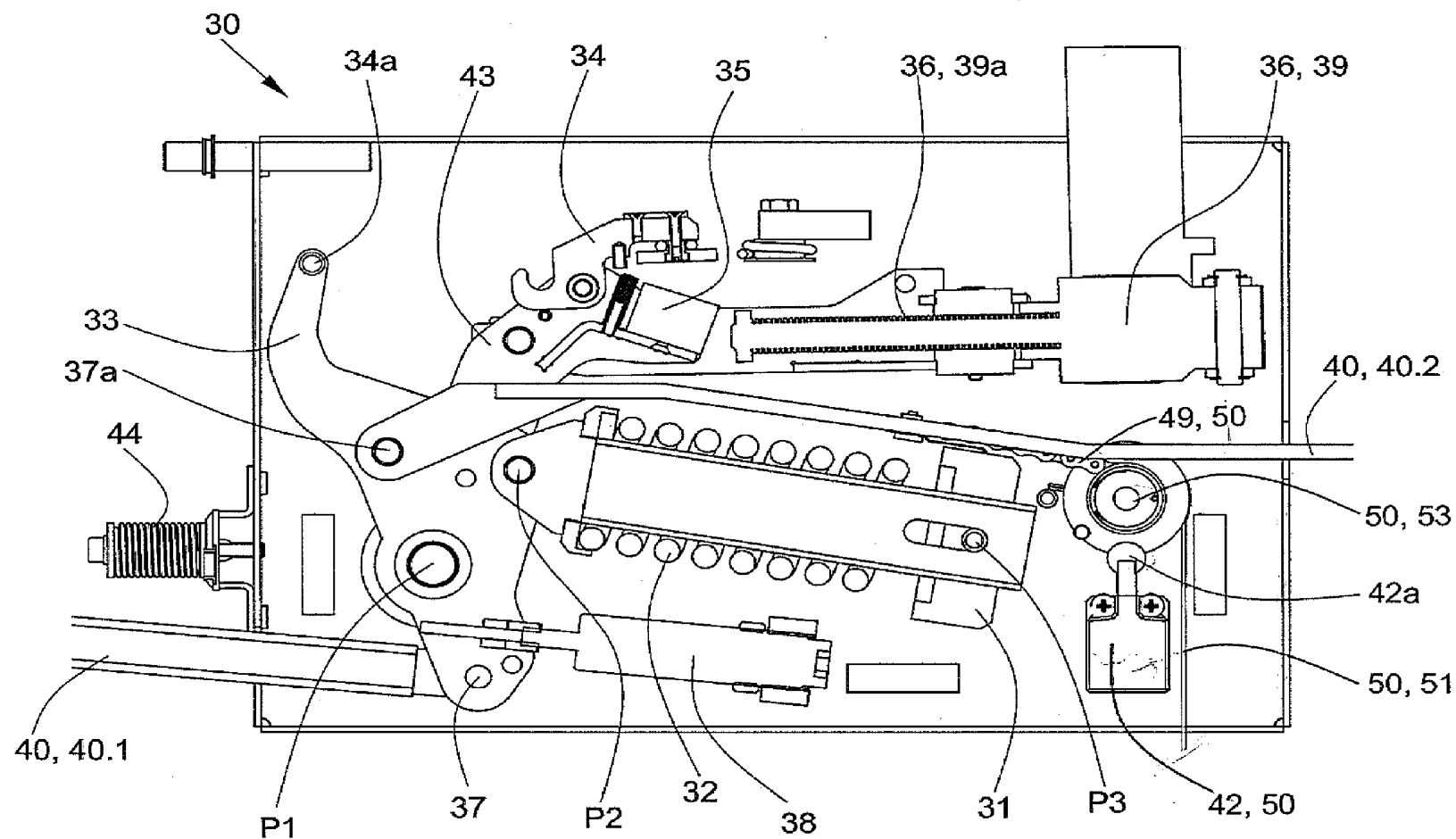


Fig. 13

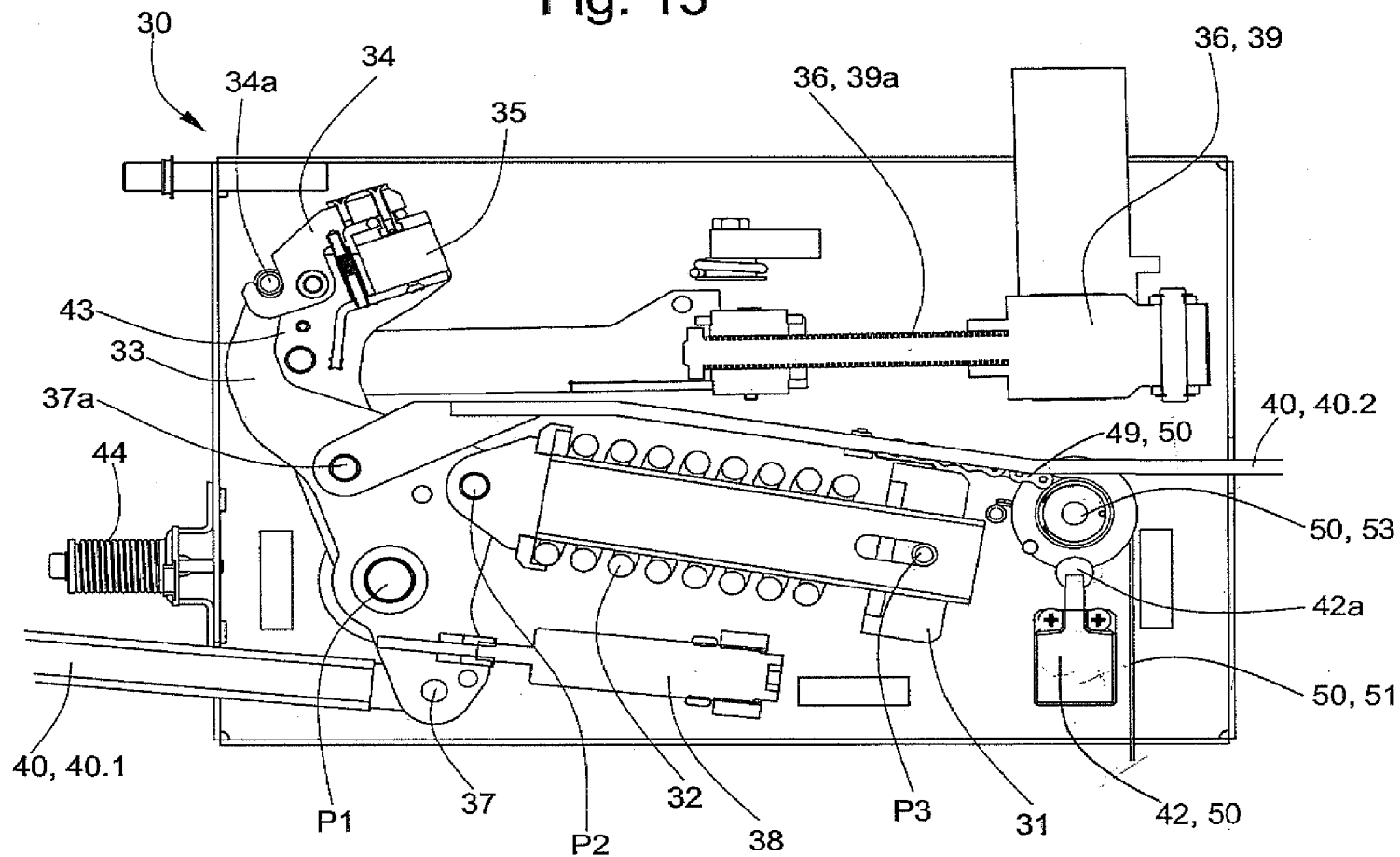


Fig. 14

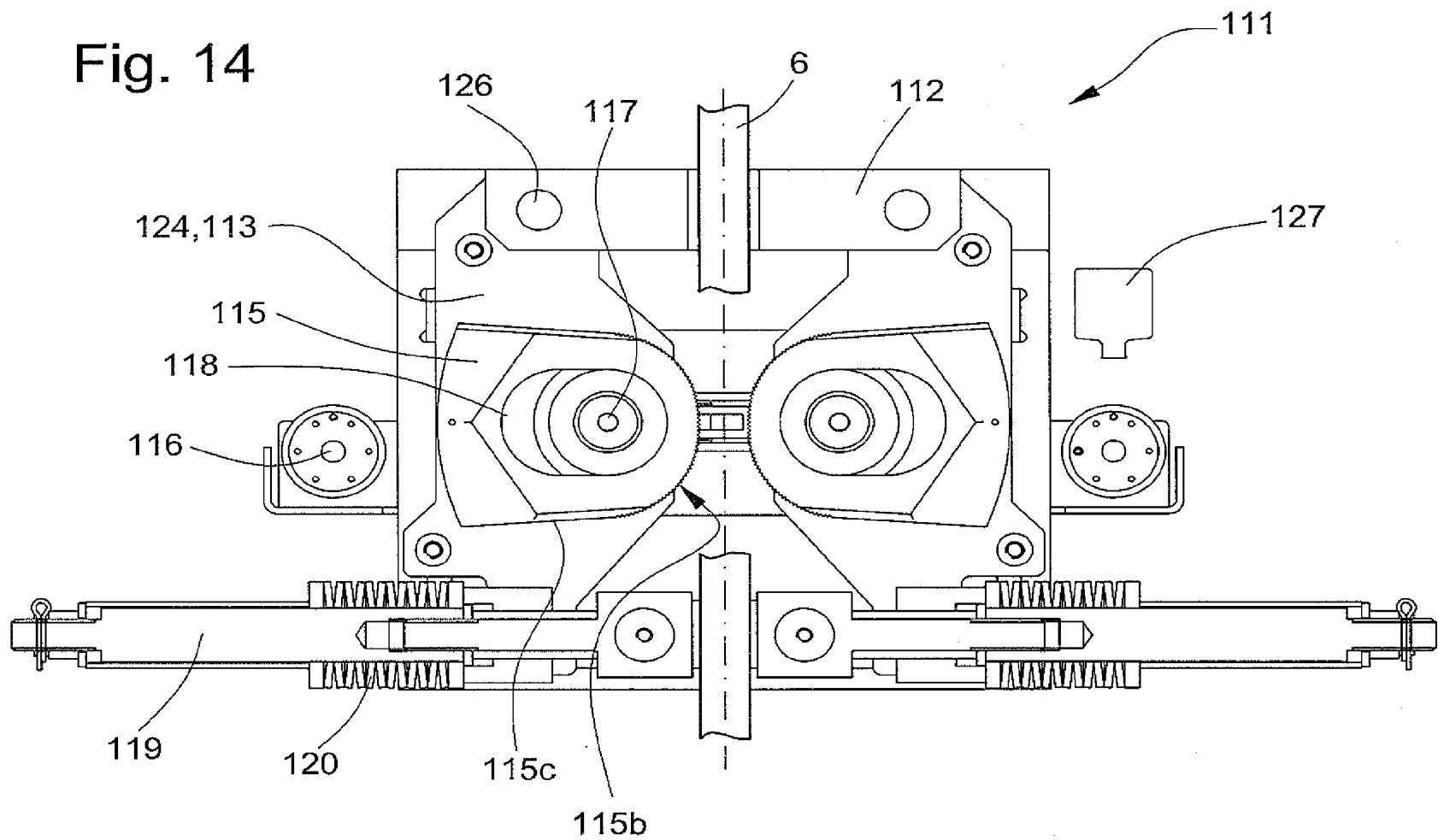
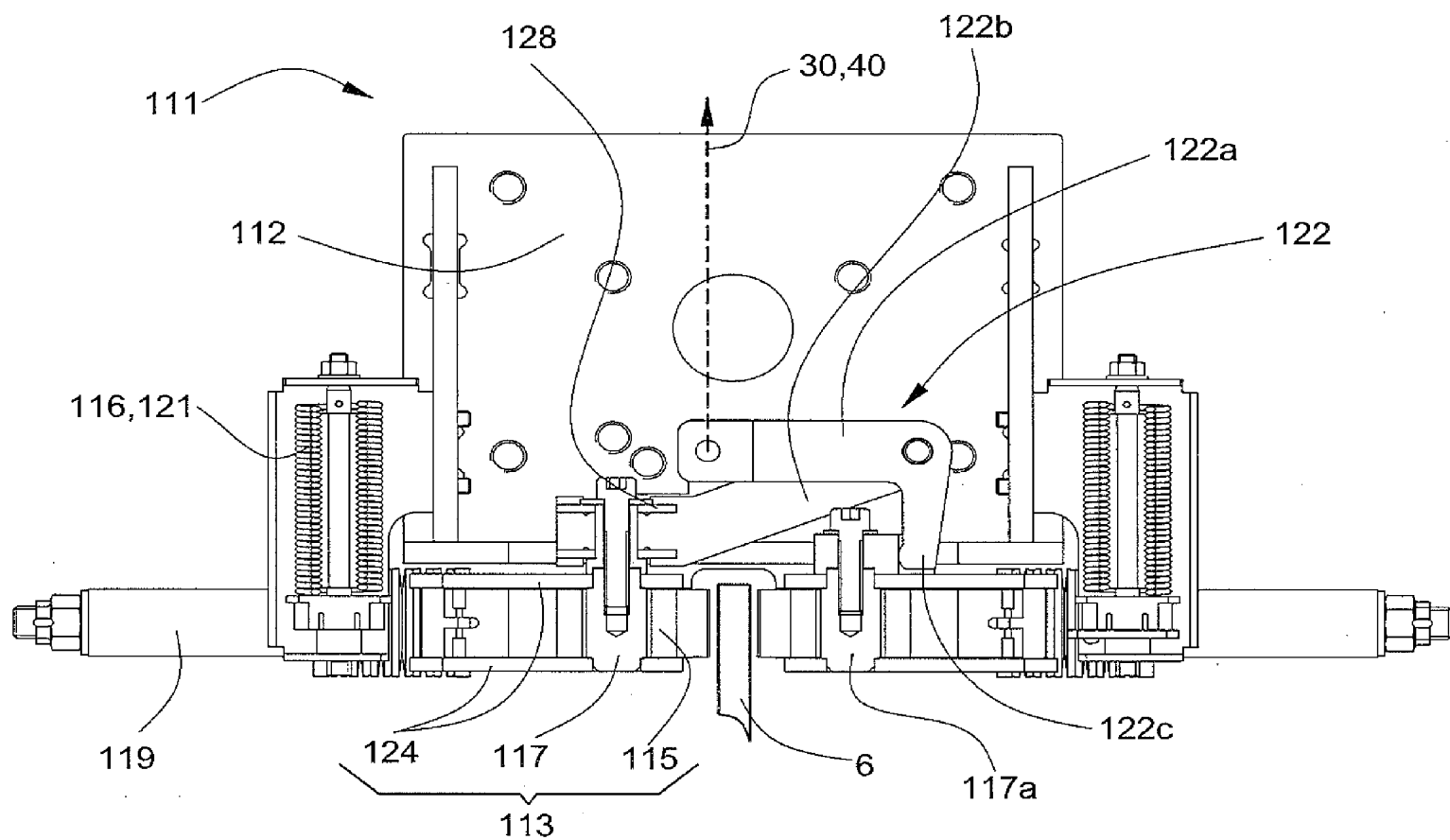
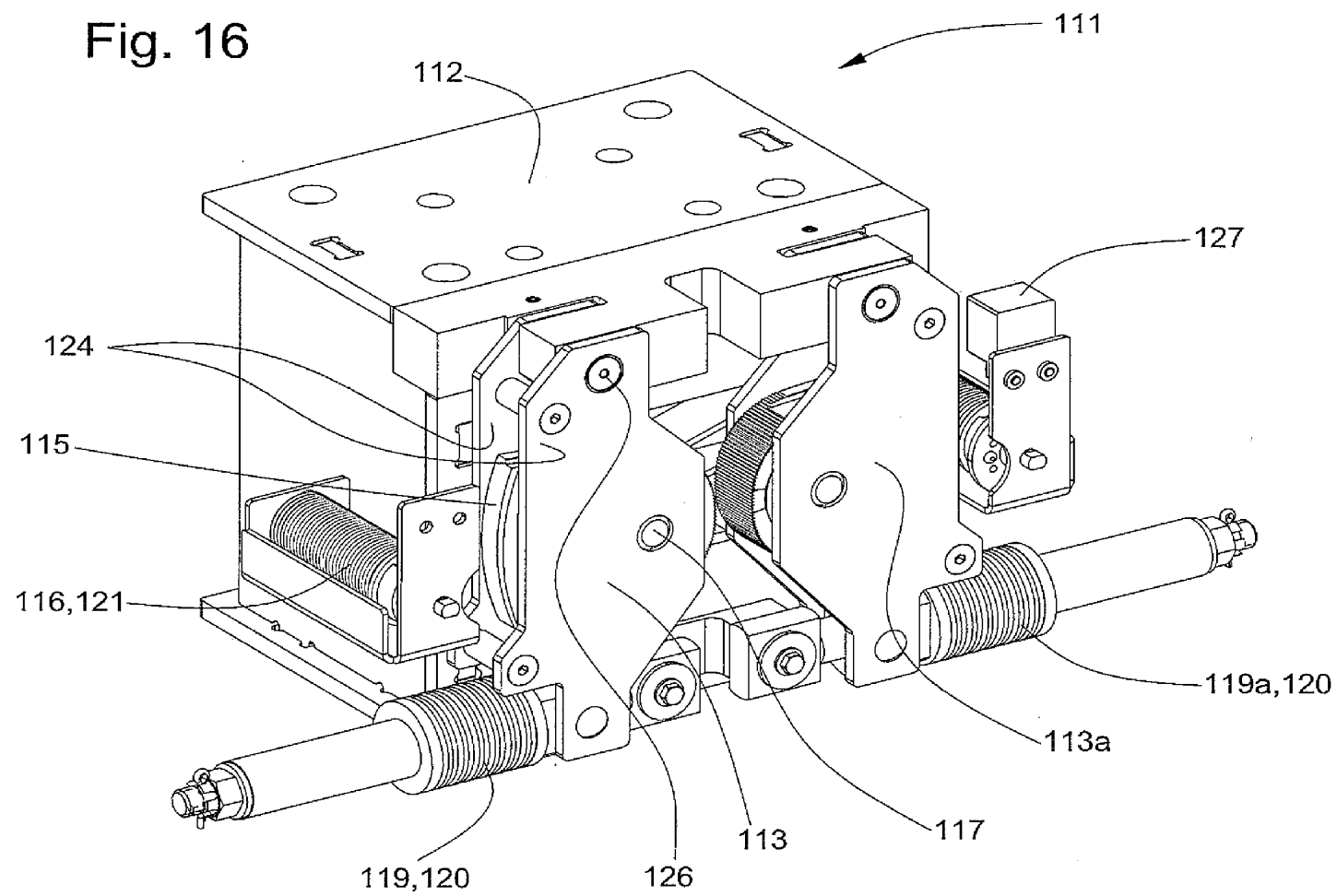


Fig. 15





ELEVATOR BRAKING EQUIPMENT

CROSS-REFERENCE TO RELATED APPLICATION

[0001] This application claims priority to European Patent Application No. 10156865.7, filed Mar. 18, 2010, which is incorporated herein by reference.

FIELD

[0002] The disclosure relates to braking equipment for an elevator cage.

BACKGROUND

[0003] The elevator installation is installed in a building. It consists substantially of a cage, which is connected by way of a support with a counterweight or with a second cage. The cage is moved along substantially vertical guide rails by a drive, which selectively acts on the support or directly on the cage or the counterweight. The elevator installation is used for transporting persons and goods within the building between individual or several floors. The elevator installation includes devices in order to safeguard the elevator cage in the case of failure of the drive or the support and also to provide protection against unintended drifting in the case of a stop at a floor. For this purpose use is usually made of brake devices which when required can brake the elevator cage on the guide rails.

[0004] A brake device of that kind is known from EP 1733992. This brake device can be actuated electromagnetically, wherein after actuation has taken place and with the elevator cage moving a trigger arm with grooves entrains a rotary shoe with brake plates and these brake plates brake the cage. In this connection, the trigger arm is reset again to a reset position by the rotary shoe. It can be disadvantageous that the trigger arm when the elevator cage is stationary, for example at a stop at a floor, can indeed be actuated, but resetting can be carried out only after rotation of the rotary shoe.

[0005] EP 2154096 discloses a further brake device of that kind. This brake device can also be actuated electromagnetically, wherein when required a brake housing with brake shoe is pressed against a rail. A subsequent movement of the brake device rotates the brake shoe into its working setting. In order that sufficient braking force can be achieved, the brake shoe is of appropriately large construction, which results in a substantial installation height of this brake device.

SUMMARY

[0006] Some embodiments of the disclosed technologies comprise a brake device with brake and an actuator, which device is suitable for attachment to an elevator cage and can produce braking of the elevator cage. In this connection, the brake device can be actuated even when the elevator cage is stationary so as to prevent any drifting of the cage and it shall be able to be reset again in simple manner.

[0007] In this connection, according to some embodiments a brake is described which is provided for attachment to an elevator cage. The elevator cage is guided along guide rails and the brake is suitable for braking the elevator cage at the guide rails or preventing drifting or slipping in a case of a stop at a floor. For this purpose, when required a brake shoe is pressed against the guide rail, whereby a corresponding braking force can be generated. The brake includes a brake hous-

ing, a brake shoe support, the brake shoe and advantageously a retraction device. The brake housing includes fastening points in order to fasten the brake to the elevator cage and it includes the constructional fastening and assembly points for the mounting of components of the brake. The brake housing is designed for transmitting required forces. The brake shoe support includes the brake shoe. In a first embodiment the brake shoe support is a brake shoe carriage, which is arranged in the brake housing to be linearly displaceable. The brake shoe support, respectively in this first embodiment the brake shoe carriage can thus be adjusted substantially perpendicularly towards and away from the guide rail surface. Alternatively or in a second embodiment the brake shoe support is a brake shoe lever, which is arranged in the brake housing to be swingable around a substantially horizontal axle. The brake shoe support, respectively in this second embodiment the brake shoe lever can thus also be adjusted substantially perpendicularly towards and away from the guide rail surface by turning it around the horizontal axle.

[0008] The brake shoe can have a curved shape, i.e. it includes curved and, if needed, straight brake surfaces which can stand in braking action with the guide rail depending on an instantaneous movement state. It is arranged in the brake shoe support to be rotatable and can also be longitudinally displaceable. A bearing axle, which mounts the brake shoe, can be arranged for that purpose in the brake shoe support. The bearing axle can be provided with a slide coating or with a roller bearing, for example a needle bearing, and the brake shoe has a matching bearing bore.

[0009] The brake shoe support can be arranged in the brake housing in such a manner that it can be displaced linearly or rotatable between a readiness setting and an engaged setting. In the readiness setting—the readiness setting also corresponds with the unactuated state of the brake or the unactuated brake—an air gap is present between guide rail and brake shoe. This air gap is usually approximately 1 millimeters to at most approximately 6 millimeters. The air gap makes it possible for the brake not to contact the rail during normal operation, whereby wear and possible grazing are prevented. In normal operation the retraction device holds the brake shoe and/or the brake shoe support in this readiness setting.

[0010] The retraction device for that purpose draws the brake shoe support together with the brake shoe away from the guide rail. For actuation, the brake shoe support with the brake shoe is pressed substantially perpendicularly against the guide rail counter to the action of the retraction device. The brake can thus be displaced in simple manner into an engagement setting and also pushed back again to the readiness setting. By virtue of the substantially perpendicular, linear adjustment the brake requires little space in terms of height and can be designed to be able to brake independently of the direction of travel.

[0011] Instead of the retraction device use can also be made of merely a detent position, for example a ball catch, which holds the brake shoe support and/or the brake shoe in the readiness setting. Pushing back from this engagement setting to the readiness setting would in this connection be carried out by a further control element.

[0012] The brake shoe can obviously also be constructed with, instead of the bearing bore, bearing pins which cooperate with correspondingly formed bearing seats in the brake shoe support.

[0013] In some cases, the brake includes an adjusting device which can linearly displace the brake shoe support from the readiness setting to the engaged setting.

[0014] In some embodiments, the brake shoe, rotatably arranged in the brake shoe support, is constructed in such a manner that it is rotatable in a first sub-region about the bearing axle and in a second sub-region, which is connected with the first, is arranged to be longitudinally displaceable at right angles or transversely to the bearing axle. The brake shoe can thus, after rotation over the first sub-region has taken place, be longitudinally displaced over the second sub-region in the brake shoe support. For this purpose, the brake shoe is constructed substantially circularly or spirally in the first sub-region and has a substantially rectilinear shape in the second sub-region. The brake shoe has, in some cases, a slot-like inner profile, i.e. the bearing bore is a slot, which enables rotation and subsequent longitudinal displacement. The retraction device engages the brake shoe, whereby the brake shoe is retracted into the readiness setting by the retraction device and the entire brake shoe support is also retracted by the action of the force on the bearing axle. Moreover, sometimes the arcuate shape of the first sub-region is formed in such a manner that a spacing of the curve from the bearing axle increases in dependence on a rotational angle, such as in the case of a spiral section proportionally to the rotational angle, and the rectilinear shape of the second sub-region is formed in such a manner that a spacing of the rectilinear shape from the longitudinal axis further increases in dependence on a longitudinal displacement, such as in the case of a wedge.

[0015] A possible effect is that the brake shoe on reaching the engagement setting is rotated in correspondence with the travel direction of the elevator cage and in correspondence with the spirally curved shape of the first sub-region, whereby the spacing of the curve from the bearing axle increases and the brake shoe support is correspondingly pushed back. Consequently in this first operating phase compensation is substantially provided again for the adjustment play which is lost during adjustment from the readiness setting to the engaged setting. During this movement accordingly merely a small actuating force required for adjustment of the brake shoe support is present. In the absence of this actuating force, thus in the case of a possible resetting of the brake, the retraction device can guide the brake shoe support directly back to the readiness setting.

[0016] If the elevator cage or the brake shoe moves further or if it is displaced in travel, the brake shoe is, however, automatically moved again. It now transfers from the rotational movement, with reaching of the second sub-region, into a rectilinear adjusting movement. The brake shoe is longitudinally displaced at right angles to the bearing axle, whereby the spacing of the curve from the bearing axle further increases. This increase in spacing, or the second operating phase, produces a further pushing back of the brake shoe support. This is used in order to build up a pressing force, which can allow secure braking of the cage.

[0017] A brake designed in that manner can be used primarily in order to, for example, secure an elevator cage against drifting when it is stopped at a floor and in order to be able to nevertheless reset the brake again in simple manner in the case of only slight drifting movements, which derive from, for example, cable stretching. The braking action is in addition present in both travel directions and overall only a small constructional height is needed. Moreover, through the definition of the shape of the first and second sub-regions, the

resulting pressing and thus braking force in the two directions of travel can be differently defined. In order to secure the cage against failing, larger braking forces are usually required than in the case of braking the cage during upward travel.

[0018] In further embodiments, the brake further includes a compression spring group with compression springs. These compression springs are biased in the compression spring group to a presettable biasing force. The brake shoe support is in the readiness setting positioned by the retraction device to bear against the compression spring group or is drawn by the retraction device against an abutment determined by the compression spring group. The braking force can thus be selectively set, since the travel geometries and thus the resulting spring travels are determined by the shape of the brake shoe. A required bias can thus be defined on the basis of spring characteristics and with consideration of anticipated coefficients of friction between brake shoe and guide rail.

[0019] In some cases, the retraction device includes a spring device engaging the brake shoe, for example a spiral spring, which can engage the brake shoe by way of a cable pull and thus draw the brake shoe support into the readiness setting. The brake shoe can thus be brought back on each occasion to its centre position and the brake shoe support retracted to the compression spring group at the same time.

[0020] In further cases, the brake shoe is of asymmetrical construction, so that a respective second rectilinear sub-region is connected on either side with the arcuate shape of the first sub-region in such a manner that a spacing between the curve and the connecting rectilinear shape and the bearing axle increases in dependence on the rotational angle and the longitudinal displacement. The increase in the spacing is different depending on the rotational direction and displacement direction of the brake shoe. Braking forces dependent on travel direction can thereby be produced, since the different increases in the spacing produce different pressing forces. This can be helpful, since in an elevator installation, as already described in the foregoing, greater forces are usually required in downward direction in order to be able to catch a possibly dropping elevator car or cage. The brake shoe itself is made of a material which is suitable as braking material. In the simplest case this can be hardened steel surfaces or also be high-quality, for example ceramic, braking surfaces which are then advantageously coated on a base body or fastened thereto. In addition, use of brake surfaces with hard-metal inserts can also be possible. An angle of rise, which describes the change in spacing of the curve from the fulcrum or from the longitudinal axis in dependence on the rotational angle and the longitudinal displacement, is determined on the basis of matching to the braking material employed, so that a self-actuating or automatic engagement of the brake can, in some cases, be guaranteed as soon as the brake shoe support has reached its engagement setting and a travel movement of the elevator cage takes place.

[0021] Since the braking forces required in downward direction are usually significantly greater than the braking forces required in upward direction, the pressing forces are, as already explained, appropriately controlled by the shaping of the brake shoe. In order to achieve good braking, however, also minimum area pressures between brake shoe and guide rail can be required, which ensure build-up of a sufficient coefficient of friction. In order to achieve comparable area pressures in downward and upward direction, it can be of advantage if the relevant second sub-region of the brake shoe

is formed with a smaller brake area, for example by formation of longitudinal grooves or longitudinal skids.

[0022] In some cases, a brake of that kind has in each instance two brake shoe supports with brake linings and a retraction device and if these parts are installed substantially in symmetrical arrangement in the brake housing to be opposite one another, so that, on co-operation with the guide rail, the guide rail runs between the two brake shoe supports with associated brake linings. The adjusting device is in that case constructed so that in the case of adjustment the two brake shoe supports are displaced towards one another, whereby the associated brake linings clamp the guide rail.

[0023] Alternatively, the brake includes additionally to the brake shoe support with brake shoe and retraction device a brake plate which is fixed opposite to this brake shoe support, so that, on co-operation with the guide rail, the guide rail runs between the brake shoe support with associated brake shoe and the fixed brake plate.

[0024] Two mutually opposite brake shoe supports are advantageous if a larger air gap is to be achieved on both sides of the guide rail. However, this construction requires a corresponding amount of constructional space on either side of the rail. A brake plate fixed at one side is consequently advantageous if small air gaps suffice. Constructional space can thus be saved, since only a small amount of space is required on one side of the rail. This construction can at the same time also be more advantageous to produce.

[0025] In a brake of that kind braking can be achieved in overall simple manner if the brake shoe support is adjusted by means of the adjusting device from its readiness setting into the engagement setting, wherein the brake shoe arranged in the brake shoe support is pressed by means of the adjusting device against the guide rail.

[0026] Insofar as the cage is at standstill, for example at a floor, the brake remains in this engaged setting. If the cage, under correct control, wants to move away from standstill, the brake is reset by a control in that the adjusting device in co-operation with the retraction device brings the brake shoe support back again to the readiness setting. This can be possible by a small force, since a significant pressing force is still not present.

[0027] If, however, the cage unintentionally moves away from standstill or is disposed in travel, the brake shoe is automatically rotated along the first sub-region of the brake shoe. In that case, the brake shoe support is pressed back in correspondence with the shape of the brake shoe, particularly by the first increase in spacing determined by the first sub-region. In this movement phase an adjusting play which has arisen by the adjustment of the brake shoe is equalized again. Up to this point in time the adjusting device or the retraction device can retract the brake shoe support at any time back into the readiness position. Thus, acceptance of or compensation for small fluctuations, such as can take place during loading of the cage, can be provided.

[0028] If, however, the cage moves again, an automatic longitudinal displacement of the brake shoe along the second sub-region of the brake shoe now takes place. The brake shoe support is thus pressed back in correspondence with the second increase in spacing determined by the second sub-region of the brake shoe. A required pressing force, which produces braking of the cage, is now built up by way of the pressure body.

[0029] In further embodiments, an actuator is described such as can be used for adjustment of the previously described brake.

[0030] The actuator can be designed in order to hold a brake or preferably two brakes of an elevator cage in a readiness setting and when required to bring it or them into an engagement setting. In this connection the actuator includes a force store, a holding device, a resetting device and one or preferably two connecting points connecting the actuator to the brake or to the adjustment device of the brake.

[0031] In some cases, the force store is a spring store which is suitable for acting on the connecting point when required and bringing the brake from its readiness setting into the engagement setting. In this regard the holding device holds the force store and thus the connecting point, advantageously by means of an electromagnet, in a first operating position corresponding with the readiness setting of the brake and the resetting device can bring the force store, the holding device and the connecting point after actuation thereof back again into the operating position. The force store can obviously also be a pneumatic or hydraulically biased store which can deliver its energy when required.

[0032] In further cases, the force store, the holding device and the connecting point co-operate by way of an actuating lever. This actuating lever can include a first connecting point for connection with the first brake and a second connecting point for connection of the actuator with a second brake. The first and if need be second connecting point can be so arranged at the actuating lever that they are substantially drawn together under the action of the force store. Essentially this means that the two connecting points do not necessarily have to be directly drawn linearly towards one another, but that, for example, in the case of use of the actuating lever the two connecting points can be displaced in such a manner that an attraction effect results, which produces the adjustment of the brakes. This attraction of the two connecting points is, in particular, to be understood in the sense that connections which connect the actuator with the brakes are drawn towards one another or pushed towards one another under the action of the force store, whereby they produce a tension force on the two brakes or on adjusting devices of the brakes.

[0033] In another embodiment the actuator further comprises a damping device which damps the course of movement during actuation of the actuator. An end collision of the actuator and the impact noises, which arise from this end collision, and material loads can thus be reduced.

[0034] In some cases, the resetting device includes a spindle motor. The spindle motor can be a geared motor. A hydraulic or pneumatic resetting device can also be used instead of this spindle drive.

[0035] The actuator can include a manually actuated emergency unlocking means. This manually actuated emergency unlocking means is preferably provided in addition to the resetting device. In the case of a defect of the resetting device or in the case of a power failure of longer duration it can be used in order to reset the actuator by hand to such an extent that load relief of the cage is possible. By load relief there is to be understood in this connection a recall of the elevator cage from a blocked setting, such as takes place in the case of emergency braking. This emergency unlocking can be realized in such a manner that, for example, there is action by means of cable pull on the connections which connect the actuator with the brake.

[0036] An elevator installation equipped in accordance with the disclosed technologies can comprise at least one elevator cage, which is arranged to be movable along at least two guide rails, and a brake device attached to the elevator cage. The brake device can include at least two brakes as described in the foregoing and the brakes each co-operate when needed with a respective guide rail. In addition, the elevator cage can include an actuator, such as is explained by way of example in the foregoing description, and which actuates the brakes when required.

BRIEF DESCRIPTION OF THE DRAWINGS

[0037] The disclosed technologies are explained by way of example in the following in conjunction with the figures, in which:

[0038] FIG. 1 shows a schematic view of an elevator installation in side view,

[0039] FIG. 2 shows a schematic view of the elevator installation in cross-section,

[0040] FIG. 3 shows a perspective view of a brake with actuator at an elevator cage,

[0041] FIG. 4 shows a perspective individual view of a brake,

[0042] FIG. 5 shows a front view of the brake of FIG. 4 in the readiness setting,

[0043] FIG. 5a shows a view of a brake shoe,

[0044] FIG. 5b an embodiment of the brake of FIG. 4,

[0045] FIG. 6 shows a plan view of the brake of FIG. 4,

[0046] FIG. 7 shows a front view of the brake of FIG. 4 in the engaged setting,

[0047] FIG. 8 shows a front view of the brake of FIG. 4 with rotated brake shoe,

[0048] FIG. 9 shows a front view of the brake of FIG. 4 in the braking setting,

[0049] FIG. 10 shows a perspective individual view of an actuator,

[0050] FIG. 11 shows a plan view of the actuator in unactuated setting,

[0051] FIG. 12 shows a plan view of the actuator in actuated setting,

[0052] FIG. 13 shows a plan view of the actuator during resetting,

[0053] FIG. 14 shows a further example of a brake,

[0054] FIG. 15 shows sectional view from the top of the brake of FIG. 14, and

[0055] FIG. 16 shows a perspective view of the brake of FIG. 14.

[0056] In the figures the same reference numerals are used for all equivalent parts over all figures.

DETAILED DESCRIPTION

[0057] FIG. 1 shows an exemplary elevator installation 1 in an overall view. The elevator installation 1 is installed in a building and serves for the transport of persons or goods within the building. The elevator installation includes an elevator cage 2, which can move upwardly and downwardly along guide rails 6. The elevator cage 2 is accessible from the building by way of doors. A drive 5 serves for driving and holding the elevator cage 2. The drive 5 is arranged in the upper region of the building and the cage 2 hangs by support means 4, for example support cables or support belts, at the drive 5. The support means 4 are in addition led by way of the drive 5 to a counterweight 3. The counterweight balances a

mass component of the elevator cage 2 so that the drive 5 primarily merely has to provide compensation for an imbalance between cage 2 and counterweight 3. The drive 5 is, in the example, arranged in the upper region of the building. It can obviously also be arranged at another location in the building or in the region of the cage 2 or the counterweight 3.

[0058] The elevator cage 2 is equipped with a brake device 10 suitable for braking the elevator cage 2 in the case of unexpected movement, in the case of excess speed or in the case of securing at a stop and/or decelerating. The brake device 10 is, in the example, arranged below the elevator cage 2. The brake device can be electrically activated (not illustrated). A mechanical speed limiter, such as is usually used, can accordingly be eliminated.

[0059] FIG. 2 shows the elevator installation of FIG. 1 in a schematic plan view. The brake device 10 includes two brakes 11, 11a, an actuator 30 and associated connections 40, 40.1, 40.2. The two brakes 11, 11a can be of identical construction and act as required on the guide rails 6 which are arranged at both sides of the cage 2. This means that they are in a position of braking and fixing the cage 2 at the rail 6. The connections can in principle be constructed as pull or push connections. As a rule, however, connections in the form of pull connections have proved better, as the risk of kinking of connections is thereby eliminated. Thus, connections 40 in the form of pull rods, pull cables, Bowden cables or similar pull means have proved themselves. Use is made in the example of an actuator 30 which when actuated draws the associated connections 40, 40.1, 40.2 substantially towards one another.

[0060] An optional emergency unlocking means 50 is in addition provided in FIGS. 1 and 2. The emergency unlocking means includes a cable pull 51, which is connected with the actuator 30 below the elevator cage 2 and there enables unlocking of the actuator 30 as explained later. A hand crank 52 can be mounted above the cage 2 at an easily accessible location. A traction force can be transmitted in the case of need by way of the cable pull 51 to the actuator 30 by means of this hand crank 52. In the normal case the hand crank 52 is stored away from the emergency unlocking means so that only trained persons can actuate the emergency unlocking means. The cable pull 51 is led to the actuator 30 via required deflections (not illustrated). A Bowden pull or a traction linkage or, for example, also a manual, hydraulic connection can obviously also be used instead of the cable pull.

[0061] The illustrated arrangements can be adapted by the expert to the elevator installation. The brakes can be attached above or below the cage 2. In addition, several brake pairs can also be used at a cage 2. The brake device can obviously also be used in an elevator installation with several cages, wherein then each of the cages has at least one brake device of that kind. The brake device can if required also be attached to the counterweight 3 or it can be attached to a self-propelled cage.

[0062] FIG. 3 shows a support structure of an elevator cage 2 in a perspective view from below. A first brake 11 is attached to the left side of the support structure of the cage 2 and a second brake 11a is disposed at the opposite side, on the right in the figure. The two brakes are of identical construction. The actuator 30 is similarly attached to the cage 2 between the two brakes 11, 11a. The actuator 30 is connected with the brakes 11, 11a by way of connections 40 at both sides, these being connecting rods in the example. The connections 40 can be constructed to be adjustable. The brake device can thereby be adjusted precisely to a width of the cage 2.

[0063] In the case of need the actuator 30 draws the connections 40 towards one another and thereby actuates the two brakes 11, 11a simultaneously. The actuator 30 is arranged at the cage to be horizontally movable, so that it is substantially centered with force equilibrium between the two brakes 11, 11a. This arrangement is also termed floating mounting. The actuator 30 is for that purpose arranged, by way of example, on horizontal slide members or slide rods. A positioning device 44 (see FIGS. 10 and 11) in that case keeps the actuator 30 in a defined position with a small force. In the example according to FIG. 3 the actuator 30 is arranged eccentrically. As a result, one side of the connections 40, for example a first connection 40.1, can be prefabricated in standard manner and merely the opposite, second connection 40.2 has to be adapted to a dimension of the cage 2. Since the function of the two brakes 11, 11a is identical, this is explained in the following only by way of the brake 11.

[0064] FIGS. 4 and 5 show an example of a brake 11 in the so-termed readiness setting or also in the unactuated setting thereof. The brake 11 is in itself again of substantially symmetrical construction. Thus, disposed in a brake housing 12 are left and right brake shoe supports 13, 13a, left and right brake shoes 15, 15a, etc. The construction and the function are explained in the following merely by reference to one side. Also in this embodiment the brake shoe support is designed as a linear displaceable brake shoe carriage 13.

[0065] The brake 11 thus includes the brake housing 12, the brake shoe carriage 13 with brake shoe 15, a retraction device 16 and a compression spring group 19. The brake shoe carriage 13 includes the brake shoe 15.

[0066] A brake shoe 15 is illustrated in detail in FIG. 5a. The brake shoe 15 has a first sub-region 15b. In this first sub-region 15b the brake shoe 15 is of substantially circular or spiral construction. The first sub-region 15b is provided with a knurling so as to achieve good capability of gripping. The arcuate shape of the first sub-region 15b is in that case formed in such a manner that a spacing R of the curve from a bearing axle 17 continuously increases in dependence on a rotational angle W1, W2, such as in the case of a spiral. Starting from the bearing axle 17 the brake shoe 15 has a slot 18 extending along a longitudinal axis 23. Subsequently, connected with the first sub-region 15b of the brake shoe 15 a second sub-region 15c with a rectilinear shape. The rectilinear shape of the second sub-region 15c is formed in such a manner that a spacing S1, S2 of the rectilinear shape from the longitudinal axis 23 further increases in dependence on a longitudinal displacement L1, L2. The second sub-region 15c is formed as a sliding/braking region. This can be a ceramic friction lining which is coated on the brake shoe body. In the mentioned example the second sub-region 15c is integrally integrated in the brake shoe 15 and consists of hardened steel. The brake shoe has a thickness s of approximately 15 to 30 millimeters so that in the case of engagement with the brake shoe 6 an ideal brake couple can form.

[0067] The brake shoe 15 formed in that manner is installed in the brake shoe carriage 13 by way of the bearing axle 17. The brake shoe carriage 13 has side plates 24 which support the bearing axle 17. The brake shoe 15 is arranged on the bearing axle 17 by way of a rotary slide bearing 25. The brake shoe 15 can thereby be rotated on the bearing axle 17 and can also be longitudinally displaced in the regions of the slot 18.

[0068] A retraction device 16 (see FIGS. 4 and 5) engages the brake shoe 15 and draws the brake shoe 15 in a horizontal position and simultaneously the entire brake shoe carriage 13 against an abutment. This abutment is formed by the compression spring group 19. The compression spring group 19 includes a plurality of compression springs 20 which are

biased in the compression spring group 19 to a predefined biasing force. In this state of readiness an air gap M of approximately 3 millimeters thus results. This air gap is a free spacing between the brake shoe 15 and the guide rail 6. It is selected by the expert with consideration of guidance inaccuracies.

[0069] The retraction device 16 is, as apparent particularly in FIG. 6, a spring device 21, in particular a spiral spring, which by way of deflections engages the brake shoe by means of a pull cable and correspondingly retracts this. A retraction force produced by the retraction device is typically approximately 40 Newtons.

[0070] In addition, the brake 11 includes an adjusting device 22 which when required can adjust the brake shoe carriage 13 or the two brake shoe carriages 13, 13a, thus eliminate the air gap f0. The adjusting device 22 comprises a lever support 22b, which is fastened substantially rigidly on one of the brake shoe carriages 13a and which has a bearing point for mounting a first lever 22a. The first lever 22a is so designed that it can press by one end on a pressure plate of the other brake shoe carriage 13. The other end of the first lever 22a is connected with the actuator 30 by means of the connection 40. As soon as the actuator draws the first lever 22a, it urges the two brake shoe carriages 13, 13a towards one another and eliminates the air gap f0, whereby the engagement setting is achieved. In FIG. 6 the brake is disposed in this engagement setting. The air gap in the region of the guide rail 6 is removed and the brake shoe carriage 13 is adjusted to such an extent that a gap corresponding with the air gap f0 arises between compression spring group 19 and brake shoe carriage 13.

[0071] FIG. 7 shows the brake similarly in the engagement setting. The brake shoe carriages 13 are pressed towards one another in such a manner that the brake shoes 15 clamp the guide rail 6. In that case it is evident that the brake shoe carriage 13 now no longer bears against the compression spring group 19, but that a gap, corresponding with the air gap f0, arises between compression spring group 19 and brake shoe carriage 13.

[0072] Insofar as the elevator cage 2 is at standstill, the brake 11 remains in this engaged setting. On resetting of the adjusting device 22 the brake shoe carriages 13, 13a can be retracted by the retraction device 16 directly back into the readiness setting thereof and the cage 2 is thus released for travel. To the extent that the cage 2, however, unintentionally moves on, the brake 11 is automatically moved into braking setting.

[0073] In FIG. 8 the cage 2 or the brake 11 has now moved downwardly in relation to the guide rail 6. The brake shoe 15 is turned on the bearing axle 17 along the first sub-region 15b by the guide rail 6 or the guide rail surface thereof and now bears by the second sub-region 15c against the guide rails 6. Due to the increasing radius of the first sub-region 15b the brake shoe carriage 13 is pressed back. The previous air gap f0 between brake shoe carriage 15 and compression spring group 19 is thereby eliminated and, in the example, the compression spring group 19 is already biased by a minimum amount f2. Up to the point of elimination of the air gap f0, a decisive braking force has still not arisen, since re-stressing of the compression spring group 19 has still not taken place. It would thus remain possible during this operating range to retract the brake shoe carriage 13 by the adjusting device 22 and retraction device 16 into the readiness setting and to free the brake 11 again. This can be helpful if slipping of the cage 2 during loading is to be limited by this brake 11. Such

slipping can, for example, happen in the case of overloading of the cage 2 or also in the case of a defect of elevator components.

[0074] The brake 11 can thus be preventatively brought into the engagement setting at a stopping point and thereby prevent risk-laden slipping. Insofar as in accordance with correct functioning no slipping takes place, the brake 11 can simply be reset again before a departure.

[0075] If the cage 2 now moves again, the brake shoe 15 remains, as illustrated in FIG. 9, adhering to the rail 6 by the friction effect between the second sub-region 15c and the guide rail 6. The brake 11 rolls, by way of the rotary/slide bearing of the bearing axle 17, along the slot and the brake shoe carriage 13 is further pushed back in correspondence with the increase in the spacing S1 of the second sub-region 15c. The compression spring group 19 is thereby further stressed until it has achieved its final stress in correspondence with a spring compression f3. This spring compression f3 produces an associated pressing force which now causes braking of the elevator cage 2. The lever of the adjusting device 22 or the actuator 30 is constructed in such a manner that it can tolerate this spring compression f3. This can be achieved by free running, play or resilient regions.

[0076] In order to be able to reset the brake again after standstill of the elevator cage 2 has taken place, the cage 2 has to be moved back, whereby the engagement process takes place in reverse sequence. In that case, before resetting of the cage 2 the adjusting device 22 is adjusted back. As result, in the case of adjusting back of the elevator cage 2 the brake shoe 15 and the brake shoe carriage 13 are directly held in the readiness setting.

[0077] By virtue of the construction of the brake shoe 15 this afore-described adjusting and engaging process takes place in both directions of travel, wherein the spring compressions f1 to f3 arise in correspondence with the shape of the brake shoe 15 or the form of the first and second sub-regions 15b, 15c of the brake shoe 15. In the case of braking in upward direction, obviously smaller braking forces are required. This is taken into consideration in that the spring compression travels in upward direction are selected to be smaller.

[0078] Respective brake positions and states of the adjusting device can be detected electrically or by position detectors. These state indications are processed in a control and subsequently used as fault indications or for sequence control of the elevator.

[0079] FIGS. 10 to 13 show an example of an actuator 13 such as can be used for actuation of a brake 11 as explained in the foregoing figures.

[0080] The actuator on the one hand keeps the brake 11 of an elevator cage or the brake device in a readiness setting or in an unactuated setting thereof (see FIG. 11). This state is termed closed setting of the actuator 30. The actuator 30 brings the brake 11 when required from the readiness setting to an engaged setting. The actuator 30 also resets the brake 11 or a corresponding adjusting device 22 back into a setting which enables return of the brake 11 to the readiness setting. For this purpose the actuator 30 has electrical interfaces with respect to a control, which, for example, communicates the corresponding control commands or receives any status reports of the actuator 30 and/or the brake 11. In addition, power storage means which might be required are present in order to safeguard functioning in the case of power failure.

[0081] The actuator 30 includes a force store 31, a holding device 34, a resetting device 36 and one or two connecting points 37, 37a, which connect the actuator 30 with the brake or at least two brakes 11 or the adjusting devices 22 thereof.

The force store 31 can be a spring store 32, which is supported at one end by means of a support point P3 in a housing of the actuator 30, and the other end of which presses by way of an engagement point P2 against an actuating lever 33. The actuating lever 33 is rotatably mounted in the housing by means of a fulcrum P1 and the holding device 34 holds, by means of a pawl which engages a catch 34a, the actuating lever 33 in the closed setting, which corresponds with the readiness setting of the brake 11, against the spring force of the force store 31. The catch 34a in this regard can be a rotatable pin or bush which is suspended in the hook-shaped pawl of the holding device 34. This construction gives constant friction conditions and thus a reproducible, constant trigger behavior.

[0082] The actuating lever 33 is connected by a first connecting point 37 with a first connection 40, 40.1 and by a second connecting point 37a with a second connection 40, 40.2. The connections 40 lead, as described in connection with FIG. 3, to the brakes 11, 11a at both sides.

[0083] The holding device 34 includes an electromagnet 35 which holds the holding device 34 in the closed setting. If the electromagnet 35 is switched to be free of current, the force store 31 presses the pawl of the holding device 34 back, whereby the catch 34a of the actuating lever 33 is freed (see FIG. 12). The force store 31 presses the actuating lever 33 into the engaged setting, whereby the two connecting points 37, 37a as considered in a projection are drawn towards one another. This means that, in particular, the connections 40, 40.1 as illustrated in FIG. 12 by movement arrows are drawn substantially towards one another, whereby connecting points of the connections 40, 40.1 with the respective adjusting devices 22 of the brakes 11 are drawn or moved towards one another. This drawing together is transmitted to the adjusting device 22 of the brake 11 (see FIG. 6). A force of the force store 31 determines, in this arrangement by way of lever actions of the adjusting device 22 of the brake 11, a pressing force of the brake shoe carriage 13 against the guide rail 6. According to experience this pressing force is approximately 800 Newtons. It can thus be ensured that the brake shoe 15 is when required automatically engaged when the cage 2 is in motion.

[0084] Advantageously, lever spacings and lever action lines at the actuating lever 33, i.e. the point of engagement P2 of the force store 31 with respect to the fulcrum P1 of the actuating lever 33 and with respect to the support point P3 of the force store 31 in the housing of the actuator 30 as well as with respect to the connecting points 37, 37a, are so arranged that on actuation of the actuator 30 a tension force which can be substantially constant over an actuation stroke arises in the connections 40. This is achieved, for example, in that a lever spacing, i.e. the force action line determined by the engagement point P2 and the support point P3, from the fulcrum P1 of the actuating lever 33 in the unactuated state is small so that it increases, due to rotation of the actuating lever 33, in the case of actuation. Compensation for a stress relief of the force store 31, for example due to stress relief of the spring store 32, is thus provided by the increase in the lever spacing.

[0085] The form of the pawl of the holding device 34, the catch 34a, a holding force of the electromagnet 35 and the force store 31 are moreover advantageously matched to one another in such a manner that when the electromagnet 35 is switched on the actuating lever 33 is held in the closed setting and when the electromagnet 35 is switched off the force store 31 can reliably press back the holding device 34. In a realized application the holding force of the electromagnet is typically approximately 116 Newtons. An electromagnet of that kind requires a low power of merely approximately 2.5 Watts. The braking device can thus be operated with very low energy

consumption. Advantageously, the holding device 34 is so constructed that after release it is urged into an open position by, for example, an auxiliary spring. Rebound of the holding device 34 is thereby prevented.

[0086] In some cases, the actuator comprises a damping device 38 which acts in damping manner on the movement course during adjustment. The damping device 38—this can be a hydraulic, pneumatic or magnetic damping device—can be set so that it brakes a movement in the end region of the adjustment travel so as to thus damp an end collision of the brake shoe with the rail. Output of noise and also impact loading of the material can thus be reduced. The damping device sometimes acts directly on the actuating lever 33. The damping device 38 can also be integrated in the force store 31.

[0087] The actuator can, as illustrated in FIG. 13, be tensioned back into its readiness setting after an actuation. This resetting can be carried out automatically, for example by a brake control device, or manually. In the case of automatic resetting, for example, the brake control device or an appropriate safety unit checks—when a travel command is present—the state of the installation and in the case of a correspondingly positive result initializes a resetting command to the actuator. A manual resetting can be required if the brake device has been actuated due to a fault, so as to stop the cage in the case of, for example, an uncontrolled movement. This usually requires the intervention of expert personnel, who then manually perform resetting of the actuator 30, for example by actuation of a switching device or, if for example no electrical energy is available, by means of the emergency unlocking means 50. The switching device can be constructed in the manner that in the event of release of the switching device the braking device is actuated again.

[0088] For resetting of the actuator 30 by means of the switching device the actuator 30 has the resetting device 36. The resetting device 36 consists of a spindle drive with geared motor 39, which drives a spindle 39a. The holding device 34 with electromagnet 35 is movable by the spindle 39a. For resetting, the holding device 34 is moved out by means of the spindle 39a, and the pawl of the holding device 34 grips the triggered actuating lever 33 or the catch 34a. The holding device 34 is then held back by the electromagnet 35. Through switching over the geared motor 39 the holding device 34 is now drawn back to the readiness setting by the latched actuating lever 33 (see FIG. 11). The holding device 34 together with the electromagnet 35 is guided by a guide lever 43 into the correct position during the movement with respect to the actuating lever 33. As a result, the electromagnet 35 on reaching the actuating lever 33 can be switched on, whereby the holding device 34 grips the actuating lever and holds it by means of the catch 34a. It is ensured by this arrangement that the actuator 30 can be directly actuated again at any time, even during resetting.

[0089] The course of the resetting or the movement course of the geared motor 39 is controlled by switches 41. A first switch 41a recognizes, in the example, the setting of the holding device 34. If the electromagnet 35 has pulled up the holding device 34, the first switch 41a is disposed in closed state. A second switch 41b recognizes a position of the geared motor 39 or of the spindle 39a, which corresponds with the operating position. In the readiness setting of the actuator 30 in correspondence with FIGS. 10 and 11 both switches 41a, 41b are thus closed. If the actuator 30 is actuated, the holding device 34 opens and frees the actuating lever 33. The first switch 41a opens at the same time. An opened first switch 41a with second switch 41b closed at the same time means that the actuator 30 is actuated. For the resetting, the spindle 39a is, as already described, moved out until the holding device 34 can

be pulled up. This is established by the first switch 41a, whereby the geared motor 39 is reversed and thus the holding device 34 with latched actuating lever 33 is drawn back into the readiness setting. As soon as the second switch 41b is closed, this means that the readiness setting has been reached and the geared motor 39 is switched off. The geared motor 39 with the spindle 39a is constructed to be self-locking. The positioning of the holding device 34 with latched actuating lever 33 is thus determined by the resetting device 36 itself.

[0090] The arrangement of the switches 41 also makes possible a secure movement course, for example after an interruption of current, during the setting. If, for example, at the time of placing in operation both switches 41 are opened after an interruption in current, the geared motor 39 is initially driven back into the operating position. Insofar as a safety monitoring means now issues a corresponding readiness signal, but in that case the first switch 41 is still open as before, the resetting of the actuator 30 can automatically take place in correspondence with the process described in the foregoing or can be initialized.

[0091] The operating settings of the actuator itself can also be monitored by further switches (not illustrated), so that control devices have appropriate state data.

[0092] The actuator 30 apparent in FIGS. 10 to 13 as well as in FIG. 1 has an optional emergency unlocking means 50. This emergency unlocking means 50 enables resetting of the actuator 30 in such a manner that a possible manual relaxation of stress of a blocked elevator cage 2 is made possible. In the example the second connection 40.2 is connected by means of a pull chain 49 with a cable drum 53. The cable drum 53 is connected by way of the cable pull 51 with the hand crank 52 (see FIG. 1). The hand crank 52 in the example is arranged on a roof of the cage 2 in the vicinity of a front shaft wall. In the case of need, the cable drum 53 can be rotated by way of the hand crank 52, which for this purpose can be plugged onto a corresponding cable pull winder, so that the pull chain 49 connected with the cable drum 52 draws back the actuating lever 33 by way of the second connection 40.2. The actuator 30 can thus be reset at least to such an extent that the brakes 11, 11a are released and the cage 2 can thereby be relieved of stress, i.e. moved out of a blocked braking setting. After this emergency unlocking the hand crank 52 is relieved of load again, whereby the cable drum 53 is rotated back, advantageously by means of a spring integrated in the cable drum 53, so that the pull chain 49 is relieved. The setting of the cable drum is advantageously monitored by a third switch 42.

[0093] In the unactuated setting of the actuator 30, as illustrated in FIGS. 10 and 11, the cable drum 53 is rotated back and the pull cable 51 and also the pull chain 49 are relieved of load. The pull chain 49 is loose, so that it does not obstruct actuation of the actuator 30. The third switch 42 is not actuated, which means that the emergency unlocking means 50 is not actuated.

[0094] In FIGS. 12 and 13 the actuator 30 is actuated. Correspondingly, the pull chain 49 of the emergency unlocking means is substantially tensioned. If required, the connection 40.2 can be tightened by drawing the cable pull 51. On rotation of the cable drum 53 a switch plunger 42a of the switch 42 is pressed back. An electrical operation of the elevator installation is then, for example, interrupted until the cable drum 53 is relieved of load again.

[0095] In an alternative embodiment of the brake according to FIGS. 14 to 16 the brake shoe holder is constructed as a brake shoe lever 113. The essential functions correspond with the explanations with respect to the exemplifying embodiment according to FIGS. 4 to 9. The brake shoe lever 113 is used instead of the brake carriage. The brake shoe lever 113 is

arranged in a brake housing 112 to be pivotable about a horizontal pivot axis 126 and a brake shoe 115 is mounted in this brake shoe lever. A retraction device 116 pulls the brake shoe lever 113, analogously to the brake shoe carriages in the previous examples, away from the guide rail 6. The brake shoe lever 113 together with the brake shoe 115 can be adjusted when required with respect to the guide rail 6 by means of adjusting device 122. The brake shoe 115 has, as explained in the preceding examples, a first sub-region 115a and a connecting second sub-region 115b. The brake shoe lever 113 is supported in its lower region in the housing 112 by a compression spring group 119, whereby in a case of rotation or displacement of the brake shoe 115 bearing against the guide rail a corresponding pressing force is built up by way of the first and second sub-regions 115a, 115b. The illustrated brake is of substantially symmetrical construction. This means that a respective brake shoe lever 113, 113a is arranged on either side of the guide rail 6. In the example, one of the retraction devices is provided with a monitoring switch 127 for monitoring the working position of the brake shoe 115 or of the brake shoe lever 113. In case of need, the brake shoes 115 or the brake shoe levers 113, 113a are adjusted by means of the adjusting device 122. The adjusting device 122 is for that purpose actuated, for example by an actuator 30, via connections 40 (see FIG. 15). The actuator 30 engages a first lever 122a of the adjusting device 122. The first lever 122a is connected with a second lever 122b by way of a fulcrum. The second lever 122b can be pivotably connected with a bearing axle 117. The first lever 122a presses by a knee 122c against a second bearing axle 117a of the second brake shoe 115a. The two bearing axles 117, 117a and thus the two brake shoes levers 113, 113a together with the brake shoes 115, 115a are thereby displaced relative to one another and pressed against the guide rail 6. This function of adjustment is also used analogously in the brake according to FIGS. 4 to 9 and it is also suitable for co-operation with the actuator 30 according to FIGS. 10 to 13.

[0096] With knowledge of the disclosed technologies, the elevator expert can change the set shapes and arrangements as desired. For example, instead of the illustrated symmetrical arrangement with two brake shoe carriages 13, 13a, 113, 113a and two compression spring groups 19, 19a, 119, 119a it is also possible to make use of a compression spring group 19, 119 arranged at only one side, whilst the other side is, for example, rigidly supported, or a rigidly supported brake shoe carriage 13, 113 can be supported on a compression spring group 19a opposite a fixed brake plate 14. An embodiment of that kind is illustrated in FIG. 5b. A brake shoe carriage 13 is arranged on one side at the left in the figure and a fixed brake plate is arranged on the opposite side on the right in the figure. The brake shoe carriage 13 can be pressed against the guide rail by means of an adjusting device, whereby the actuation sequence, as already illustrated in the foregoing, results. However, by contrast with the symmetrical arrangement the entire brake housing is now displaced by the geometry of the brake shoe, whereby the fixed brake plate is drawn against the rail. The fixed brake plate is mounted by way of compression spring groups 19 so that in the case of corresponding spring compression, which is determined by the geometry of the brake shoe, a predetermined pressing force results.

[0097] In addition, the parts preferably used in the description of the actuator 30, such as pull chain and pull cable, can be replaced by the expert with equivalent parts, such as other tension or possibly pressure means, or use can be made of appropriate lever systems instead of cable drums and winders. In addition, the values mentioned in the description, such as, for example, the holding force of the electromagnet, etc.,

are informational. They are fixed by the expert with consideration of the selected materials and shapes.

[0098] Alternatively, for example, the connections 40, 40.1 can also be drawn towards one another in that a lever system in the form of a rhombus is used. In that case a force store urges when required two oppositely disposed corner points of the rhombus away from one another, whereby the two remaining corner points of the rhombus are necessarily drawn together. The connections 40, 40.1 are in that case coupled to these two other corner points of the rhombus.

[0099] Having illustrated and described the principles of the disclosed technologies, it will be apparent to those skilled in the art that the disclosed embodiments can be modified in arrangement and detail without departing from such principles. In view of the many possible embodiments to which the principles of the disclosed technologies can be applied, it should be recognized that the illustrated embodiments are only examples of the technologies and should not be taken as limiting the scope of the invention. Rather, the scope of the invention is defined by the following claims and their equivalents. I therefore claim as my invention all that comes within the scope and spirit of these claims.

I claim:

1. An elevator cage brake comprising a brake shoe, the brake shoe comprising a first sub-region and a second sub-region, wherein the first sub-region is configured to rotate about a bearing axle, and wherein the second sub-region is configured to be longitudinally and transversely displaceable relative to the bearing axle.

2. The elevator cage brake of claim 1, further comprising a brake housing and a brake shoe support, wherein the brake shoe support is configured to be displaceable in the brake housing.

3. The elevator cage brake of claim 2, further comprising a plurality of compression springs, the plurality of compression springs being biased to a biasing force, wherein the brake shoe support is positioned by a retraction device to bear against the plurality of compression springs.

4. The elevator cage brake of claim 2, further comprising a retraction device, the retraction device being configured to hold at least one of the brake shoe and the brake shoe support in a readiness position when the brake is in an unactuated state.

5. The elevator cage brake of claim 4, wherein the retraction device comprises a spring device configured to engage the brake shoe, and wherein the spring device is configured to draw the brake shoe and the brake shoe support into the readiness position.

6. The elevator cage brake of claim 2, further comprising an adjusting device configured to displace the brake shoe support from a readiness position to an engaged position.

7. The elevator cage brake of claim 2, further comprising a fixed brake plate configured opposite the brake shoe support, wherein the brake shoe and the fixed brake plate are configured to receive a guide rail.

8. The elevator cage brake of claim 2, wherein the brake shoe is a first brake shoe, the elevator cage brake further comprising:

a second brake shoe; and

respective brake shoe supports configured to support the first and second brake shoes in opposing positions, wherein the elevator cage brake is configured to receive a guide rail between the first and second brake shoes.

9. The elevator cage brake of claim 1, wherein the first sub-region has a substantially arcuate shape and the second sub-region has a substantially rectilinear shape.

10. The elevator cage brake of claim 1, wherein the first sub-region comprises a curved region, the curved region having a center and having first and second extremities, the curved region also having a width, the width increasing from the center to the first and second extremities, and wherein the second sub-region comprises a rectilinear region, the rectilinear region having a middle portion, an upper portion and a lower portion, the upper portion being wider than the middle and lower portions.

11. The elevator cage brake of claim 1, wherein the brake shoe further comprises a third sub-region, each of the second and third sub-regions having respective rectilinear forms, the first sub-region having a curved shape with first and second extremities, the second sub-region being connected to the first extremity of the curved shape and the third sub-region being connected to the second extremity of the curved shape, the second and third sub-regions having respective widths, each of the respective widths increasing as the second and third sub-regions extend away from the first and second extremities of the curved shape.

12. An elevator braking method, comprising:

moving an elevator brake shoe support from a readiness position to an engagement position;
engaging an elevator guide rail with a brake shoe with at least a portion of a first sub-region of the brake shoe, the elevator brake shoe being coupled to the elevator brake shoe support, the elevator brake shoe support being coupled to an elevator car;
rolling at least part of the first sub-region of the brake shoe along at least a portion of the elevator guide rail;
moving the elevator brake shoe support away from the elevator guide rail;
engaging the elevator guide rail with a second sub-region of the brake shoe;
vertically displacing the brake shoe relative to the elevator brake shoe support; and
further moving the elevator brake shoe support away from the elevator guide rail.

13. An elevator system brake actuator, comprising:

a force store;
a holding device;
a resetting device;
a first connecting point configured to be coupled to a first elevator brake; and
a second connecting point configured to be coupled to a second elevator brake, wherein the holding device is coupled to the force store and to the first and second connecting points, the holding device being configured to hold the force store and the first and second connecting points in respective readiness positions, wherein the force store is configured to exert respective forces on the first and second connecting points for placing the first and second elevator brakes into respective engaged positions, and wherein the resetting device is configured to

return the first and second connecting points to the respective readiness positions.

14. The elevator brake system actuator of claim 13, further comprising an actuating lever, wherein the actuating lever is configured to draw a connector for the first elevator brake substantially toward a connector for the second elevator brake.

15. The elevator brake system actuator of claim 13, wherein the force store is configured to apply an approximately constant tension force to the first and second connecting points.

16. The elevator brake system actuator of claim 13, further comprising a damping device, the damping device being configured to dampen one or more movements during operation of the actuator.

17. The elevator brake system actuator of claim 13, wherein the actuator is configured to move relative to an elevator cage coupled to the first and second elevator brakes.

18. The elevator brake system actuator of claim 13, further comprising an emergency unlocking component, the emergency unlocking component being configured for manually resetting the actuator.

19. An elevator installation comprising:

an elevator cage;
at least one guide rail; and
a brake, the brake being coupled to the elevator cage and the at least one guide rail, the brake comprising a brake shoe, the brake shoe comprising a first sub-region and a second sub-region, wherein the first sub-region is configured to rotate about a bearing axle, and wherein the second sub-region is configured to be longitudinally and transversely displaceable relative to the bearing axle.

20. An elevator installation comprising:

an elevator cage;
at least one guide rail;
first and second elevator brakes coupled to the elevator cage; and
an elevator brake actuator, comprising,
a force store,
a holding device,
a resetting device,
a first connecting point coupled to the first elevator brake; and
a second connecting point coupled to the second elevator brake, wherein the holding device is coupled to the force store and to the first and second connecting points, the holding device being configured to hold the force store and the first and second connecting points in respective readiness positions, wherein the force store is configured to exert respective forces on the first and second connecting points for placing the first and second elevator brakes into respective engaged positions, and wherein the resetting device is configured to return the first and second connecting points to the respective readiness positions.

* * * * *



US 20040112683A1

(19) **United States**(12) **Patent Application Publication**
Liebetrau et al.(10) **Pub. No.: US 2004/0112683 A1**(43) **Pub. Date: Jun. 17, 2004**(54) **SAFETY DEVICE FOR ELEVATORS****Publication Classification**(76) Inventors: **Christoph Liebetrau**, Menziken (CH);
Ruedi Stocker, Buchrain (CH); **Esben**
Rotboll, Zug (CH)(51) **Int. Cl.⁷** **B66B 5/20**; B66B 5/18(52) **U.S. Cl.** **187/372**; 187/376

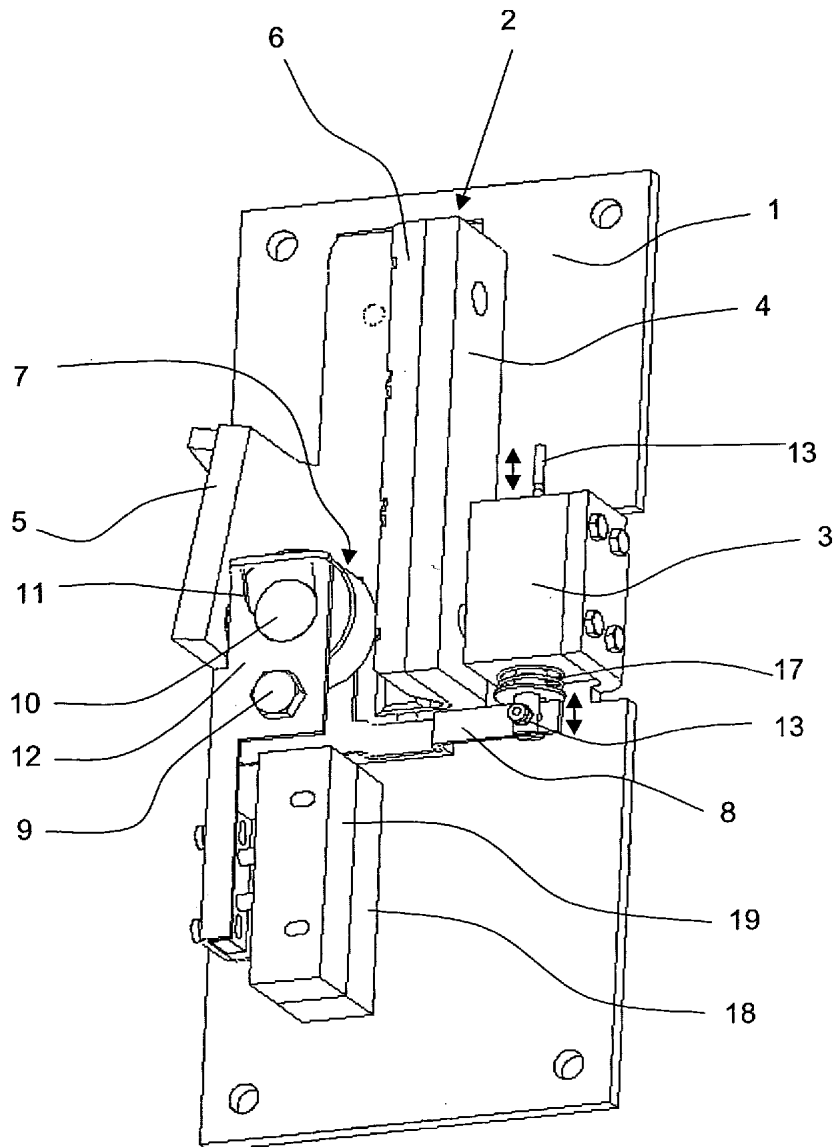
Correspondence Address:

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720 WATER STREET
TOLEDO, OH 43604-1619 (US)(57) **ABSTRACT**

A safety device brakes an elevator car with a guide rail exhibiting an oblong guide flange. The safety device includes a base carrying a retaining element and an abutment with the guide flange positioned therebetween. A mechanism squeezes, when braking, a braking element blocking roller between the guide flange and the abutment. The mechanism, co-operating with an electromagnet, moves the braking element in a controlled way between different positions associated with different operating conditions of the safety device.

(21) Appl. No.: **10/667,874**(22) Filed: **Sep. 22, 2003**(30) **Foreign Application Priority Data**

Sep. 23, 2002 (EP) 02405819.0



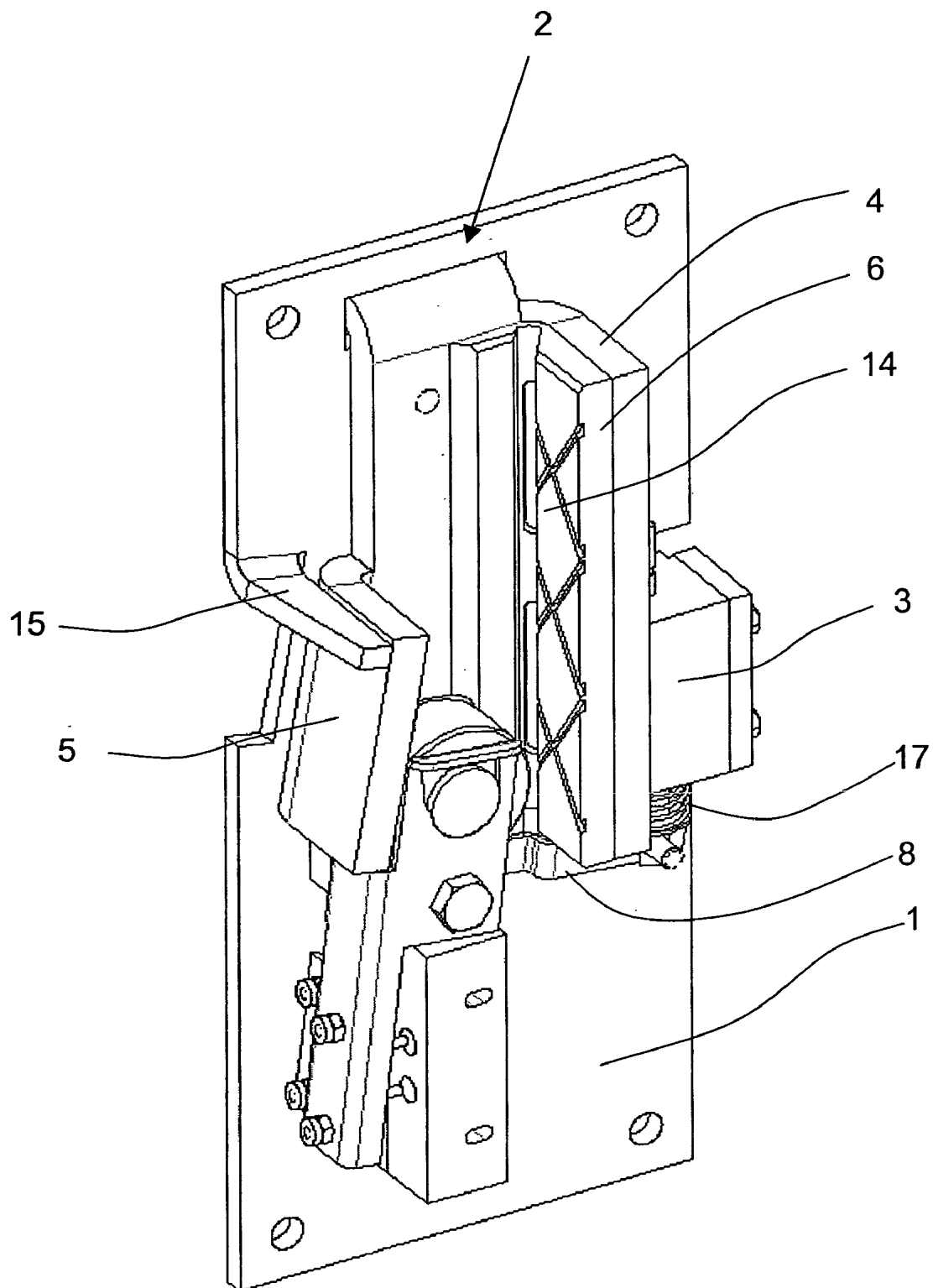


Fig. 2

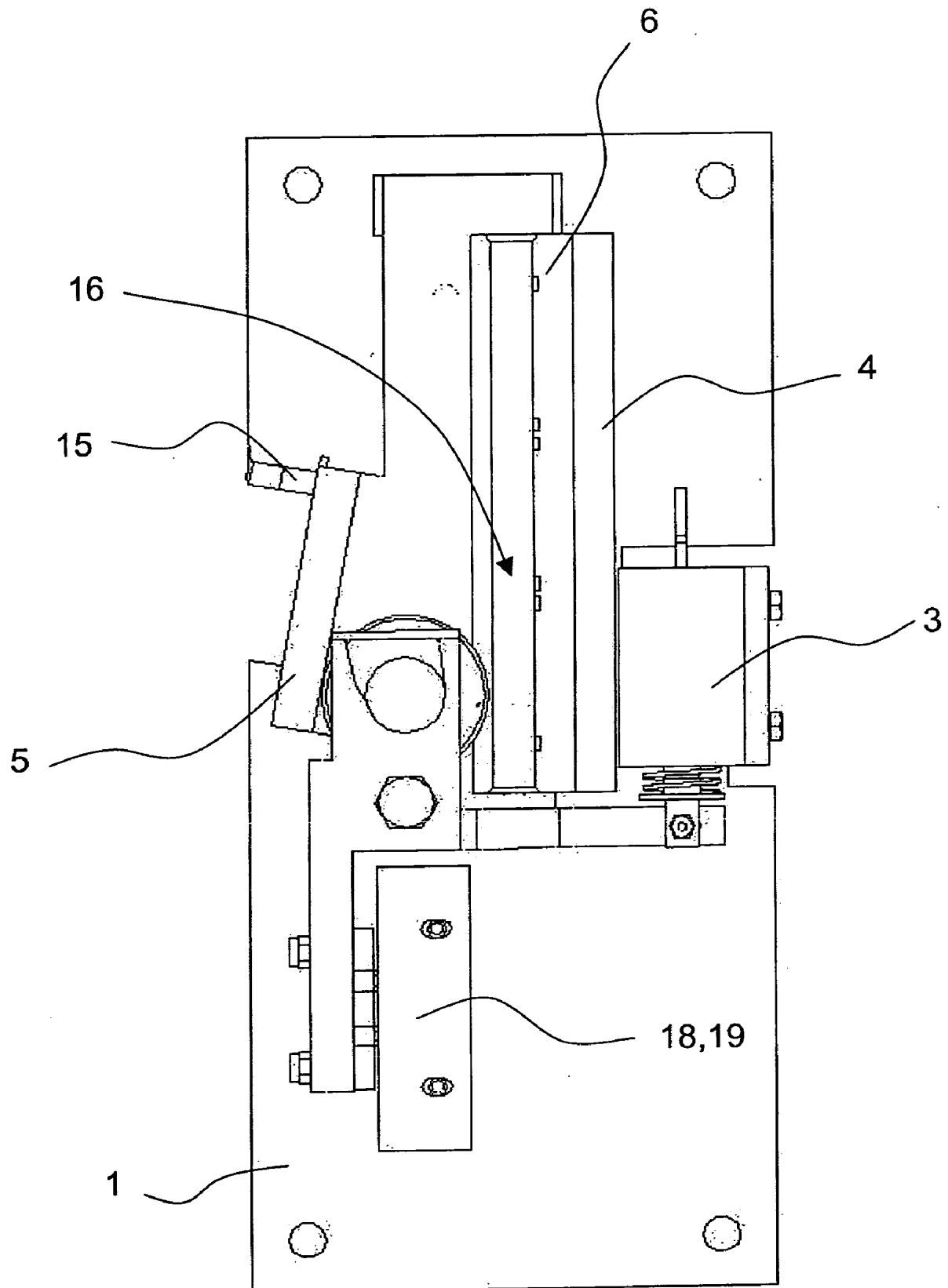


Fig. 3

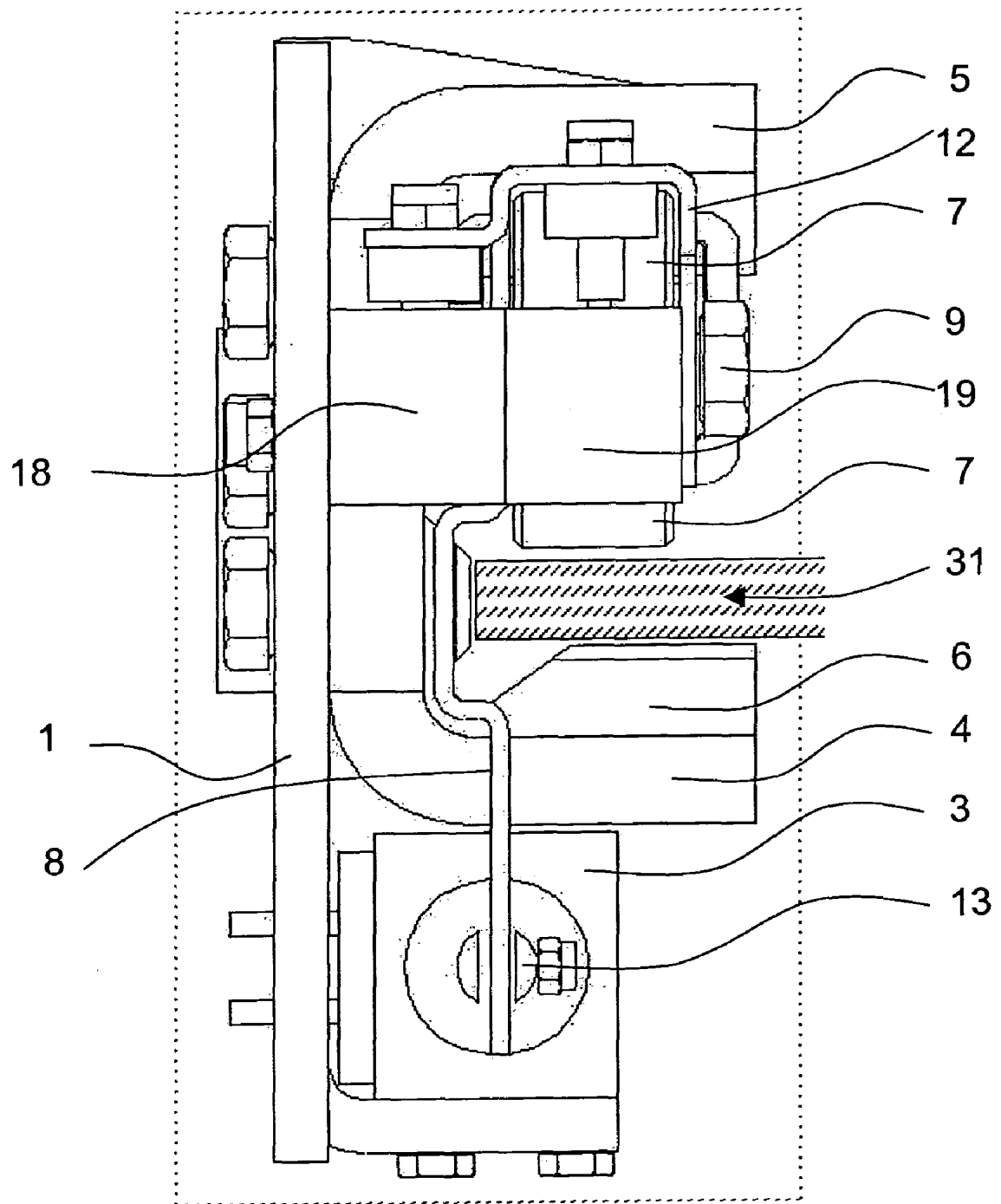


Fig. 4

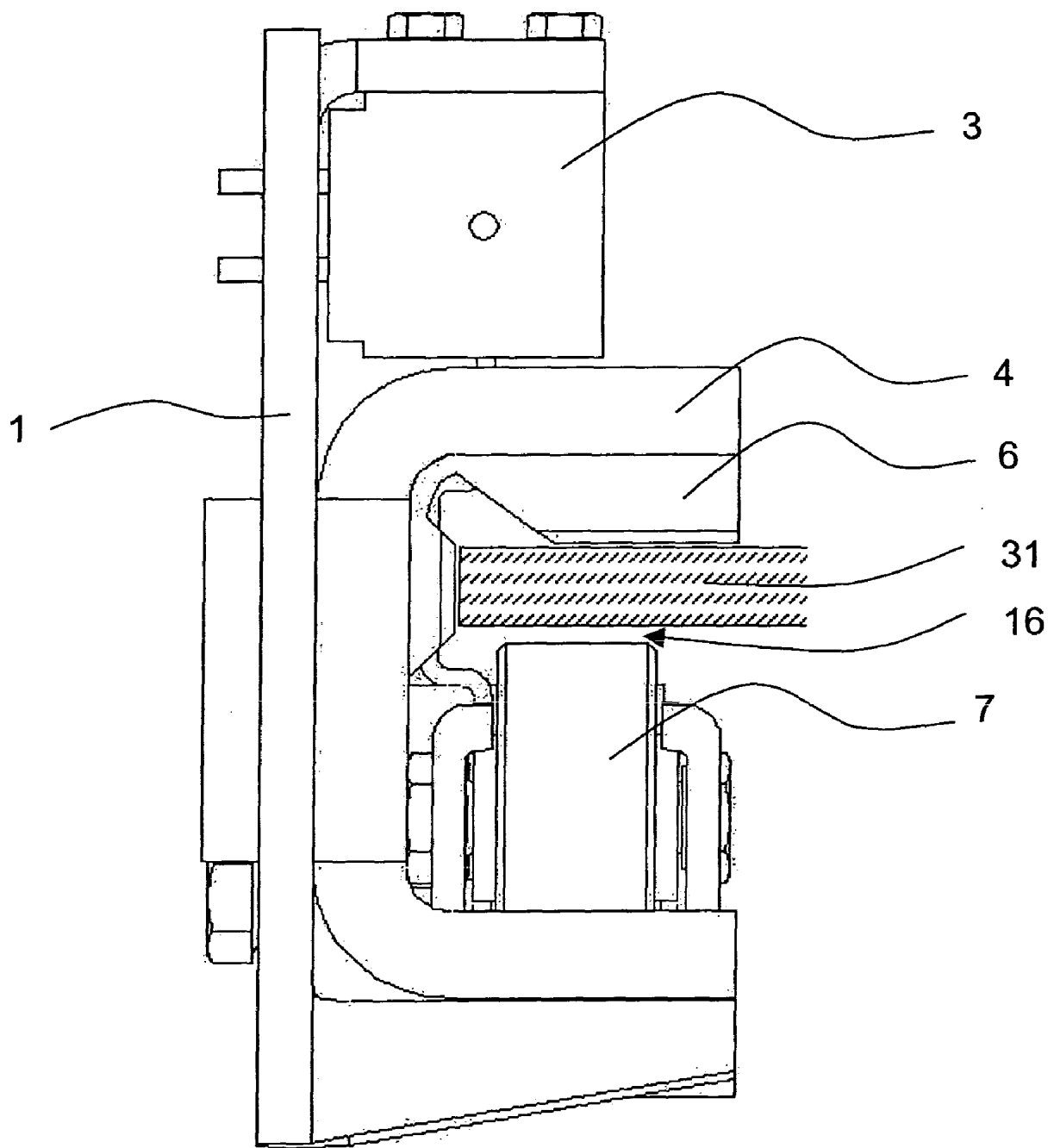


Fig. 5

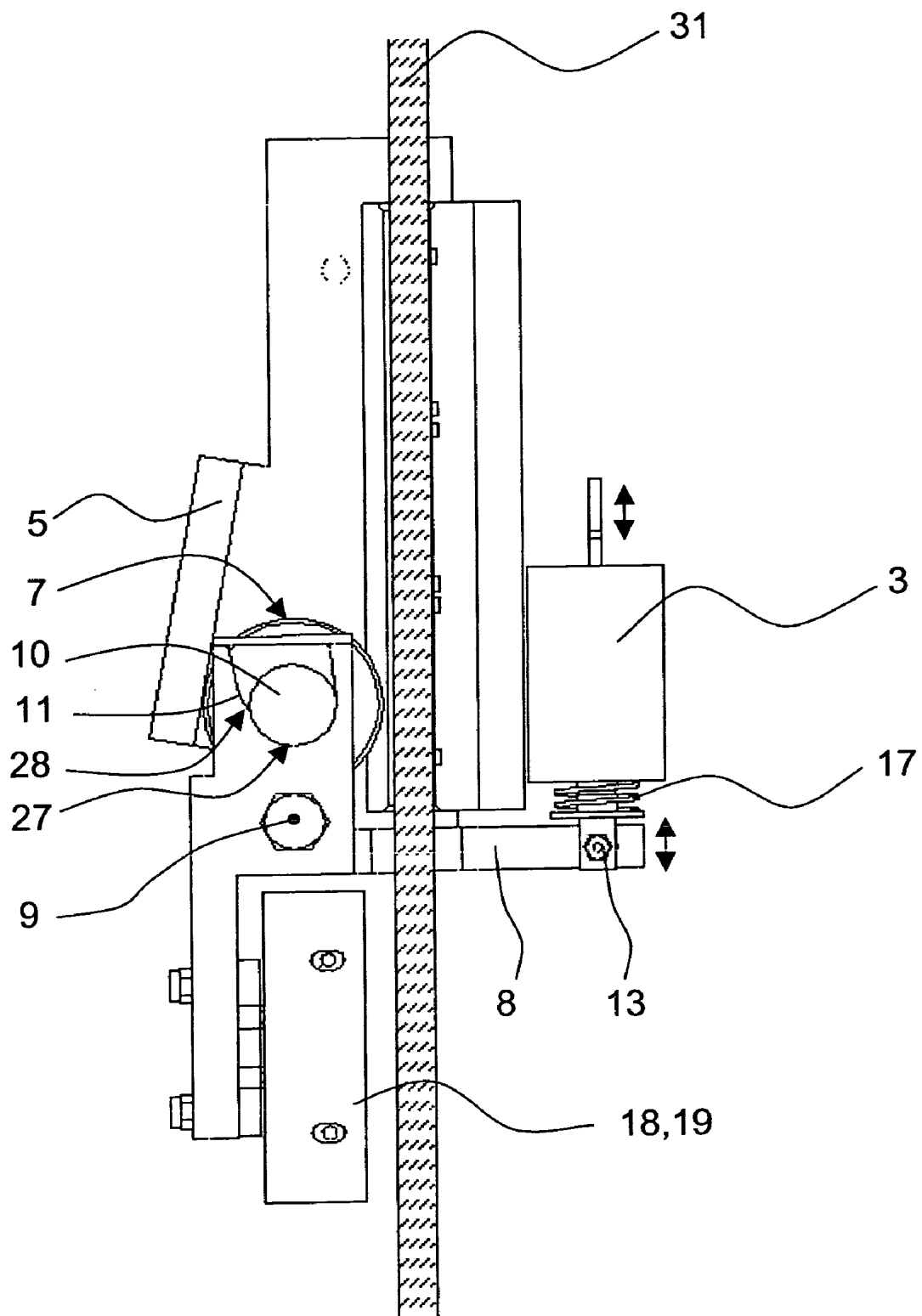


Fig. 6

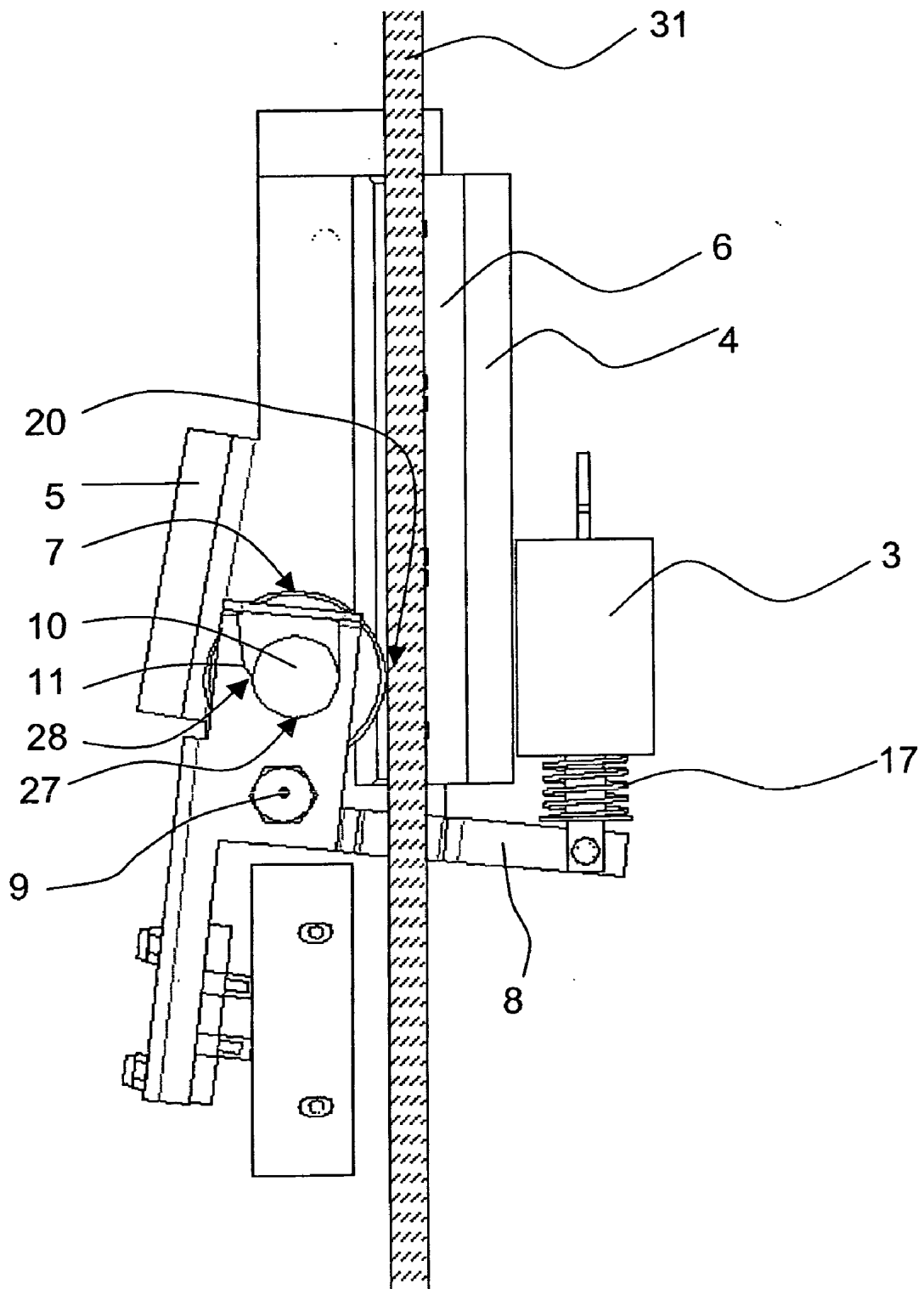


Fig. 7

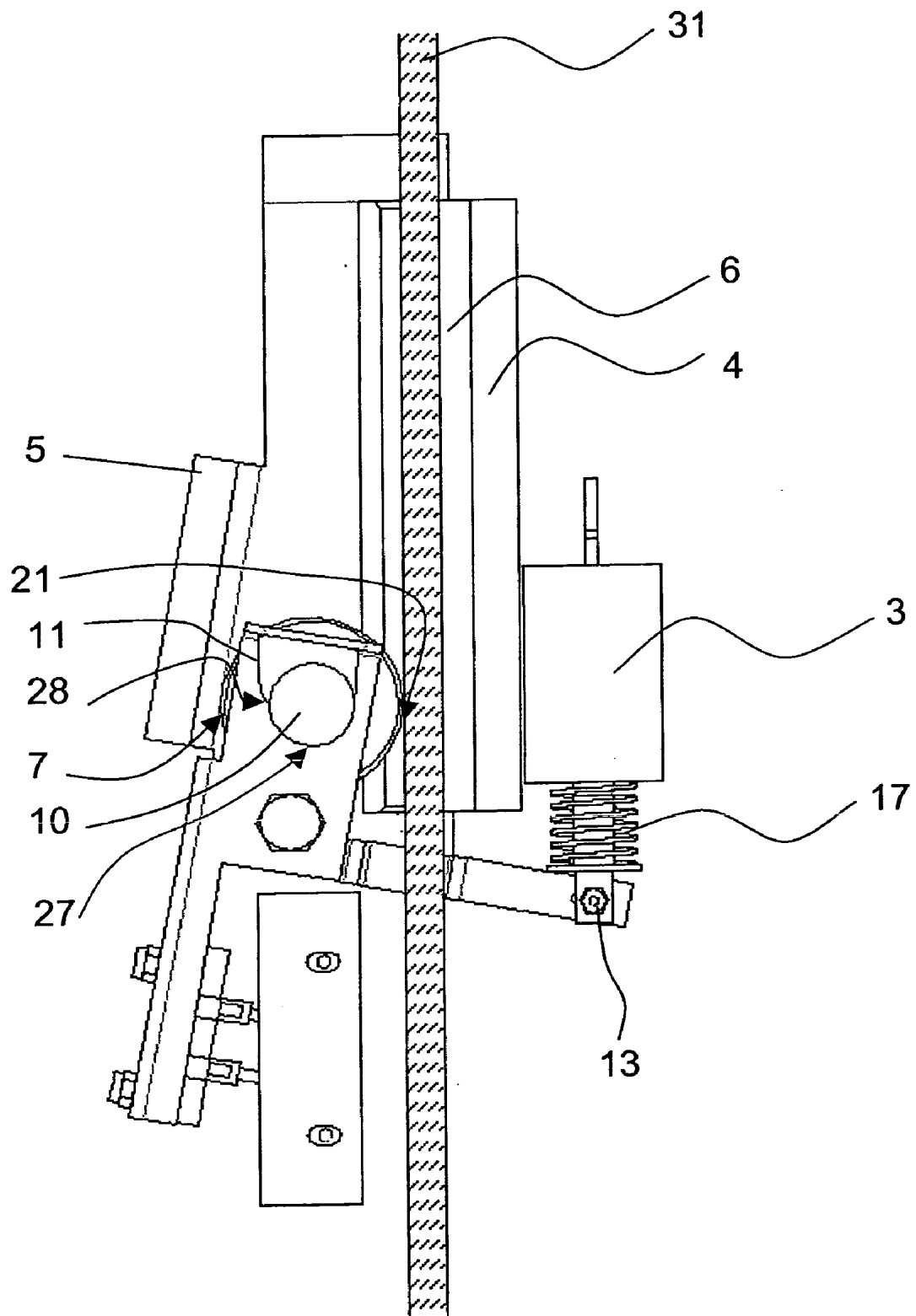


Fig. 8

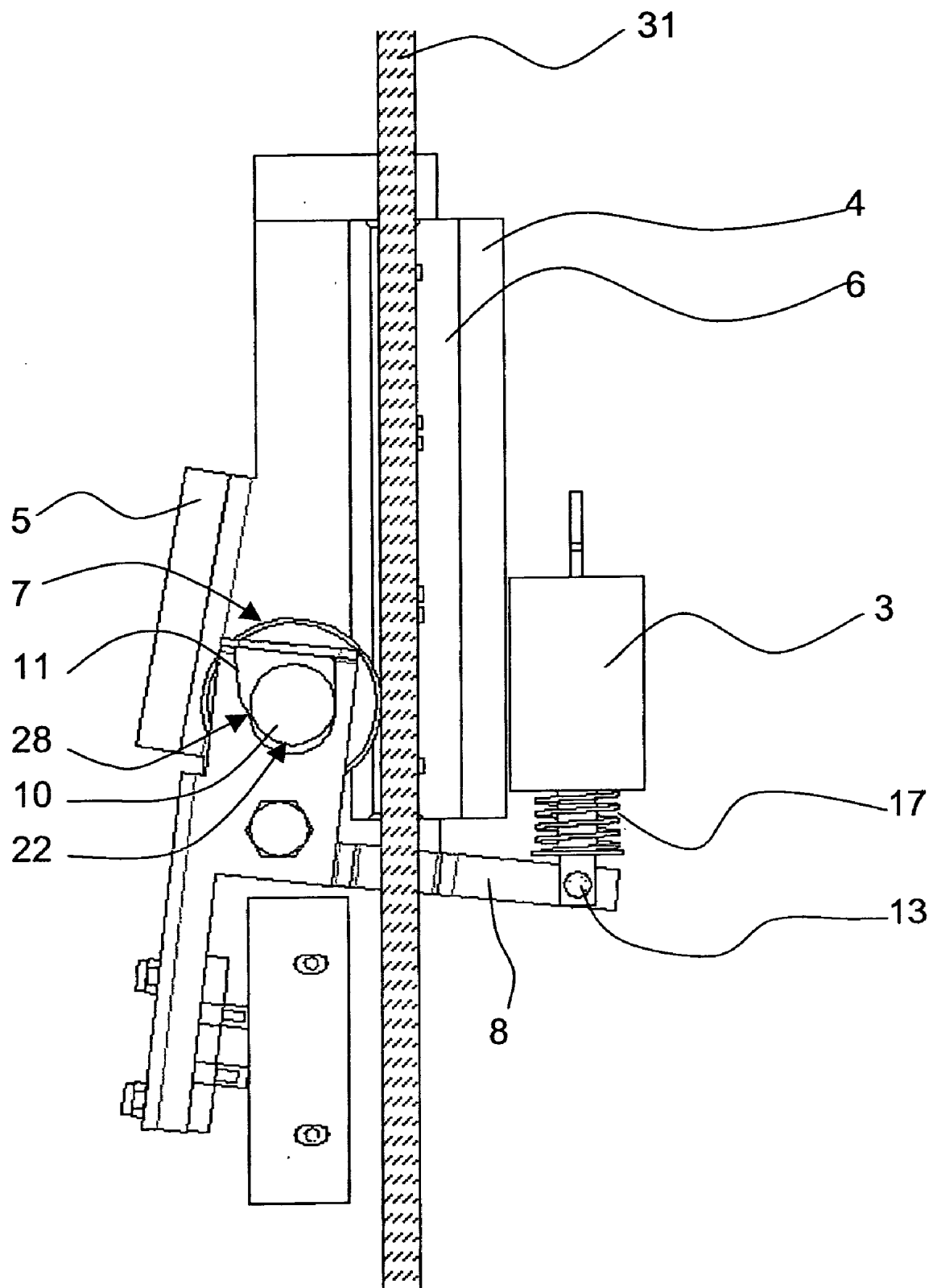


Fig. 9

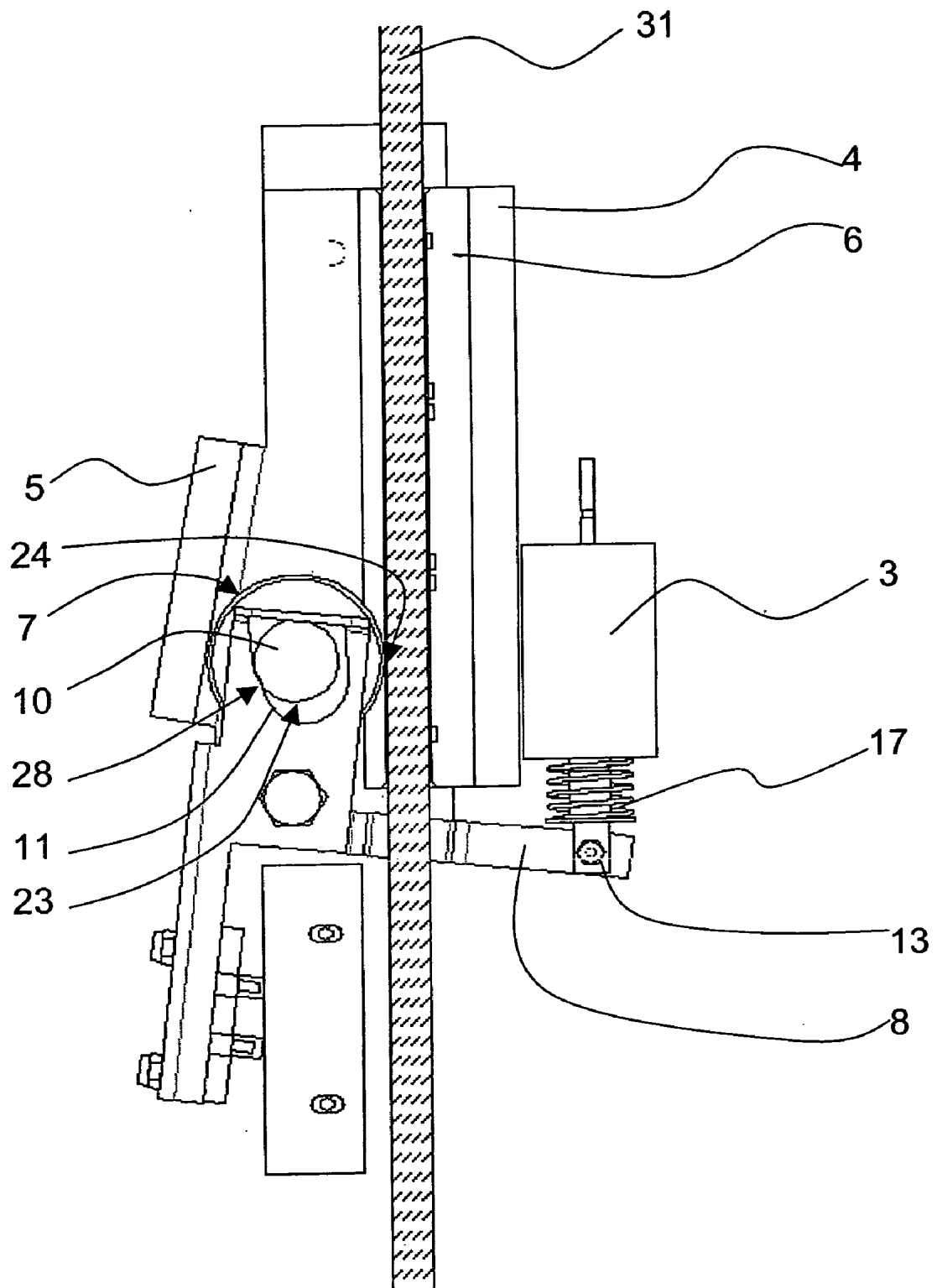


Fig. 10

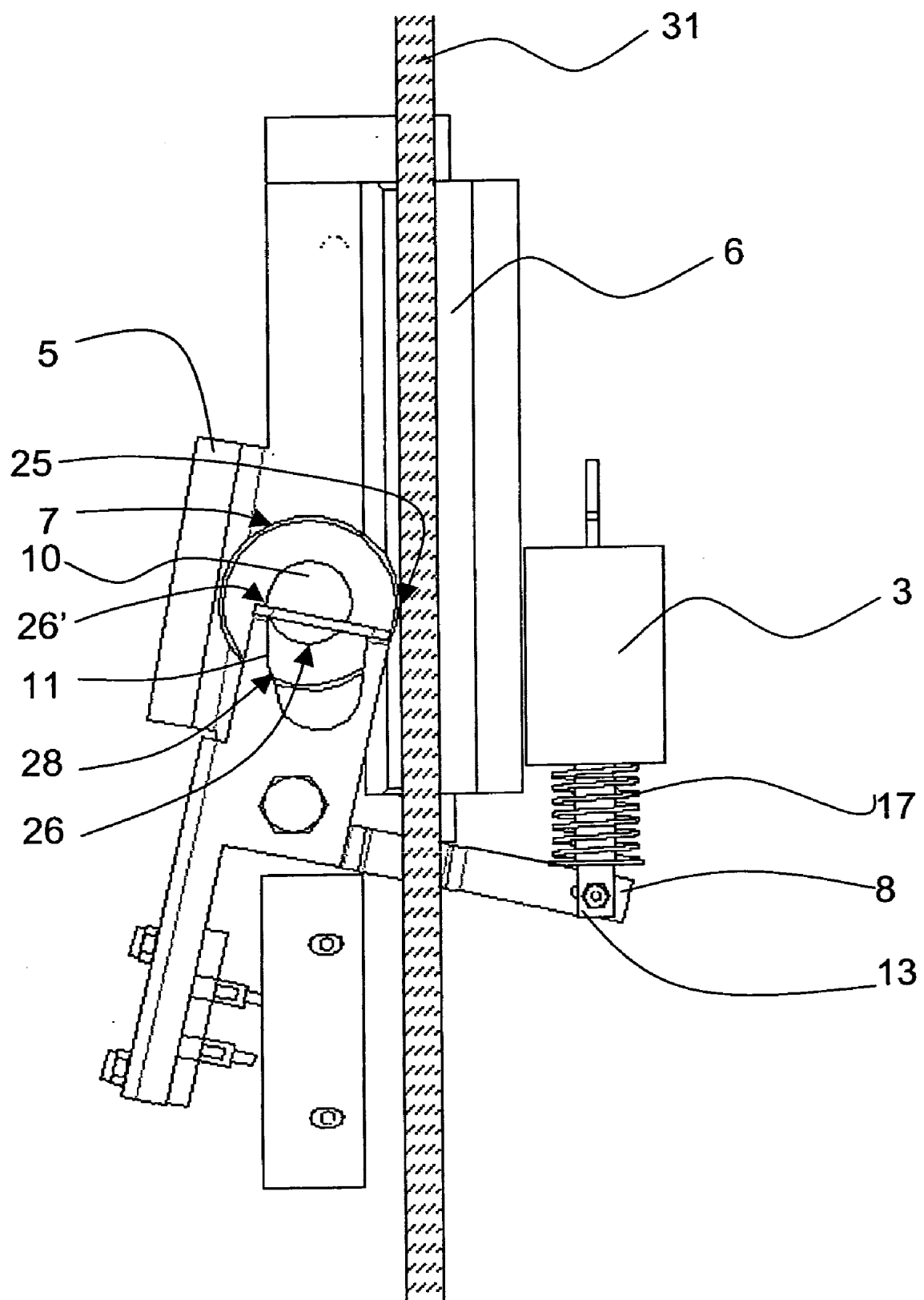


Fig. 11

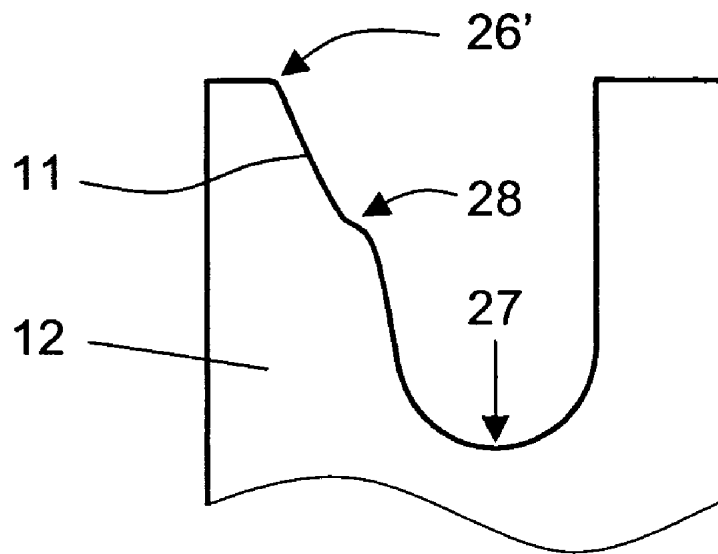


Fig. 12

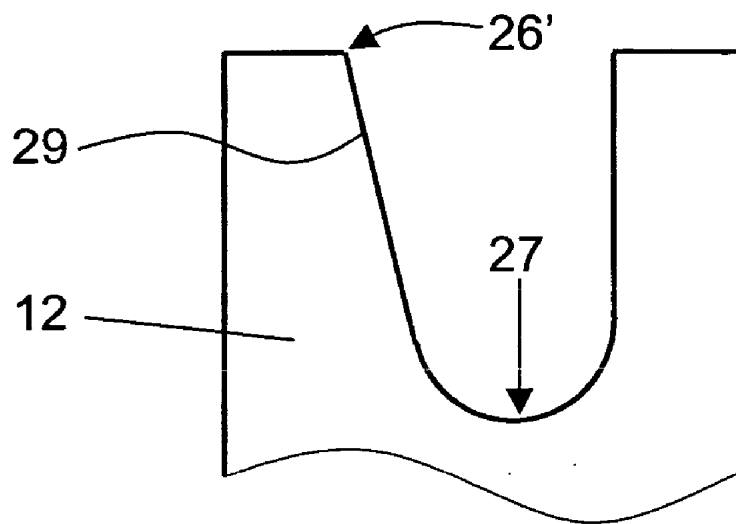


Fig. 13

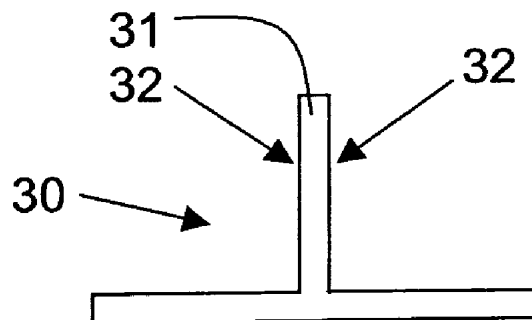


Fig. 14

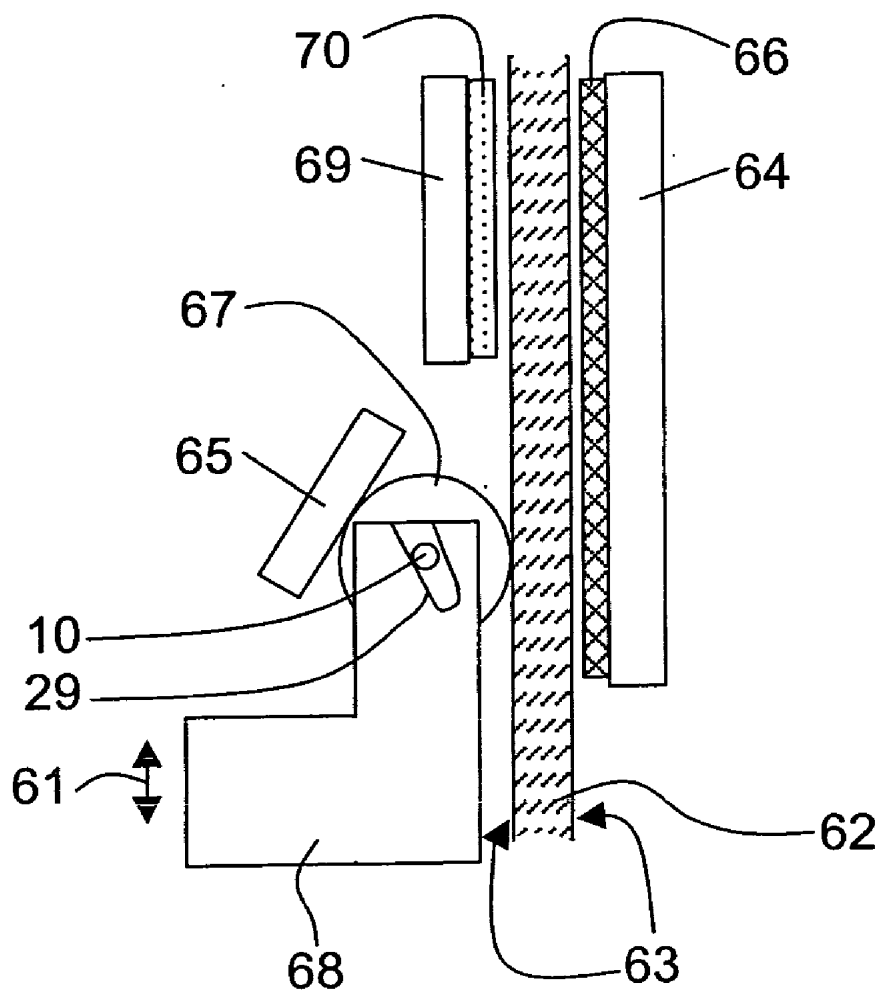


Fig. 15

SAFETY DEVICE FOR ELEVATORS

BACKGROUND OF THE INVENTION

[0001] The present invention relates generally a safety device for elevators to prevent unintended elevator car movement.

[0002] For guiding the elevator car in the case of elevators with guide rails, guide shoes, which are arranged at the elevator car, are employed and such guide shoes are developed either as roller guide shoes or as sliding guide shoes. In the first case, rollers are generally provided with so-called two-dimensional or three-dimensional guides, which roll on appropriate guide surfaces of the guide rail. In the second case, slideway linings slide with small free motion along the guide rails, so that they confer to the elevator car during the vertical transport motion a guide in the horizontal plane. Safety devices, which are physically separate from the guide shoes, are fastened to the elevator car and such safety devices operate to engage the guide rail.

[0003] The well-known devices of this kind work in the manner that in case of exceeding the speed limit of the elevator car or respectively in case of over-speed, the safety device is mechanically operated by a speed governor device.

[0004] The common safety devices of the state of the art can be categorized according to their construction either to the group of the brake safety devices or the group of the wedge blocking safety devices or the roller blocking safety devices.

[0005] A brake safety device is shown in the U.S. Pat. No. 6,131,704, which has a slideway for guiding the elevator car along the guide rail. This safety device includes a forked lever mechanism and a relatively large and heavy electromagnet. With this safety device, the guiding apparatus is functionally separated from the braking device or respectively from the safety device. The usage of such a safety device is therefore uneconomical in particular in the case of low cost elevators with small hoisting height, that is to say for buildings with few floors and low hoisting speeds of the elevator car.

[0006] In the case of wedge blocking safety devices or roller blocking safety devices, a loose wedge or loose roller is engaged on a side of the guide rail in order to fit between the stationary guide rail on the one hand and an associated abutment of the safety device on the other hand, by means of the speed limiter, while the safety device block is supported on the opposite side of the guide rail. The prevailing frictional circumstances lead to a further blocking of the clamp body or respectively of the blocking roller and consequently to the braking of the elevator car. Such a blocking roller safety device is described for example in the published European application EP 0 870 719 A1.

[0007] Conventional safety devices are applied only in the case of over-speed or in case of inspection work (typically twice per year). Traditional safety devices are in particular of major disadvantage if the elevator car stands at a floor and due to loading, it slips or it falls uncontrolled.

[0008] According to the state of the art, an additional so-called creeping protection device prevents the slipping of the elevator car. Thereby, a bolt is pushed into engagement, for example in the appropriate openings of the guide rail,

during each stop at a floor, so as to hold in each case the elevator car at the floor level. Further details about the construction and the function of such a creeping protection device are shown in the published European application EP 1 067 084 A1.

[0009] A task of the following described invention is therefore to avoid the mentioned disadvantages of the state of the art devices and to create an improved safety device for elevators.

SUMMARY OF THE INVENTION

[0010] The safety device according to the present invention has the advantage that it allows, in an excellent manner, an engagement of the safety device in the case of an operating state below the over-speed, that is not so easily possible with the well-known safety devices. Conventional safety devices are never operated in normal operation of the elevator car below the over-speed, which, as a consequence, also makes impossible the early recognition of a possible malfunctioning of the safety device.

[0011] A further advantage of the safety device according to the present invention is that it can also be employed as a multifunctional brake device and guiding device for elevators, since it represents a device, which can substitute into one and the same construction three otherwise separated functional units to be employed on an elevator car: these are a guiding device for the elevator car, a safety device and a creeping protection device.

[0012] The position of a braking element of the safety device is changeable in a controlled way. Thanks to pre-definition of different positions of the braking element, the safety device can be transferred into different operating states and different functions of the safety device are to be assigned in each case to these different operating states. A mechanism determining the positioning of the braking element allows keeping, in a normal state, the braking element distant from the guide surface of the guide rail. In this normal state, the safety device does not display a braking effect. This normal state of the safety device is adequate for a normal undisturbed drive of the elevator car. The position of the braking element can be changed in a controlled way in such a manner that the braking element touches the guide surface at the guide rail and it is additionally so positioned opposite an abutment that the braking element is not squeezed between the guide surface and the abutment. In this arrangement, the brake is to be arranged in braking readiness, i.e. a state of the readiness for braking. If the safety device is transferred into this state, then a further movement of the elevator car can be possible to a certain extent, since the safety device is not blocked in this state. In the state of braking readiness, an interaction of the braking element with the guide rail is however possible, for example by friction. This interaction between braking element and guide rail makes it possible that the braking element—in a state of braking readiness—is moved in case of a further movement of the elevator car relative to the remaining components of the safety device and opposed to the direction of motion of the elevator car. In case of suitable arrangement of the abutment, the position of the braking element can be changed in such a manner that the braking element comes in addition automatically in contact with the abutment and is squeezed between the guide surface of the

guide rail and the abutment. This position of the braking element is called a brake position. In this position, the braking element is blocked and the safety device is arranged in the safety position and in this safety position, a further drive of the elevator car is prevented by the fact that the guide rail is held between the braking element and a retaining element of the safety device.

[0013] This safety device can be constructed as a creeping protection device or respectively as a sliding safety device, by transferring the safety device, in case of a stop, into the state of braking readiness. If, under these premises, the elevator car should be additionally loaded, so that the suspension means of the elevator car are stretched and the elevator car is lowered, then the braking element would be moved relative to the safety device. As described above, the safety device can be brought thereby into the safety position, if the elevator car is lowered at least by a defined minimal distance. In case of a suitable arrangement of the abutment, a slipping of the elevator car can thus be prevented, if the elevator car threatens to drop due to an overload.

[0014] In case of this safety device, any reversible controlled transition between the normal condition and the condition of the braking readiness can be realised.

[0015] This safety device can also serve as guiding device for the elevator car along the guide rail. The retaining element of the safety device is arranged in such a manner that it acts, in normal state of the safety device, as a guiding device for guiding the elevator car alongside the guide rail. The range of motion in a plane perpendicularly to the direction of motion of the elevator car can be arbitrarily limited by further guiding devices. In this way, a guide for guiding the elevator car alongside the guide rail can be functionally integrated into the safety device thanks to a suitable arrangement of the safety device. Such a guide is usually realised, in conventional elevator systems, independently from a safety device with the help of separated guide shoes. The combination of a safety device and of a guiding device or respectively the integrating of a guide into a safety device is particularly economical and entails a favourable weight saving and space saving. The safety device enables a construction in a particularly compact form. For example, the retaining element, and/or one or more guiding elements, and/or the abutment can be developed as part of the walls of a housing for the safety device. This housing can also be constructed as single piece and offers the basis for a simple modular construction of the safety device according to the present invention.

[0016] For the safety device, a constructive simple embodiment results if the braking element is developed as blocking roller. This execution form enables a reliable transition of the safety device from the state of the braking readiness into the safety position. This transition is connected with an rolling motion of the blocking roller, which is simply controllable and which can automatically take place by itself even in case of increasing wear of the retaining element and/or of the blocking roller.

[0017] The operating mechanism for the positioning of the braking element can be realized in a simple way with the help of an electromagnet. By a suitable pre-definition of the current flowing through the electromagnet, forces can be varied, and with the assistance of these forces, the braking

element can be brought in each case into the desired position. Such an operating mechanism can be controlled in a simple manner electronically.

DESCRIPTION OF THE DRAWINGS

[0018] The above, as well as other advantages of the present invention, will become readily apparent to those skilled in the art from the following detailed description of a preferred embodiment when considered in the light of the accompanying drawings in which:

[0019] **FIG. 1** is a perspective view of a safety device according to the present invention with a blocking roller as a braking element and an electromagnet for operating the safety gear;

[0020] **FIG. 2** is another perspective view of the safety device shown in **FIG. 1**;

[0021] **FIG. 3** is a front elevation view of the safety device shown in **FIG. 1**;

[0022] **FIG. 4** is a bottom plan view of the safety device shown in **FIG. 1**;

[0023] **FIG. 5** is a top plan view of the safety device shown in **FIG. 1**;

[0024] **FIG. 6** is a view similar to **FIG. 3** with the safety device in a normal state, i.e. with the magnet carrying current;

[0025] **FIG. 7** is a view similar to **FIG. 6** with the safety device in readiness for braking with a retaining element without wear;

[0026] **FIG. 8** is a view similar to **FIG. 7** showing wear of the retaining element;

[0027] **FIG. 9** is a view similar to **FIG. 7** with the safety device in readiness for braking with a retaining element without wear, however with an extension of the suspension means of the elevator car;

[0028] **FIG. 10** is a view similar to **FIG. 9** with the safety device in the safety position with a retaining element without wear;

[0029] **FIG. 11** is a view similar to **FIG. 10** showing wear of the retaining element;

[0030] **FIG. 12** is a schematic representation of an embodiment of the suspension of the blocking roller of the safety device;

[0031] **FIG. 13** is a schematic representation of a simpler embodiment of the suspension of the blocking roller;

[0032] **FIG. 14** is a schematic representation of a guide rail with a guide flange in cross section; and

[0033] **FIG. 15** is a schematic representation of a further embodiment safety device in accordance with the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

[0034] **FIG. 1** shows a base **1**, on which a safety device block **2** and an electromagnet **3** of the safety device are firmly installed. The safety device block **2** has a U-shaped cross section formed by two legs **4** and **5**, whereby the inside

of the leg 4 is provided with a guide and brake lining 6. The safety device is installed on an elevator car (not shown) in an elevator system (not shown) and at the same time is aligned on a guide rail 30 (see FIG. 14), which serves for guiding the elevator car, in such a manner that a guide flange 31 (see FIGS. 4 and 14) of the guide rail 30 is arranged between a braking element, which is developed in the present case as a blocking roller 7, and the guide and brake lining 6.

[0035] In operation, the guide and brake lining 6 touches a guide surface 32 (see FIG. 14) of the guide flange 31. The leg 4 forms together with the guide and brake lining 6 an oblong retaining element for the guide flange 31. With the safety device, the elevator car can be held or respectively braked at the guide flange 31, whereas the guide flange 31 is held between the guide and brake lining 6 and the blocking roller 7. The other leg 5 is arranged inclined and represents thus an abutment for the blocking roller 7. So that the elevator car can be braked against a direction of motion, the space between the leg 5 and the lining 6 is narrowed in opposition to the direction of motion in such a manner that the blocking roller 7 can be squeezed between the leg 5 and the guide flange 31. As clearly shown in FIG. 1, in the present case the space between the leg 5 and the guide and brake lining 6 is upwards reduced. The safety device represented in FIG. 1 is therefore suitable to react against a descent of the elevator car.

[0036] A lever mechanism 8 is operated by an operating mechanism including the electromagnet 3, whereby the lever mechanism 8 is mounted for swivelling around an axle 9, which is arranged parallel to a longitudinal surface of the guide and brake lining 6 and perpendicularly to the direction of motion of the elevator car. Preferably, a free end of the lever mechanism 8 is coupled with the electromagnet 3. Thereby, the location of the blocking roller 7 in the mentioned interspace can be changed depending upon the operating state, preferably in that way that the position of an axle 10 of the blocking roller 7 is changeable along a guide 11 of the lever mechanism 8, for example via rolling of the axle 10 alongside the guide 11.

[0037] The safety device block 2 is preferably constructed as single piece with the leg 4, acting as retaining element, and the leg 5, acting as abutment. The legs 4 and 5 are rigidly connected to the base 2 in such a manner that when blocking further movement of the blocking roller 7, the leg 4 together with the guide and brake lining 6 is pressed against the guide flange 31 on the side opposite the blocking roller 7.

[0038] The lever mechanism 8 includes for example a part, which serves as a suspension 12 for the blocking roller 7. This suspension 12 comprises the guide 11, in which the axle 10 of the blocking roller 7 is moveably placed. The guide 11 can be formed as a groove or respectively as an oblong recess. In order to operate the lever mechanism 8, the electromagnet 3 exhibits a holding or tie bolt 13 connected with the free end of the lever mechanism 8, and such holding or tie bolt 13 can be moved in its lengthwise direction relative to the electromagnet 3, by means of a magnetic field generated with the electromagnet 3, as indicated in FIGS. 1 and 6 by double headed arrows.

[0039] In FIG. 2, the base 1 is represented with the safety gear block 2 and the electromagnet 3 in such a manner that a first range with the U-shaped cross section between the two

legs 4 and 5 and a second range with an L-shaped cross section as well as a surface structure 14 of the guide and brake lining 6 are clearly visible. In the shown example, the surface structure 14 exhibits an X-shaped applied profile. Over a support 15, being connected with the base 1 on the side of the leg 5 applied from the blocking roller 7, those forces that act on the leg 5 when braking can be absorbed by the base 1.

[0040] From the FIGS. 3, 4 and 5, a free space 16 is clearly evident and such free space 16 is reserved for the guide flange 31 of the guide rail 30. In FIGS. 4 and 5, a part of the guide flange 31 is shown in section.

[0041] As shown in FIGS. 1-3 and 6-11, a spring 17 is arranged at the electromagnet 3 and the electromagnet 3 is electrically controllable by means of a release mechanism. In case of a suitable electrical control of the electromagnet 3, the holding or tie bolt 13 can be moved and the free end of the lever mechanism 8 can be deflected against a restoring force of the spring 17. At the same time, the lever mechanism 8 is rotated around the axis of rotation 9 around an appropriate bevel and the position of the blocking roller 7 in the interspace between the leg 5 and the guide flange 31 is changed in a controlled way. In normal operation (driving the elevator car), the electromagnet 3 is current-activated and the holding or tie bolt 13 is held against the spring resistance in an upper extreme position in order to keep the blocking roller 7 distant from the guide flange 31. In this arrangement, the spring 17 is therefore compressed. If the electromagnet 3 is not current-activated, the holding or tie bolt 13 is arranged under the effect of the spring 17 in a position, which is shifted downwards in such a manner that the blocking roller 7 is brought into contact with the guide flange 31 (FIG. 7). If the blocking roller 7 touches the guide flange 31, then the premise is created that the safety device achieves a braking action by an interaction with the guide flange 31. The safety device is then either in the state of braking readiness (braking readiness position), as long as the blocking roller 7 is not squeezed between the guide flange 31 and the leg 5, or in the safety state wherein the blocking roller 7 is squeezed between the guide flange 31 and the leg 5 in a brake position.

[0042] In the case of power failure, just as with an appropriate control of the electromagnet 3, the safety device is therefore due to the effect of the spring 17 in the braking readiness state or the safety state.

[0043] In FIG. 6, the elevator is in the operating state and in such operating state, the elevator runs undisturbed (standard drive) and the safety brake is arranged in the rest position. The electromagnet 3 is current-activated and the lever mechanism 8 is deflected in such a manner that the blocking roller 7 is out of contact with the guide rail 30. In this position, the axle 10 of the blocking roller 7 rests under effect of the weight on a lowest end or point 27 of the guide 11 of the lever mechanism 8.

[0044] FIG. 7 corresponds to an operating state in which the elevator stands for example at a floor stop, so that no relative motion between the guide rail and the elevator car or respectively the safety device takes place. The current supply to the electromagnet 3 is interrupted, whereupon the lever mechanism 8 is so far swiveled that the blocking roller 7 abuts against a zone or portion 20 of the guide flange 31 of the guide rail. The safety device is in the braking

readiness position, and no additional loading of the elevator car took place. The blocking roller of 7 rests unaltered at the lower end 27 of the guide 11. FIG. 8 corresponds to the same case, however with a wear of the guide and brake lining 6 of for example 2 mm within a zone or portion 21. In this case, the bolt 13 is somewhat further extended and the blocking roller 7 approaches thereby nearer to the leg 4, since the guide and brake lining 6 became thinner due to wear. The axle 10 of the blocking roller 7 is still placed—as in the case of the FIG. 7—at the lower end 27 of the guide 11.

[0045] FIG. 9 serves for the explanation of an operating state, in which the elevator stands and the elevator car was loaded and is lowered consequently within the limits of the elastic resilience of the suspension or respectively of the suspension means, whereupon a movement of the safety device occurred relative to the stationary guide flange 31 of the guide rail 30. During the lowering of the elevator car, the blocking roller 7, which is already adjacent to the guide rail in accordance with FIG. 7, has been put into an anticlockwise rotation under effect of the friction with the guide rail 30 and is rolled along the guide 11. The axis of rotation 10 of the blocking roller 7 has taken thereby a new position 22 (in FIG. 9 defined by the lowest point of the axis of rotation 10), which is shifted opposite to the direction of motion of the elevator car. At the same time, the blocking roller 7 is pushed along closer to the leg 5, however not yet squeezed between the leg and the guide rail. That the blocking roller 7 has automatically changed its position alongside the guide 11 with the described lowering of the elevator car is a consequence of the superposition of all forces affecting the blocking roller 7. These forces are in particular:

- [0046] (i) the friction between the blocking roller 7 and the guide rail 30;
- [0047] (ii) the friction between the axle 10 of the blocking roller 7 and the guide 11;
- [0048] (iii) the weight of the blocking roller 7; and
- [0049] (iv) the force, which is exercised by the guide 11 due to the effect of the forces of the electromagnet 3 and of the spring 17 on the blocking roller 7.

[0050] If the safety device is as described in a condition of braking readiness, then the blocking roller 7 is in a state of equilibrium, which changes only if the elevator car changes its position. The state of equilibrium is characterised by the fact that with a suitable adjustment of the guide 11 relative to the guide rail 30, an equilibrium of the forces is set in such a manner that only in a case of a lowering of the elevator car and consequently of the safety gear block 2, the lever mechanism 8 is swivelled relative to the guide rail 30 under effect of the force of the spring 17 (with a lowering of the safety device relative to the guide rail 30, the spring 17 lengthens in its lengthwise direction) and during this swivelling motion the blocking roller 7 rolls alongside the guide 11 and at the same time realises a movement relative to the safety gear block 2, this movement being parallel to the guide rail 30 and opposite the direction of motion of the elevator car. In this way, in the state of braking readiness, the blocking roller 7 takes on a new state of equilibrium after each lowering of the elevator car, and such state of equilibrium exhibits a reduced distance from the leg 5. Therefore, the blocking roller 7 passes through a series of states of

equilibrium when lowering the elevator car, until the blocking roller 7 is finally squeezed between the leg 5 and the guide flange 31 and consequently brought into the brake position. The initial tension of the spring 17 and the form of the guide 11 can be co-ordinated for optimization purposes, in order to reliably control the described change of the position of the blocking roller 7 relative to the guide 11 and to the leg 4 in space and time.

[0051] If the elevator car is ready for the continuation of the drive, the electromagnet 3 is current-activated and in this manner the lever mechanism 8 and the blocking roller 7 are moved under effect of the electromagnet 3 and of the gravitational force in such a way that the safety device arrives again into the normal or rest position. The described operating sequence recurs with each “stop”. The resilience of the suspension and of the suspension means of the elevator car and the geometrical proportions of the safety device are thereby co-ordinated in such a way that by loading the elevator car beyond the permissible maximum weight, the blocking roller 7 rolls so far alongside the guide 11 that the blocking roller 7 is squeezed between the inclined leg 5 and the guide rail and the safety gear is shifted into the safety or brake position. In this way, the function of a creeping protection device is realised with the safety device.

[0052] FIG. 10 shows a state in which the safety device is shifted into the safety or brake position. As a result of a relative motion between the safety device and the guide flange 31 of the guide rail 30, whose amount exceeds the useful load range described in connection with FIG. 9, the blocking roller 7 moves along the guide 11 up to a position 23 and is now squeezed between the guide rail and the leg 5. The prevailing frictional proportions in a zone or portion 24 lead to further blocking of the blocking roller 7 in case of a further on appearing relative motion. At the same time, the leg 5 is finally pushed from the blocking roller 7 in a direction (left in FIG. 10) away from the guide rail or respectively the blocking roller 7 is pressed against the guide flange 31. FIG. 11 shows the state for example in case of a 2 mm wear of the guide and brake lining 6 with a strong friction in a zone or portion 25. In the final case, the axle 10 takes an extreme position 26 within the upper range of the guide 11.

[0053] After that the safety device is set into the safety or brake position, the force of the electromagnet 3 is not sufficient any more in order to release the blocking roller 7 from the blocking and to release again the movement of the elevator car, but rather the safety device is to be released in a so-called reversal drive from the safety position, before the elevator car can be moved again downwards.

[0054] The leg 4 has a flat surface, as evident from the figures. The guide and brake lining 6 preferably consists of a material, which preferably exhibits a small coefficient of friction during a small surface pressure and a large coefficient of friction during a large surface pressure. Such materials are for example used in multi-plate clutches or brake linings, well known from the automobile industry point of view. The characteristic of the coefficient of friction that the guide and brake lining 6 exhibits as a result a transition zone is as steep as possible between a range with a low coefficient of friction and a range with a very high coefficient of friction. This enables the utilization of the guide and brake lining 6 for the purpose of braking (in case

of a large contact pressure) and for the purpose of guiding (in case of a small contact pressure) subject to the size of the contact pressure between the guide and brake lining 6 and the guide flange 31. In case of a suitable material choice, it is therefore possible to undertake the provided functional combination, according to the present invention, of a brake safety device and a guiding device into a single multi-functional brake in the shape of the present safety device and to optimize independently from each other their employment as a brake device or as a guiding device for the elevator car.

[0055] As particularly evident from the FIGS. 6 to 12, the guide 11 does not exhibit a straight-lined form for the axle 10 of the roller 7, but it is provided with a middle portion 28, in which it makes first a curve to the right and then a curve to the left. This curvature course can be optimized depending upon each employment. The detailed course of the guide 11 between the lower end 27 and the upper extreme position 26 determines in which measure the blocking roller 7 changes its position relative to the leg 5, if the safety device block 2 is moved around a given measure alongside the guide rail 30. This change is anyhow non-linear as a function of the path alongside the guide rail 30, if the guide 11 exhibits a curved course.

[0056] A peculiarity, which can be brought back to the special course of the curvature of the guide 11, is represented in FIG. 12. The curvature of the guide is at the same time exaggeratedly represented for reasons of clarity. The suspension 12 of the lever mechanism 8 is developed in accordance with FIG. 12 in such a manner that, depending on the operating state, the position of the axle 10 of the blocking roller 7 is changed along the guide 11 at two locations in an at least approximately discontinuous manner. The average lengthwise direction of these grooves or oblong recesses forms preferably an angle with the direction of motion of the elevator car. The guide 11 exhibits, because of its curvilinear course, several locations at which the blocking roller 7 can take, due to its form, a stable position—in the following designated as locking position—if the blocking roller were transported alongside the guide of 11 to one of these locking positions as a result of the mechanisms described before. If the blocking roller 7 has arrived alongside the guide 11 at one of these locking positions, then the lever mechanism 8 takes under the effect of the spring 17 a position in which the guide 11 supports the blocking roller 7 in such a way, that the position of the blocking roller 7 is not substantially influenced through small changes in the deflection of the lever mechanism 8 and is therefore stabilized, in particular against the influence of the weight of the blocking roller 7. The suspension 12 has a lower locking position at the lower end 27 of the guide 11 for the normal operation in the normal state of the safety device in case of current-activated electromagnet 3, a middle locking position within the middle portion 28 or above the middle portion 28 of the guide 11 for the operation as creeping protection device or respectively for the operation of the safety device in the safety position in each case with a not current-activated electromagnet 3, and an upper locking position at an extreme position 26' at the upper end of the guide 11.

[0057] FIG. 13 shows a guide 29, which can be used as a simplified alternative to the guide 11 in the safety device and which exhibits a linear course. In the example according to FIG. 13, the guide 29 does not exhibit any change of direction. In this case, there is no locking position in the

middle portion of the guide 29 for more precisely controlling the position of the blocking roller 7 in case of operation as creeping protection device, in contrast to the example in accordance with FIG. 12.

[0058] FIG. 14 shows an example of the simple guide rail 30 with the guide flange 31, whose thickness is so designed that it fits into the free space 16 (see FIGS. 3 and 5). The guide rail 30 with the guide flange 31 is vertically arranged in the elevator hoistway. Preferably, two guide rails with guide flange are arranged laterally to the elevator car. The elevator car carries in this case two or four safety devices, which stand in interaction with the guide rails. The principle of the present invention is however independent from the thickness or form of this guide flange, provided that at least one guide surface 23 is available.

[0059] The momentary position of the electromagnet 3 and, thus, the condition of the safety device is ascertained in the shown example by two switches 18 and 19, which supervise the position of the holding or tie bolt 13 or respectively the deflection of the lever mechanism 8 and consequently also the operating state of the safety device. The one switch 18 is provided in order to indicate whether the safety device of the elevator installation is in readiness and the other switch 19 (also called “brake—in engagement—switch”) is provided in order to indicate whether the safety device is in the safety position. The brake—in engagement—switch is advantageously integrated into the safety circuit of the elevator.

[0060] In a further embodiment of the invention, the safety device can exhibit a two-dimensional or even a three-dimensional guide for the elevator car at the safety device block. Such an example is represented in FIG. 15. The safety device, in accordance with FIG. 15, exhibits beside a blocking roller 67, which is guided alongside the guide 29, a retaining element 64 with a guide and a brake lining 66 and an abutment 65. A lever mechanism 68 is available, which is pivoted as indicated by a double arrow 61. Through the lever mechanism 68, the blocking roller 67 can be brought into a brake position, and in such brake position, the blocking roller 67 is squeezed between a guide surface 63 of an oblong guide flange 62 installed in the elevator hoistway and the abutment 65. The safety device comprises an operating mechanism (e.g. an electromagnet, or a mechanical, or pressure controlled mean), which is arranged in such a manner that it acts upon the blocking roller 67 by means of this operating mechanism and lever mechanism 68 in order to change the position of the blocking roller 67 with respect of the oblong guide flange 62. The safety device is thereby characterised in accordance with FIG. 15 by an additional guiding device 69 that is provided, whose guide surface is provided with a guide lining 70. The guide lining 70 can be realised in a different way in respect to the guide and brake lining 66, for example as a wear resistant lining with a small coefficient of friction. The latter is meaningful since the guiding device 69 has exclusively a guide function and, in contrast to the retaining element 64, it does not deploy any braking action.

[0061] Furthermore, a suitable safety switch (not shown) can be provided, which measures and/or controls the wear of the guide lining and in case of excessive wear, it stops the elevator.

[0062] The multi-functional safety device is brought into the state of braking readiness with each stop in the regular

driving of the elevator in accordance with the invention, as the current of the electromagnet is switched off. The execution of the safety device allows the lowering of the elevator car in the stopping place in case of loading, without the safety devices getting blocked with the guide rail. By moving the safety devices at each stop, a quasi-automatic checking of the functional efficiency of the multi-functional rail brake takes place.

[0063] There are further conceivable embodiments of the invention, which emanate from modifications of the described safety devices. As a braking element also wedges, ellipsoids or other objects can be considered in place of the described blocking roller, if they are squeezable due to their form. Instead of the described lever mechanism, each mechanism can be considered if with this mechanism the position of the braking element can be changed in a controlled manner, in order to guarantee the described functionality of the safety device. The described electromagnet could be replaced by another operating mechanism, which is suitable for changing, via a controlled force effect, the position of the braking element in such a manner that the safety device changes from the normal state into the state of the braking readiness and inversely. Obviously, the described switches 18 and 19 can be replaced also by a sensor, which is suitable to characterize the momentary position of the braking element or respectively their change in order to seize the momentary operating state of the safety device and as the case may be to derive thereon signals for controlling the elevator. The safety device can also be developed for braking for any direction of motion alongside a guide rail. The abutment must be merely aligned according to the respective suitable purpose relative to the guide rail, in order to enable a squeezing of the braking element. Further on, the braking element must be guided accordingly, in order to enable an automatic transition between the normal position of the safety device in the state of the braking readiness and from there in the respective safety position. In case of suitable guidance of the braking element and a suitable arrangement of the appropriate abutment, a single safety device can be designed on the basis of the present invention for the purpose of braking alongside each of the two directions of motion, which can be realised alongside a guide rail.

[0064] In accordance with the provisions of the patent statutes, the present invention has been described in what is considered to represent its preferred embodiment. However, it should be noted that the invention can be practiced otherwise than as specifically illustrated and described without departing from its spirit or scope.

What is claimed is:

1. A safety device for braking an elevator car in an elevator system, the elevator system including at least one guide rail having at least one guide surface thereon, the safety device comprising:

a retaining element;

an abutment spaced from and fixed relative to said retaining element;

a braking element movably positioned between said retaining element and said abutment and spaced a distance from said retaining element sufficient to accept

a portion of a guide rail therebetween, said braking element having a rest position spaced from a guide surface of the guide rail;

a lever mechanism connected to said braking element for moving said braking element from said rest position to a braking readiness position contacting the guide surface of the guide rail whereby when said safety device is mounted on the elevator car and said braking element is in said braking readiness position, downward movement of the elevator car causes said braking element be squeezed between the guide surface of the guide rail and said abutment for braking the elevator car; and

an operating mechanism connected to said lever mechanism for selectively moving said braking element between said rest position and said braking readiness position.

2. The safety device according to claim 1 wherein said braking element is a blocking roller.

3. The safety device according to claim 1 wherein said abutment is angled relative to said retaining element whereby an interspace between said retaining element and said abutment narrows opposite a predetermined direction of motion of the elevator car.

4. The safety device according to claim 1 wherein said lever mechanism swivels around an axle.

5. The safety device according to claim 1 wherein a position of said braking element is changeable along a guide of said lever mechanism.

6. The safety device according to claim 5 wherein said guide is formed by a groove or an oblong recess in a suspension of said blocking roller.

7. The safety device according to claim 5 said guide is shaped to hold said braking element in said rest position.

8. The safety device according to claim 1 wherein said operating mechanism applies a force to said braking element for bringing said braking element into contact with the guide surface and keeping said braking element in a state of equilibrium whereby during a movement of the elevator car, said braking element is moved automatically relative to said abutment and opposite to the direction of motion of the elevator car.

9. The safety device according to claim 1 wherein said operating mechanism includes an electromagnet activated by electrical current to act upon said lever mechanism to maintain said braking element in said rest position away from the guide surface.

10. The safety device according to claim 9 wherein said electromagnet includes a bolt connected to said lever mechanism and a spring acting on said bolt, whereby when said electromagnet is activated by electrical current, said bolt is moved by a magnetic field to maintain said braking element in said rest position against a force applied by said spring, and when said electromagnet is not activated, said spring moves said braking element toward said braking readiness position.

11. The safety device according to claim 10 wherein said force applied by said spring is a preload on said braking element and when said electromagnet is not activated, said braking element moves automatically with a movement of the elevator car relative to said abutment and opposite to the direction of motion of the elevator car under said preload.

12. The safety device according to claim 1 wherein the guide surface is one guide surface of the guide rail and said

retaining element is a first guiding element for guiding the elevator car alongside another guide surface of the guide rail.

13. The safety device according to claim 12 including a second guiding element spaced a distance from said first guiding element for guiding the elevator car alongside the one guide surface.

14. The safety device according to claim 13 wherein said retaining element and said second guiding element form parts of a safety device block.

15. The safety device according to claim 1 wherein said retaining element and said abutment are formed as legs of a U-shaped safety device block attached to a base and an interspace between said abutment leg and the guide surface is narrowed opposite the direction of motion of the elevator car.

16. The safety device according to claim 1 wherein said retaining element has a guide and brake lining attached thereto, said guide and brake lining being made of a material that exhibits a small coefficient of friction in response to a small surface pressure and a large coefficient of friction in response to a large surface pressure.

17. A safety device for braking an elevator car in an elevator system, the elevator system including at least one guide rail having at least one guide surface thereon, the safety device comprising:

a first leg having a guide and brake lining attached thereto;
a second leg spaced from and fixed relative to said first leg;

a blocking roller movably positioned between said first leg and said second leg and spaced a distance from said first leg sufficient to accept a portion of a guide rail therebetween, said blocking roller having a rest position spaced from a guide surface of the guide rail;

a lever mechanism connected to said blocking roller for moving said blocking roller from said rest position to a braking readiness position contacting the guide surface of the guide rail whereby when said safety device is mounted on the elevator car and said blocking roller is in said braking readiness position, downward movement of the elevator car causes said blocking roller be squeezed between the guide surface of the guide rail and said second leg for braking the elevator car; and

an operating mechanism connected to said lever mechanism for selectively moving said blocking roller between said rest position and said braking readiness position.

18. The safety device according to claim 17 said first leg and said second leg are formed as legs of a U-shaped safety device block attached to a base and an interspace between said second leg and the guide surface is narrowed opposite the direction of motion of the elevator car.

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