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

(11) **EP 3 789 334 B1**

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention of the grant of the patent:
28.06.2023 Bulletin 2023/26

(21) Application number: **20382791.0**

(22) Date of filing: **07.09.2020**

(51) International Patent Classification (IPC):
B66B 5/20 *(2006.01)*

(52) Cooperative Patent Classification (CPC):
B66B 5/20

(54) BRAKING DEVICE FOR ELEVATOR APPARATUS AND ASSOCIATED BRAKING METHOD

BREMSVORRICHTUNG FÜR AUFZUGSEINRICHTUNG UND ZUGEHÖRIGES BREMSVERFAHREN

DISPOSITIF DE FREINAGE POUR APPAREIL ÉLÉVATEUR ET PROCÉDÉ DE FREINAGE ASSOCIÉ

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR

(30) Priority: **06.09.2019 ES 201930780**

(43) Date of publication of application:
10.03.2021 Bulletin 2021/10

(73) Proprietor: **ORONA S. COOP.**
20120 Hernani (Guipúzcoa) (ES)

(72) Inventors:
- **ALONSO RAMILA, Raúl**
  20120 Hernani (Guipúzcoa) (ES)
- **COCHO ERAUSKIN, Endika**
  20120 Hernani (Guipúzcoa) (ES)

(74) Representative: **Herrero & Asociados, S.L.**
Cedaceros, 1
28014 Madrid (ES)

(56) References cited:
EP-A1- 3 153 451 **US-A1- 2007 007 083**

EP 3 789 334 B1

Description

OBJECT OF THE INVENTION

[0001] The present invention relates to the technical field of elevator safety devices, more specifically to the one related to braking or holding devices that act between the cabin and the elements or fixed surfaces for guiding the elevator shaft by means of linearly movable wedges, and refers in particular to an electromechanical actuating device for activating the parachute of an elevator apparatus, such as an elevator, in emergency situations. The invention also relates to a method for braking elevator apparatuses associated with the device.

BACKGROUND OF THE INVENTION

[0002] Safety systems commonly used in elevators generally consist of emergency braking devices that are used to stop an elevator cabin in cases where it reaches excessively high speeds, which can occur, for example, due to defects in control or control activation of its brake, due to wire breaks and unhooking.

[0003] These emergency braking devices are also used to prevent uncontrolled movements of the cabin, such as, for example, sliding out of the stop position. They can also be activated to lock the cabin in a certain position, such as, for example, to temporarily secure the safety space during the performance of inspection or maintenance operations of the elevator.

[0004] Safety electronic is increasingly used in the technical field of elevator safety systems, and electronic safety systems can be classified into the active type, which require a power supply for positive actuation of the safety mechanism, and into the passive type, which require the power supply to keep the security system in an operating holding state.

[0005] Although passive security systems offer an increased functionality, they have the great disadvantage of requiring a continuous supply of power to be operational, involving increased power expenditure, thus increasing the operating costs of the apparatus. Furthermore, such passive systems typically have larger components due to high power requirements during operation, which adversely affects the overall size, weight, and efficiency of the apparatus.

[0006] One of the key elements of the safety systems is the actuator installed in the elevator cabin, also referred to as the traveling assembly. This actuator allows a safe operation in the event of any risk event detected by the positioning system and must ensure braking that will be carried out in the traditional way, in the manner of conventional wedging. The main difference is in the braking activation, which is electromechanical, rather than mechanical, by a speed limiter.

[0007] Various devices for elevator safety braking are known in the current state of the art. For example, the PCT patent with publication number WO2013052059 describes a braking system that includes two or more braking surfaces located in an elevator cabin and that can frictionally engage a rail. One or more actuators are located in the elevator cabin and are operatively connected to a braking surface. The actuators are configured to drive engagement and disengagement of the braking surface with the rail to stop and hold the elevator cabin during operation. Furthermore, one or more braking guides are located in the elevator cabin to maintain a selected distance between the two or more braking surfaces and the rail.

[0008] Patent document with publication number EP1902993 discloses an elevator braking system comprising a braking member that guides a roller, wherein the member is designed as a guide that can be moved relative to a guide rail and a pressure body. The guide directly cooperates with the roller and is formed in such a way that it moves to a pole-distant position during de-energization of electromagnets for the guide rail, so that the roller contacts the guide rail and moves into a wedge space, and temporarily brings the guide device from the pole-distant position to a position near to the pole.

[0009] For its part, European patent EP3147248 relates to a braking system for an elevator structure guided along a guide rail. The braking system includes a braking member having a braking surface configured to frictionally engage the guide rail, the braking member being movable between a braking position and a non-braking position. Further included is a braking member driving mechanism operatively coupled thereto and configured to drive it from the non-braking position to the braking position, such that the driving mechanism remains coupled to the braking member in the braking position for controlling the braking force applied on the elevator structure by frictional engagement between the guide rail and the braking member.

[0010] In that same sense, the international PCT application with publication number WO2017087978 describes a selectively operable magnetic braking system comprising a safety brake adapted to stop movement when moving from a non-braking state to a braking state, and a magnetic brake configured to move between an engaged position and an unengaged position. The magnetic brake, when in the engaged position, moves the safety brake from the non-braking state to the braking state, and an electromagnetic component configured to hold the magnetic brake with holding power in the unengaged position.

[0011] Finally, the Spanish patent with publication number ES2622333 relates to an elevator with a cabin guided on guide rails and with a safety brake arranged in the cabin and designed to exert a braking force on the guide if a safety criterion is not met. The safety brake comprises a brake box provided with a wedge-shaped opening into which at least a part of a guide rail can be inserted; a brake body capable of being inserted into the opening between a surface of the brake housing delimiting the wedge-shaped opening and a guide surface of

the guide rail; an actuating mechanism by which an actuating force can be transmitted on the brake body and by which the brake body can be pressed on the delimiting surface and the guide surface; and a release mechanism that is connected to the brake body and holds it in the rest position against the activation force. The invention is characterized in that the release mechanism has at least one articulated arm that can be placed in an extended position and a bent position. US2007/007083 discloses a braking device for an elevator apparatus, according to the preamble of claim 1.

[0012] In this case, a system is described with an activation mechanism that places the braking element between guide and block, and an independent deactivation mechanism with an articulated arm for reassembling that acts on the first activation mechanism. This articulated mechanism also reassembles in its extended position.

DESCRIPTION OF THE INVENTION

[0013] The object of the invention consists of a braking device for elevator apparatus, which comprises, among other elements, an articulated actuating mechanism, electromechanically actuated and configured to cause emergency braking, by wedging against the movement guides, when a determination element detects an abnormal movement of the elevator cabin, as in claim 1. The object of the invention also consists of a method of braking elevator apparatus according to claim 9.

[0014] Within the usual wedging sequence, the device is specially designed to work with systems that include a sensor for the absolute positioning of the cabin in the shaft. Electromechanical wedging causes braking based on a signal received from said sensor. There are multiple ways to cause a wedging braking, but this device proposes to do it in a very specific way.

[0015] The device described herein comprises an electromagnet, the actuation of which causes the movement of an articulated actuating mechanism. The articulated actuating mechanism comprises a first sector, linked to the linear electromagnet, and a second sector, linked to an interlocking roller, and on which a friction element is located that can perpendicularly contact the guide, in order to obtain a safe position of the cabin on said guide, without causing roller wedging.

[0016] If the cabin, once in a safe position, moves with respect to the guide, the contact of the friction element on the guide generates a friction force, essentially vertical, on the second sector of the articulated mechanism, which drags it to the roller to which it is linked until it attaches to or engages the guide, thus producing the conventional wedging that immobilizes the cabin on the guide.

[0017] The essentially vertical movement of the electromagnet, parallel to the guide, is transmitted to the friction element with the intermediation of the articulated mechanism, which transforms it into a horizontal movement of the second sector of said articulated mechanism.

[0018] The particularity of the device resides fundamentally in the fact that the actuating mechanism has the advantage of being reversible and does not require the wedging to immobilize the cabin to be reassembled. This design of the actuator allows a rest position, with the friction element in contact with the guide, the actuator being in the active position without producing a total wedging and the system can return to the initial position.

[0019] The fact that it can be reassembled without wedging occurring is very interesting, because it allows the electromagnet to only be powered when the elevator has to move. This significantly reduces the necessary power consumption, obtaining a better energy rating for the device and producing a lower environmental impact.

DESCRIPTION OF THE DRAWINGS

[0020] To complement the description that is being made and in order to help a better understanding of the features of the invention, according to a preferred example of a practical embodiment thereof, a set of drawings is attached as an integral part of said description wherein, for illustrative and non-limiting purposes, the following has been represented:

Figure 1.- Shows a front perspective view of the braking device, in which its main constituent elements can be seen.

Figure 2.- Shows a front view of the device in rest position.

Figure 3.- Shows a view of a first stage of the operation sequence of the device, in which it is in an inactive position and the elevator apparatus is operating normally.

Figure 4.- Shows a view of a second stage of the operation sequence of the device, at the moment in which there is a power cut of the elevator apparatus.

Figure 5.- Shows a view of a third stage of the operation sequence of the device, in which the braking element moves along the central slot.

Figure 6.- Shows a view of a fourth stage of the operation sequence of the device, in which the braking element engages the guide for immobilization of the cabin.

PREFERRED EMBODIMENT OF THE INVENTION

[0021] A detailed explanation of a preferred embodiment of the object of the present invention is provided below, with the aid of the aforementioned figures.

[0022] The braking device for elevator apparatus described herein is designed to perform an emergency braking in a cabin that moves longitudinally along essen-

tially vertical guides (1), holding it on said guides (1) to catch it and avoid uncontrolled movements thereof, or even falls due to the action of gravity.

[0023] For this, this braking device, shown schematically in Figure 1, is basically made up of:

- a wedging block (2), integrally attachable to a cabin chassis,
- an activation electromagnet (3), and
- an articulated actuating mechanism (4).

[0024] The wedging block (2) in turn comprises a central slot (5), intended to house the guide (1), a lateral catching element (6), movable perpendicular to the central slot (5), and a lateral braking element (7), movable perpendicular to the central slot (5) in the opposite direction to that of the catching element (6) and attachable to the guide (1) for braking and immobilizing the cabin.

[0025] In the preferred embodiment described herein, the catching element (6) consists of a brake shoe, and further incorporates elastic elements (8) for progressive braking, while the braking element (7) consists of a roller provided with a central toothed friction surface and movable along a guide rail (9), having curved geometry and located in the wedging block (2).

[0026] Said guide rail (9), shown in the attached figures, has, consecutively, a central sector (10) remote from the central slot (5) wherein the guide (1) is housed, an upper sector (11), having a curved geometry of progressive approach towards the central slot (5), and an upper housing (12).

[0027] The activation electromagnet (3) in this preferred embodiment is of the linear type and vertically movable in a direction essentially parallel to that of the guides (1), as observed in the operation sequence shown in Figures 3 to 6. This electromagnet (3) is normally powered, while the elevator apparatus moves longitudinally along the guides (1), in the arrangement shown in Figure 3.

[0028] The electromagnet (3) used in this preferred embodiment is single-acting, so that the stroke movement from the initial to the final position is carried out by the action of electromagnetic forces, and the return to the initial resting position is due to outside forces.

[0029] For its part, the articulated actuating mechanism (4) is interposed between the electromagnet (3) and the braking element (7), for transmission and transformation of the vertical movement of the electromagnet (3) into a movement perpendicular to the central slot (5) and, therefore, to the guide (1). According to the invention, this actuating mechanism (4) comprises, a first arm (13), integrally linked to the electromagnet (3), a second arm (14), pivotally linked to the first arm (13) through a first joint (15), and a third arm (16), pivotally linked by a first end (17) to the second arm (14) through a second joint (18), and linked in turn to the braking element (7), which it moves.

[0030] The third arm (16) also has a second end (19), which comprises an integral friction element (20), intended to contact the guide (1), as illustrated in Figures 4 to 6 of the operation sequence.

[0031] In this preferred embodiment, the arms (13, 14, 16) are corresponding plates, and in the specific case of the third arm (16) it is an oblong plate that has a longitudinal groove (21) along which an axis of the toothed roller that forms the braking element (7) moves longitudinally. In figure 2 it can also be seen that the device incorporates an elastic element (22), in this case a spring, to keep the braking element (7) away from the guide (1) in the rest position.

[0032] It is foreseen that the friction element (20) consists of a machining performed at the second end (19) of the third arm (16) itself. Likewise, the option is provided for said friction element (20) to incorporate magnetic means, such as magnets, to ensure correct engagement with the guides (1).

[0033] As can be seen in the attached figures, the first arm (13) maintains an essentially vertical arrangement, parallel to the guides (1), while the third arm (16) has, at rest, an essentially horizontal arrangement, perpendicular to the guide (1), which varies towards an oblique arrangement when pivoting through the second joint (18) to activate braking. The second arm (14), both at rest and in the active position, always maintains an oblique arrangement with respect to the other two arms that make up the actuating mechanism (4).

[0034] In figure 3 the device is observed in its inactive position and the elevator apparatus is operating normally and the electromagnet (3) is powered. The actuating mechanism (4) keeps the braking element (7) and the friction element (20) away from the guide (1).

[0035] Figure 4 illustrates a position in which the elevator apparatus is in a rest position, without use and in an energy saving mode that causes the electromagnet (3) to stop being powered. This cut in the supply of the electromagnet (3) activates the actuating mechanism (4), which makes the friction element (20) move and come into contact with the guide (1), without causing any movement in the element braking device (7), so that the braking device keeps the elevator cabin secured against the guide (1), but without the wedging block (2) having come into operation.

[0036] It is necessary to indicate at this point that in the event that a cabin stop wedging has occurred, to release the wedging block (2), that is, to separate the braking element (7) with respect to the guide (1) and the catching element (6) to allow the cabin to move again, the temporary inactivation of the elevator apparatus and the intervention of a specialized technical team is necessary.

[0037] On the contrary, the simple retention of the cabin in a safe position with respect to the guide (1), by engaging the friction element (20) on it, is automatically reversible when feedback of the electromagnet (3) occurs when the elevator apparatus is back in operation, without the need for external intervention.

[0038] Figures 5 and 6 show the operation of the device in the event of an emergency braking of the cabin. In this

case, once the friction element (20) is in contact with the guide (1), if an unwanted movement of this cabin occurs, a friction force is generated between the friction element (20) and the guide (1) that causes the movement of the third arm (16) to which it is jointly linked.

[0039] In turn, the movement of the third arm (16) drags the braking element (7), which moves along the guide rail (9), in a direction essentially parallel to the guide (1), until it contacts said guide (1) due to the geometry of the upper sector (11), at which time a wedging occurs with the catching element (6), thus immobilizing the cabin against the guide (1).

[0040] The method for braking an elevator apparatus equipped with the device described above begins with an interruption in the power supply of the electromagnet (3), either due to a sudden cut in the power supply or due to the elevator apparatus entering in the rest position or stand-by, in order to reduce energy consumption.

[0041] After said interruption, the braking method comprises the following sequence of operating steps:

- activation of the actuating mechanism (4) by the electromagnet (3),
- movement and approach of the friction element (20) until contacting the guide (1) for safe positioning of the cabin on said guide (1), without activation of the wedging block (2).

[0042] Once in the cabin secured position on the guide (1), in case of restoration of the power supply of the electromagnet (3), for example, when the elevator is no longer in the rest position to start operation, this electromagnet (3) shall act on the actuating mechanism (4) which shall move the friction element (20) away from the guide (1), again allowing a movement of the cabin.

[0043] On the contrary, in the event that in the cabin secured position on the guide (1), and with the electromagnet (3) not powered, a movement of the guide (1) with respect to the cabin is detected, the sequence that will lead to conventional wedging is started, which comprises the following stages:

- friction of the friction element (20) on the guide (1),
- drag of the braking element (7), and approach until contacting the guide (1),
- separation of the friction element (20) from the guide (1), and
- wedging by coupling the braking element (1) with the guide (1) and the catching element (6), to immobilize the cabin against the guide (1).

Claims

1. Braking device for elevator apparatus, for emergency braking of a cabin that can be moved longitudinally by vertical guides (1), comprising:

- a wedging block (2) attachable to a chassis of the cabin, comprising in turn:

  - a central slot (5) to house the guide (1),
  - a catching element (6), movable perpendicular to the central slot (5), and
  - a braking element (7) movable with respect to the central slot (5), and attachable to the guide (1) and to the catching element (6) to immobilize the cabin,

- an activation electromagnet (3), and
- an articulated actuating mechanism (4) comprising a first sector linked to the electromagnet (3) and a second sector linked to the braking element (7), wherein the actuating mechanism (4) comprises a friction element (20), located in the second sector and capable of engaging the guide (1) for fixing a safe position of the cabin on the guide (1), such that when the actuating mechanism (4) engages the friction element (20) with the guide (1), and a relative movement of the guide (1) with respect to the cabin occurs, said actuating mechanism (4) moves the braking element (7) in the same direction until it engages the guide (1), **characterised in that** the actuating mechanism further (4) comprises:

  - a first arm (13), integrally linked to the electromagnet (3),
  - a second arm (14), pivotally linked to the first arm (13) through a first joint (15), and
  - a third arm (16), pivotally linked by a first end (17) to the second arm (14) through a second joint (18), and linked to the braking element (7), which it moves, and

  wherein the friction element (20) is integrally linked to a second end (19) of the third arm (16);

the friction element (20) is a machining located at the second end (19) of the third arm (16).

2. Braking device according to claim 1, wherein the friction element (20) incorporates magnetic means.

3. Braking device according to claim 1 wherein additionally comprises an elastic retaining element (22) linked to the braking element (7).

4. Braking device according to any of the preceding claims wherein the braking element (7) is a toothed roller.

5. Braking device according to claim 4 wherein the third arm (16) is an oblong plate having a longitudinal groove (21) through which the axis of the toothed roller moves.

6. Braking device according to any of the preceding claims, **characterized in that** the catching element (6) is a brake shoe.

7. Braking device according to claim 4, wherein the wedging block (2) comprises a guide rail (9) having curved geometry for movement of an axis of the toothed roller.

8. Braking device according to claim 7, wherein the guide rail (9) comprises a central sector (10) wherein the guide (1) is housed, an upper sector (11) having a curved geometry of progressive approach towards the central slot (5), and an upper housing (12).

9. Method of braking elevator apparatus, which uses the braking device described in any of claims 1-8, **characterized in that** it comprises the following operation sequence:

- interruption in the power supply of the electromagnet (3),
- activation of the actuating mechanism (4) by the electromagnet (3), and
- movement and approach of the friction element (20), by the actuating mechanism (4) until contacting the guide (1), for safe positioning of the cabin on said guide (1), without activation of the wedging block (2).

10. Elevator apparatus **characterized in that** it comprises a braking device according to any of claims 1-8.

Patentansprüche

1. Bremsvorrichtung für eine Aufzugseinrichtung zum Notbremsen einer Kabine, die von vertikalen Führungen (1) längs bewegt werden kann, umfassend:

- einen Klemmblock (2), der an einem Chassis der Kabine angebracht werden kann, wiederum umfassend:

  - einen mittigen Spalt (5) zur Aufnahme der Führung (1),
  - ein Fangelement (6), das senkrecht zu dem mittigen Spalt (5) bewegt werden kann, und
  - ein Bremselement (7), das in Bezug auf den mittigen Spalt (5) bewegt und an der Führung (1) und an dem Fangelement (6) zur Immobilisierung der Kabine angebracht werden kann,

- einen Aktivierungselektromagneten (3) und
- einen gelenkigen Betätigungsmechanismus (4), umfassend einen ersten Sektor, der an den Elektromagneten (3) angeschlossen ist, und einen zweiten Sektor, der an das Bremselement (7) angeschlossen ist, wobei der Betätigungsmechanismus (4) ein Reibungselement (20) umfasst, das sich im zweiten Sektor befindet und in die Führung (1) eingreifen kann, um eine sichere Position der Kabine an der Führung (1) zu fixieren, so dass bei einem Eingriff des Betätigungsmechanismus (4) in das Reibungselement (20) mit der Führung (1) und einer Relativbewegung der Führung (1) in Bezug auf die Kabine der Betätigungsmechanismus (4) das Bremselement (7) in dieselbe Richtung bewegt, bis es in die Führung (1) eingreift, **dadurch gekennzeichnet, dass**

der Betätigungsmechanismus (4) ferner:

- einen ersten Arm (13), der integral an den Elektromagneten (3) angeschlossen ist,
- einen zweiten Arm (14), der durch ein erstes Gelenk (15) schwenkbar an den ersten Arm (13) angeschlossen ist, und
- einen dritten Arm (16), der durch ein zweites Gelenk (18) mittels eines ersten Endes (17) schwenkbar an den zweiten Arm (14) und an das Bremselement (7), das er bewegt, angeschlossen ist, umfasst und

wobei das Reibungselement (20) integral an ein zweites Ende (19) des dritten Arms (16) angeschlossen ist;
das Reibungselement (20) eine Vorrichtung ist, die sich am zweiten Ende (19) des dritten Arms (16) befindet.

2. Bremsvorrichtung nach Anspruch 1, wobei das Reibungselement (20) magnetische Mittel enthält.

3. Bremsvorrichtung nach Anspruch 1, wobei sie zusätzlich ein elastisches Halteelement (22), das an das Bremselement (7) angeschlossen ist, umfasst.

4. Bremsvorrichtung nach einem der vorstehenden Ansprüche, wobei das Bremselement (7) eine Stachelwalze ist.

5. Bremsvorrichtung nach Anspruch 4, wobei der dritte Arm (16) eine längliche Platte mit einer Längsnut (21) ist, durch die sich die Achse der Stachelwalze bewegt.

6. Bremsvorrichtung nach einem der vorstehenden Ansprüche, **dadurch gekennzeichnet, dass** das Fangelement (6) ein Bremsschuh ist.

7. Bremsvorrichtung nach Anspruch 4, wobei der Klemmblock (2) eine Führungsschiene (9) mit gebogener Geometrie zum Bewegen einer Achse der Sta-

chelwalze umfasst.

8. Bremsvorrichtung nach Anspruch 7, wobei die Führungsschiene (9) einen mittigen Sektor (10), in dem die Führung (1) aufgenommen ist, einen oberen Sektor (11) mit einer gebogenen Geometrie mit stufenweiser Annäherung in Richtung des mittigen Spalts (5) und ein oberes Gehäuse (12) umfasst.

9. Verfahren zum Bremsen einer Aufzugseinrichtung, welches die in einem der Ansprüche 1-8 beschriebene Bremsvorrichtung nutzt, **dadurch gekennzeichnet, dass** es die folgende Betriebsabfolge umfasst:

- Unterbrechung der Stromzufuhr des Elektromagneten (3),
- Aktivierung des Betätigungsmechanismus (4) durch den Elektromagneten (3) und
- Bewegen und Annähern des Reibungselements (20) durch den Betätigungsmechanismus (4), bis es die Führung (1) kontaktiert, damit die Kabine sicher an der Führung (1) positioniert wird, ohne dass der Klemmblock (2) aktiviert wird.

10. Aufzugseinrichtung, **dadurch gekennzeichnet, dass** sie eine Bremsvorrichtung nach einem der Ansprüche 1-8 umfasst.

Revendications

1. Dispositif de freinage pour appareil élévateur, pour le freinage d'urgence d'une cabine qui peut être déplacée longitudinalement par des guides verticaux (1), comprenant :

- un bloc de calage (2) pouvant être fixé à un châssis de la cabine, comprenant à son tour :
  - une fente centrale (5) pour loger le guide (1),
  - un élément d'accrochage (6), mobile perpendiculairement à la fente centrale (5), et
  - un élément de freinage (7) mobile par rapport à la fente centrale (5), et pouvant être fixé au guide (1) et à l'élément d'accrochage (6) afin d'immobiliser la cabine,
- un électroaimant d'activation (3), et
- un mécanisme d'actionnement articulé (4) comprenant un premier secteur relié à l'électroaimant (3) et un second secteur relié à l'élément de freinage (7), dans lequel le mécanisme d'actionnement (4) comprend un élément de friction (20) positionné dans le second secteur et capable de mettre en prise le guide (1) pour fixer une position de sécurité de la cabine sur le guide (1), de sorte que lorsque le mécanisme d'actionnement (4) met en prise l'élément de friction (20) avec le guide (1) et qu'un déplacement relatif du guide (1) par rapport à la cabine se produit, ledit mécanisme d'actionnement (4) déplace l'élément de freinage (7) dans la même direction jusqu'à ce qu'il mette en prise le guide (1), **caractérisé en ce que** le mécanisme d'actionnement (4) comprend en outre :
  - un premier bras (13) relié, de manière solidaire, à l'électroaimant (3),
  - un deuxième bras (14) relié, de manière pivotante, au premier bras (13) par le biais d'une première articulation (15), et
  - un troisième bras (16) relié, de manière pivotante, par une première extrémité (17), au deuxième bras (14) par le biais d'une seconde articulation (18) et relié à l'élément de freinage (7) qu'il déplace, et
  - dans lequel l'élément de friction (20) est relié, de manière solidaire, à une seconde extrémité (19) du troisième bras (16) ;
  - l'élément de friction (20) est un usinage positionné au niveau de la seconde extrémité (19) du troisième bras (16).

2. Dispositif de freinage selon la revendication 1, dans lequel l'élément de friction (20) comprend des moyens magnétiques.

3. Dispositif de freinage selon la revendication 1, dans lequel il comprend de plus un élément de retenue élastique (22) relié à l'élément de freinage (7).

4. Dispositif de freinage selon l'une quelconque des revendications précédentes, dans lequel l'élément de freinage (7) est un rouleau denté.

5. Dispositif de freinage selon la revendication 4, dans lequel le troisième bras (16) est une plaque oblongue ayant une rainure longitudinale (21) à travers laquelle l'axe du rouleau denté se déplace.

6. Dispositif de freinage selon l'une quelconque des revendications précédentes, **caractérisé en ce que** l'élément d'accrochage (6) est un segment de frein.

7. Dispositif de freinage selon la revendication 4, dans lequel le bloc de calage (2) comprend un rail de guidage (9) ayant une géométrie courbe pour le déplacement d'un axe du rouleau denté.

8. Dispositif de freinage selon la revendication 7, dans lequel le rail de guidage (9) comprend un secteur central (10), dans lequel le guide (1) est logé, un secteur supérieur (11) ayant une géométrie courbe

d'approche progressive vers la fente centrale (5), et un boîtier supérieur (12).

9. Procédé de freinage d'appareil élévateur, qui utilise le dispositif de freinage selon l'une quelconque des revendications 1 à 8, **caractérisé en ce qu'**il comprend la séquence d'opérations suivante :

- interruption de l'alimentation électrique de l'électroaimant (3),
- activation du mécanisme d'actionnement (4) par l'électroaimant (3), et
- déplacement et approche de l'élément de friction (20), par le mécanisme d'actionnement (4) jusqu'au contact avec le guide (1), pour le positionnement en toute sécurité de la cabine sur ledit guide (1), sans activation du bloc de calage (2).

10. Appareil élévateur **caractérisé en ce qu'**il comprend un dispositif de freinage selon l'une quelconque des revendications 1 à 8.

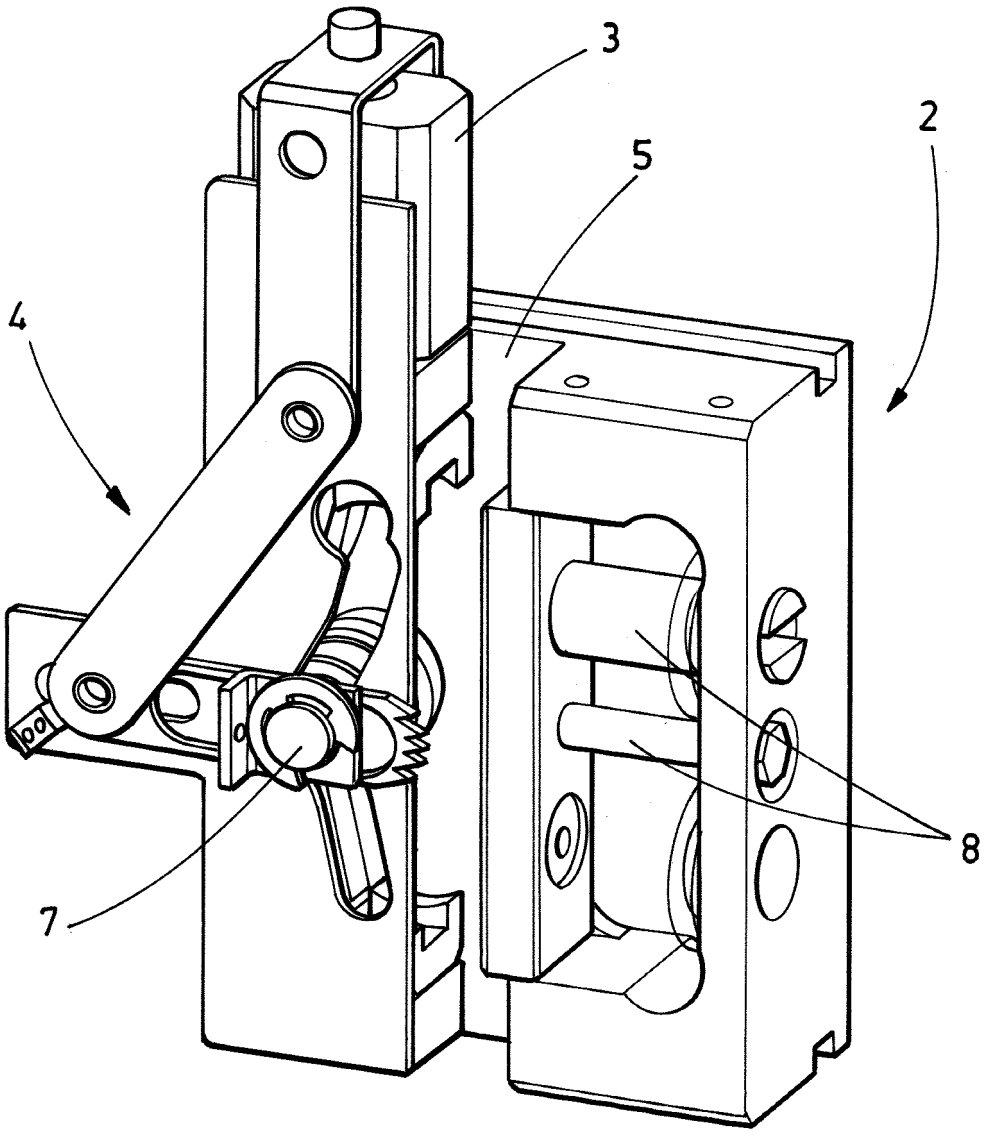

FIG.1

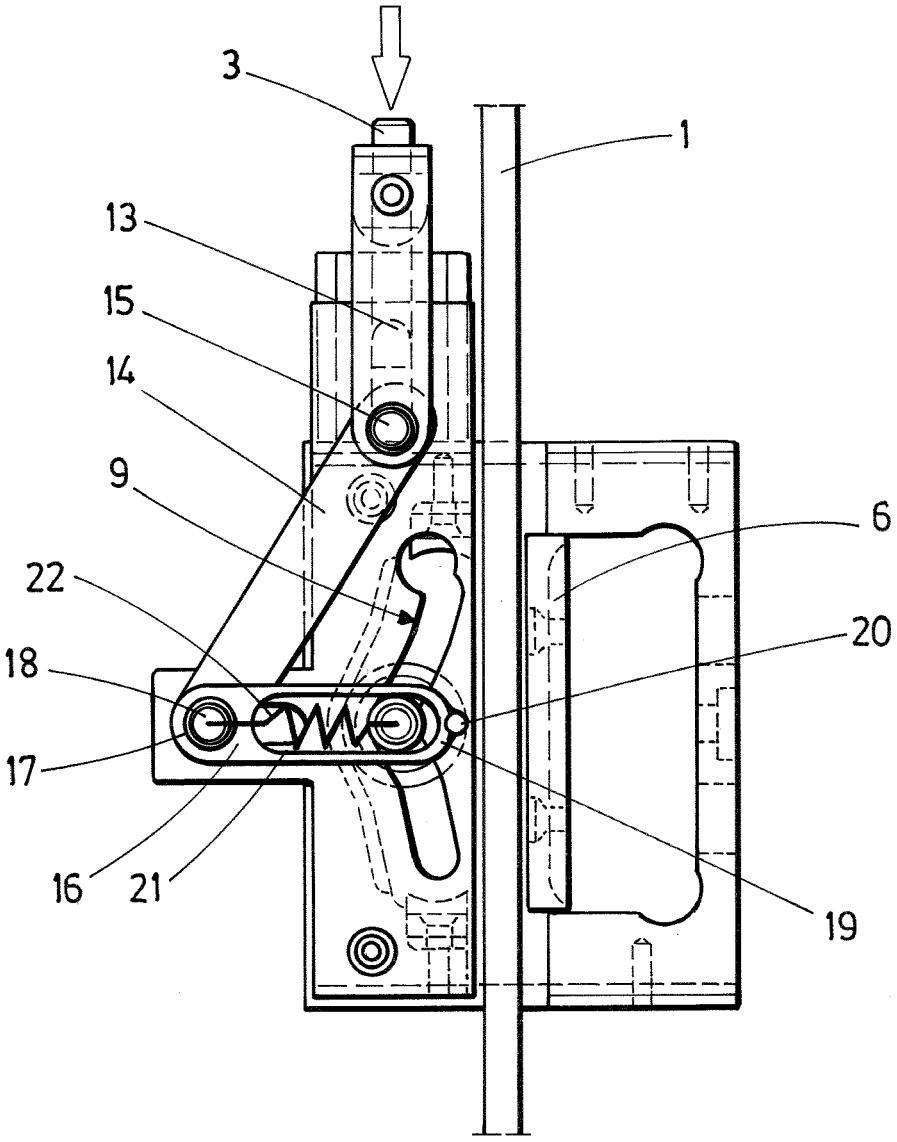

FIG.2

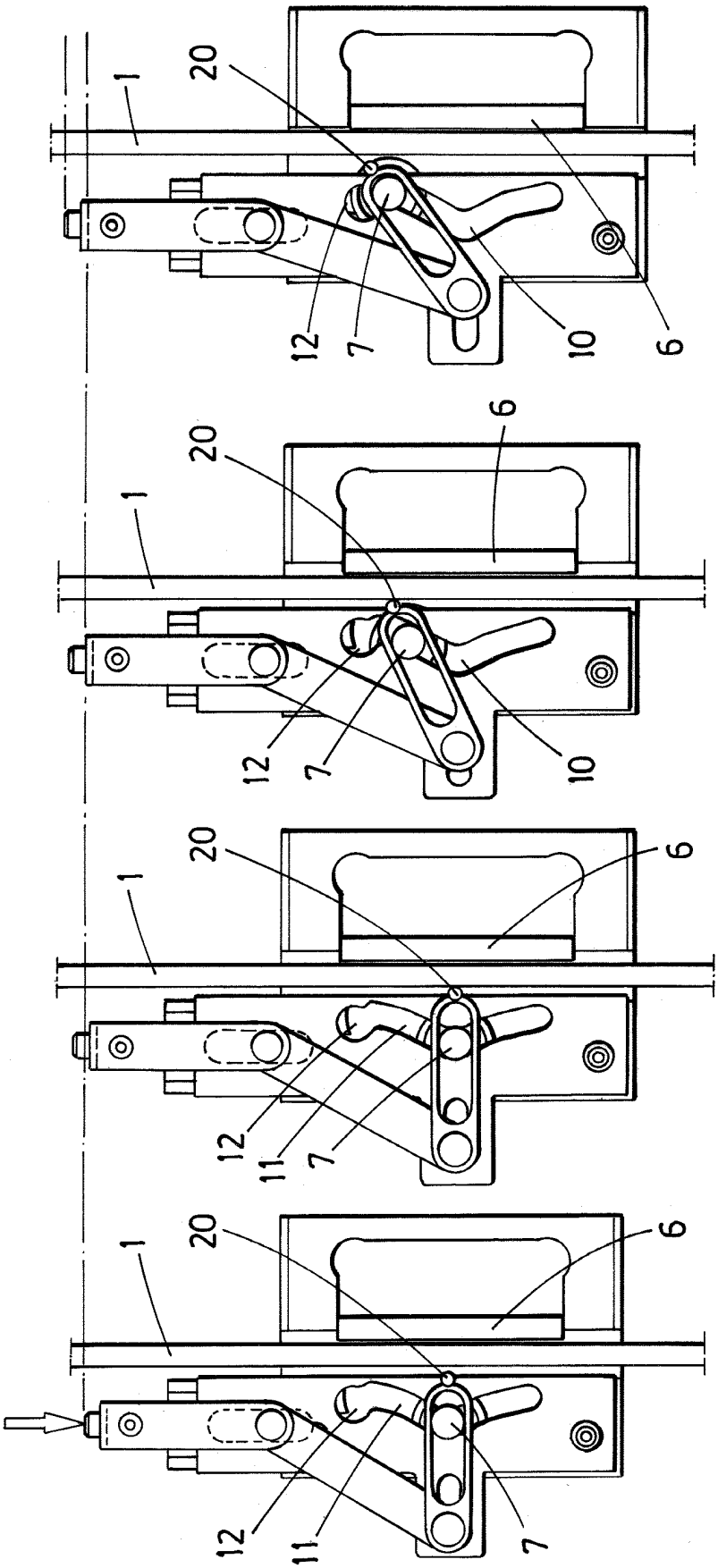

FIG.6

FIG.5

FIG.4

FIG.3

REFERENCES CITED IN THE DESCRIPTION

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

Patent documents cited in the description

- WO 2013052059 A **[0007]**
- EP 1902993 A **[0008]**
- EP 3147248 A **[0009]**
- WO 2017087978 A **[0010]**
- ES 2622333 **[0011]**
- US 2007007083 A **[0011]**