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(71) Applicant: **ORONA, S. COOP.**
20120 Hernani (Guipuzcoa) (ES)

(72) Inventors:
- **ALONSO RAMILA, Raúl**
  20120 Hernani (Guipúzcoa) (ES)
- **GARCIA ZALACAIN, Oier**
  20120 Hernani (Guipúzcoa) (ES)

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

(54) ELECTROMECHANICAL SAFETY GEAR DEVICE FOR ELEVATOR APPARATUS

(57) Electromechanical safety gear device for elevator apparatus, that can be electronically activated for the emergency braking of a car longitudinally movable along a guide (1), the device comprising an engagement block integral with the car. The device comprises an activation plate (2) movable with respect to the guide (1) and operable by the activation mechanism, and a guiding element (4) of a braking element (6), movable by a guiding mechanism (3) in a direction parallel to the guide (1). The activation plate (2) additionally comprises a friction element (12) for defining relative positions of the activation plate (2) with respect to the guide (1): a standby position, with the activation plate (2) spaced from the guide (1), an active position, in which the friction element (12) contacts said guide (1), and a braking position.

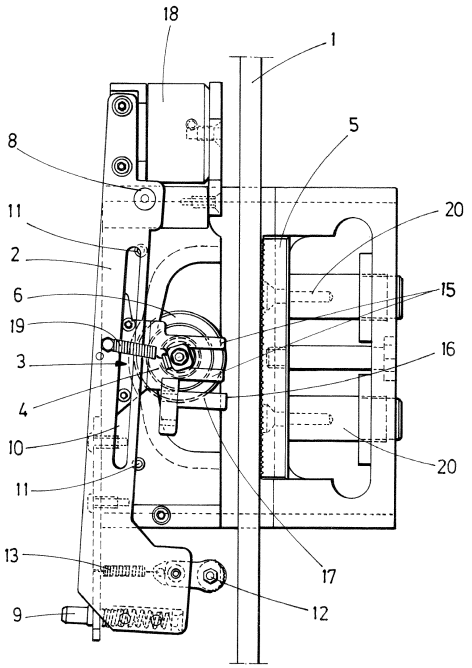

FIG.1

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Description

Object of the Invention

[0001] The present invention is comprised in the technical field of safety devices for elevators, more specifically in the field of braking devices acting between cars or counterweights and guiding surfaces, and relates particularly to an electromechanically-actuated safety gear device for elevator apparatus.

Background of the Invention

[0002] Safety elements commonly used in elevator apparatus include, among others, emergency braking devices which are used for reducing the speed of movement of an elevator car until it comes to a halt in cases in which the elevator car reaches excessively high speeds, which may occur due to defects in brake control or actuation, or to cable breaking and disconnecting, for example.

[0003] Among these emergency braking devices, those known as safety gears prevent the free fall or uncontrolled movement of the car by means of the immobilization thereof on guides along which the car moves. Therefore, a safety gear, also sometimes known as engagement, is in charge of stopping the car by means of a force of friction it causes when acting on the guides of the car, and must be capable of stopping said car at full capacity, keeping it secured on the guides. Conventionally, safety gears are activated by means of a mechanical-type speed limiting element which, in the case of excessive car speed, is locked and causes the activation of said safety gears.

[0004] Moreover, the use of safety electronics in the technical field of elevator safety systems is on the rise, and these electronic safety systems can be classified into active-type systems which require power supply for the positive actuation of the safety mechanism, and passive-type systems which require power supply for keeping the safety system in an operative restraining state.

[0005] Although passive safety elements offer an increased functionality, they have the significant drawback of requiring continuous power supply for restraining same, with the increase in energy expenditure that this entails, thereby increasing the operative costs of the apparatus and negatively affecting its energy rating. Likewise, said passive elements typically have components of very large dimensions due to the high power requirements during operation, adversely affecting the overall size, weight, and efficiency of the apparatus.

[0006] In the specific case of safety gears, there are variants and adaptations prepared for working without a mechanical-type speed limiter, using electronic safety devices instead for detecting emergency situations.

[0007] A first example can be found in European patent with publication number EP1813566 relating to a safety device for an elevator capable of reducing the time period required for stoppage after detection of a speed abnormality. The device comprises a speed limiter activating engagement when a speed abnormality is detected, a rail that moves away from the guide in the downward direction, and a braking element including an attraction element or magnet. When the limiter detects an abnormality, the magnet is attracted to the guide by the limiter, causing the braking element to stop moving downward and to move upward along the rail to cause engagement.

[0008] Another European patent, in this case with publication number EP1902993, describes a braking or arresting device for an elevator car guided in a shaft along guide rails, wherein a roller is the braking element placed between the guide and the block for immobilizing the car. This roller is kept such that it is spaced from the guide as a result of an electromagnet. Furthermore, there is a guiding element which, in the active position, puts the roller in contact with the guide so as to cause engagement, whereas in the non-active position, the electromagnet keeps the guiding element stowed away.

[0009] Finally, patent with publication number EP2651810 discloses a device for actuating and resetting a safety gear of an elevator installation that can be fitted on a braking surface or a guide rail. The device includes a pressure accumulator, preferably a compression spring, an actuator, a restraining device, and a remotely actuable resetting device configured for tensing the pressure accumulator in a standby position. The actuator can be attached to the safety gear element and is attached to the pressure accumulator, and the actuator is configured for, on one hand, keeping the safety gear element in the standby position, and on the other hand, if necessary, moving it to an engaged position upon releasing the pressure accumulator. Likewise, the restraining device includes a restraining latch held by means of an electromagnet and released by means of a spring force, this latch being configured for keeping the actuator in the standby position.

[0010] These safety gears existing today have the main drawbacks of having generally large dimensions, in addition to the occurrence of automatic engagement of the elevator apparatus as a result of an interruption in the power supply thereof, where in this case the temporary inactivation of the elevator apparatus and the intervention of a technical team specializing in releasing the engagement block are required.

Description of the Invention

[0011] Conventionally, safety gears for elevator apparatus are activated by means of a mechanical speed limiting element which, when an excessive speed of movement of the car with respect to the guides is detected, is locked and causes the activation of said safety gears. Designs prepared for working without this mechanical speed limiting element, using for said function secure electronic systems for detecting emergency situations, are now emerging. This leads to need to use a safety gear that can be electronically activated.

[0012] The object of the invention consists of an electromechanically-actuated safety gear device for elevator apparatus comprising an engagement block integral with a car and in proximity with a guide of the elevator. There is arranged on one side of the guide a braking shoe of the car secured to the block, whereas on the other side of the guide of the elevator there is a roller for engagement thereof between the block and the shoe, retaining in this engagement movement the guide located between the roller and the shoe and thereby securing the car against the guide.

[0013] Based on this general engagement principle already known in the current state of the art, the device comprises an actuating and resetting mechanism comprising, among other elements:

- An activation plate, articulated at one end whereby it is attached to the block, and actuated by an activation mechanism, preferably an electromagnet, whereas at the opposite end it has a compression spring acting on the activation plate in a direction opposite that of the electromagnet.
- A longitudinal groove, made in the body of the activation plate, through the inside of which a guiding element linearly slides, guiding the roller in the direction of said sliding. In a preferred embodiment, the guiding element is in the form of horseshoe-shaped body with two free arms, between which the shaft of the roller moves freely. This horseshoe-shaped body allows the roller to have a free movement in two directions within its engagement movement with the block.
- A magnetic element, attached to the guiding element, which allows an additional magnetic coupling with the guide.
- A friction element, movable on the body of the activation plate, which allows

defining three positions of the activation plate with respect to the guide such as:

- A first position separated from the guide, when the electromagnet is attracted to the activation plate.
- A second position, in which the friction element contacts the guide when the electromagnet is deactivated and therefore the compression spring acts. Said friction element keeps the car in a safe position.
- A third position, in which the car, starting from the safe position, continues to move, such that said friction element pivots, causing engagement between roller and shoe.

[0014] The device is based mainly on the pivoting-type movement of the activation plate with respect to the engagement block, although linear-type movements are likewise contemplated. When the elevator is working normally, with the car moving along the guides, the electromagnetic activation mechanism is powered, causing the activation plate to be kept spaced from the guide.

[0015] When the elevator enters a standby position, power supply to the activation mechanism is stopped, such that the compression spring causes the activation plate to pivot and to move closer to the guide until causing the friction element to contact same. This friction element would be kept in a position normally perpendicular to the guide as a result of a spring. The possibility of being able to alternate between the active and inactive positions by providing and stopping power supply to the electromagnetic activation mechanism is contemplated, provided that there is no relative movement of the guide with respect to the block.

[0016] With the friction element in contact with the guide, securing the car on said guide, if a relative movement of the guide with respect to the block occurs, the friction element pivots, causing the activation plate to move even closer to the guide until causing the magnetic element to adhere thereto. The movement of the guide in turn causes a relative movement of the roller with respect to the block, until reaching a position in which the roller would contact both the guide and the block, initiating engagement.

[0017] At that time, the block would start to move horizontally with respect to the guide, until the shoe touches the guide and then compresses springs attached to the shoe. By compressing said springs, the horseshoe has a projection which, when hitting against the stops, would push the activation plate, moving it away from the guide and closer to the electromagnet, such that furthermore the magnetic element no longer contact the guide. Therefore, prior to disengaging the apparatus, the electromagnet would again be powered, causing the safety gear to return to the standby position when the roller moves downward as a result of a tension spring pulling the roller to said position.

Description of the Drawings

[0018] To complement the description being made and for the purpose of helping to better understand the features of the invention according to a preferred practical embodiment thereof, a set of drawings is attached as an integral part of said description in which the following is depicted in an illustrative and non-limiting manner:

Figure 1 shows a front view of the electromechanical safety gear device in a standby position, with a partial cross-section, in which its main elements can be seen.

Figure 2 shows a front view of the device in an active position, in which the friction element secures the car on the guide.

Figure 3 shows a front view of a first step of the operating sequence of the device, in which the car moves in an uncontrolled manner with respect to the guide.

Figure 4 shows a front view of a second step of the

operating sequence.

Figure 5 shows a front view of a third step of the operating sequence.

Figure 6 shows a front view of a fourth step of the operating sequence.

Preferred Embodiment of the Invention

[0019] A detailed description of a preferred embodiment of the object of the present invention is provided below, with the help of the drawings mentioned above.

[0020] The described electromechanical safety gear device for elevator apparatus is conceived to perform emergency braking of a car longitudinally movable along at least one essentially vertical guide (1), securing the car on said guide (1) so as to prevent uncontrolled movements or even fall due to the action of gravity.

[0021] To that end, this safety gear schematically shown in its standby position in Figure 1 is basically formed by:

- an engagement block integrally coupled to the car,
- an activation mechanism that can be electronically actuated,
- an activation plate (2), linked to the engagement block, movable with respect to the guide (1) and operable by the activation mechanism, in turn having a guiding mechanism (3), and
- a guiding element (4) coupleable with the guiding mechanism (3) and movable along said guiding mechanism (3) in a direction essentially parallel to the guide (1).

[0022] The engagement block in turn comprises a central rail for housing the guide (1), a side arresting element (5) movable perpendicular to the central rail, and a side braking element (6) movable perpendicular to the central rail in a direction opposite that of the arresting element (5) and coupleable both to the arresting element (5) and to the guide (1) for braking and immobilizing the car.

[0023] In the preferred embodiment herein described, the arresting element (5) consists of a shoe, whereas the braking element (6) consists of a roller provided with a central shaft (7) and a toothed surface of friction.

[0024] The activation plate (2), which in this preferred embodiment has an elongated geometry and moves in a pivoting manner with respect to the guide (1), has a first end comprising a pivoting articulation (8) with the engagement block for creating a pivoting movement of the activation plate (2) with respect of the guide (1), and a second end comprising a compression spring (9) for moving the activation plate (2) closer to the guide (1).

[0025] The guiding mechanism (3) of said activation plate (2) in turn comprises a longitudinal through groove (10) located in a central sector of the activation plate (2), and stops (11) located at respective ends of the longitudinal groove (10).

[0026] The activation plate (2) additionally comprises a movable friction element (12), which in this preferred embodiment consists of a pivoting cam body located at the second end, as can be seen in the attached drawings. This friction element (12) is kept in a normally horizontal position, perpendicular to the guide (1), as a result of the action of an inner spring (13).

[0027] In this preferred embodiment, the guiding element (4) is in the form of a horseshoe-shaped body, as illustrated in Figures 1-6, and comprises a central housing (14), demarcated by respective upper and lower arms (15) of the horseshoe-shaped body, such that the housing (14) allows insertion of the central shaft (7) of the braking element (6). Furthermore, the guiding element (4) comprises at least one contact surface (16) intended for contacting the guide (1).

[0028] This guiding element (4) additionally comprises a magnetic element (17) for creating an additional magnetic coupling with the guide (1). In the embodiment shown in the attached drawings, the contact surface (16) is located at a free end of the magnetic element (17), although in alternative embodiments, it can be located in other parts of the guiding element (4), such as the free ends of the arms (15), for example. Likewise, the aforementioned housing (14) allows a sliding longitudinal movement of the braking element (6) to occur therein.

[0029] In terms of the activation mechanism, it comprises at least one electromagnetic element (18), in this case an electromagnetic suction pad, linked to the pivoting articulation (8) for keeping the activation plate (2) in a position spaced from the guide (1), and an elastic element (19) linking the guiding element (4) with the activation plate (2). The aforementioned compression spring (9) therefore moves the activation plate (2) closer to the guide (1) when the electromagnetic element (18) is not powered.

[0030] Figures 2-6 illustrate an operating sequence of the device described above. In this sense, while the device is in a standby position in Figure 1, with the car moving normally along the guide (1) and the electromagnetic element (18) is powered and keeps the activation plate (2) spaced from said guide (1), in Figure 2 the elevator is in a standby position, waiting to be used, such that it does not have to be powered, thereby reducing its power consumption.

[0031] This lack of power supply of the electromagnetic element (18) during the standby state of the elevator apparatus causes the activation plate (2) to move towards the guide (1), as a result of a combined action of the pivoting articulation (8) and the compression spring (9), until the friction element (12) contacts said guide (1), to thereby keep the car in a safe position without the engagement block having to come into action.

[0032] If a relative movement of the guide (1) with respect to the engagement block occurs, the friction element (12) pivots, overcoming the resistance of its inner spring (13), and causing the activation plate (2) to move even closer to the guide (1), as illustrated in Figure 3. This movement of the activation plate (2) in turn causes

a relative movement of the braking element (6) within the guiding element (4) until contacting the guide (1), the position shown in Figure 4, initiating engagement.

[0033] At that time at which the guiding element (4) furthermore moves along the longitudinal groove (10) of the guiding mechanism (3), the braking element (6) moves horizontally through the housing (14) towards the guide (1) until contacting the arresting element (5), which additionally comprises reinforcement springs (20) for controlling the braking force.

[0034] The compression of said reinforcement springs (20) causes a protuberance of the guiding element (4) to hit against the stops (11) of the guiding mechanism (3), thereby causing the activation plate (2) to move closer to the electromagnetic element (18), furthermore separating the contact surface (16) and the magnetic element (17) from the guide (1), which can be observed in the attached Figure 5.

[0035] Finally, it can be seen in Figure 6 an intermediate position in the disengagement of the device, in which the electromagnetic element (18) is again powered, such that the activation plate (2) moves away from the guide (1), causing the guiding element (4) to drive the braking element (6) to its standby position through the pull exerted by the elastic element (19).

Claims

1. Electromechanical safety gear device for elevator apparatus that can be electronically activated for the emergency braking of a car longitudinally movable along a guide (1), the device comprising:

    - an engagement block integral with the car, in turn comprising:

        - a central rail for housing the guide (1),
        - a side arresting element (5) movable perpendicular to a side of the central rail, and
        - a braking element (6) movable with respect to the central rail and coupleable to the guide (1) for braking and arresting the car,

    - an activation mechanism that can be electronically actuated,
    - an activation plate (2) movable with respect to the guide (1) and operable by the activation mechanism, in turn having a guiding mechanism (3), and
    - a guiding element (4) of the braking element (6) coupleable with the guiding mechanism (3) and movable by said guiding mechanism (3) in a direction essentially parallel to the guide (1),

    the device being **characterized in that** the activation plate (2) additionally comprises a movable friction element (12) for defining relative positions of the activation plate (2) with respect to the guide (1):

    - a standby position, in which the activation mechanism keeps the activation plate (2) spaced from the guide (1),
    - an active position, in which the activation mechanism moves the activation plate (2) towards the guide (1) for contacting the friction element (12) with the guide (1), and
    - a braking position, in which a relative movement of the guide (1) with respect to the car causes a movement of the friction element (12), in turn leading to the following sequence of actuation:

        - the guiding element (4) contacting the guide (1),
        - the guiding element (4) moving along the guiding mechanism (3) due to friction with the guide (1), and
        - the braking element (6) being driven by the guiding element (4) until engagement with the arresting element (5).

2. Safety gear device according to claim 1, **characterized in that** the friction element (12) moves in a pivoting manner with respect to the activation plate (2).

3. Safety gear device according to any of the preceding claims, **characterized in that** the guiding element (4) comprises:

    - a housing (14) for coupling the braking element (6), and
    - at least one contact surface (16) intended for contacting the guide (1).

4. Safety gear device according to any of the preceding claims, **characterized in that** the activation plate (2) moves in a pivoting manner with respect to the guide (1) and comprises:

    - a pivoting articulation (8) for the pivoting movement of the activation plate (2) with respect of the guide (1), and
    - a compression spring (9) for moving the activation plate (2) closer to the guide (1).

5. Safety gear device according to claim 1, **characterized in that** the guiding mechanism (3) comprises:

    - a longitudinal through groove (10), and
    - stops (11), located at respective ends of the longitudinal groove (10).

6. Safety gear device according to claim 5, **characterized in that** the guiding element (4) comprises a protuberance coupleable with the stops (11) of the guid-

ing mechanism (3) for moving the activation plate (2) closer to the activation mechanism.

7. Safety gear device according to claim 4, **characterized in that** the activation mechanism comprises an electromagnetic element (18) linked to the pivoting articulation (8) for keeping the activation plate (2) in a position spaced from the guide (1).

8. Safety gear device according to any of the preceding claims, **characterized in that** the braking element (6) is a roller and the arresting element (5) is a shoe.

9. Safety gear device according to any of the preceding claims, **characterized in that** the guiding element (4) comprises a magnetic element (17) for additional magnetic coupling with the guide (1).

10. Safety gear device according to claim 8, **characterized in that** the contact surface (16) is located in the magnetic element (17).

11. Elevator apparatus, **characterized in that** it comprises the electromechanical safety gear device according to any one of claims 1 to 10.

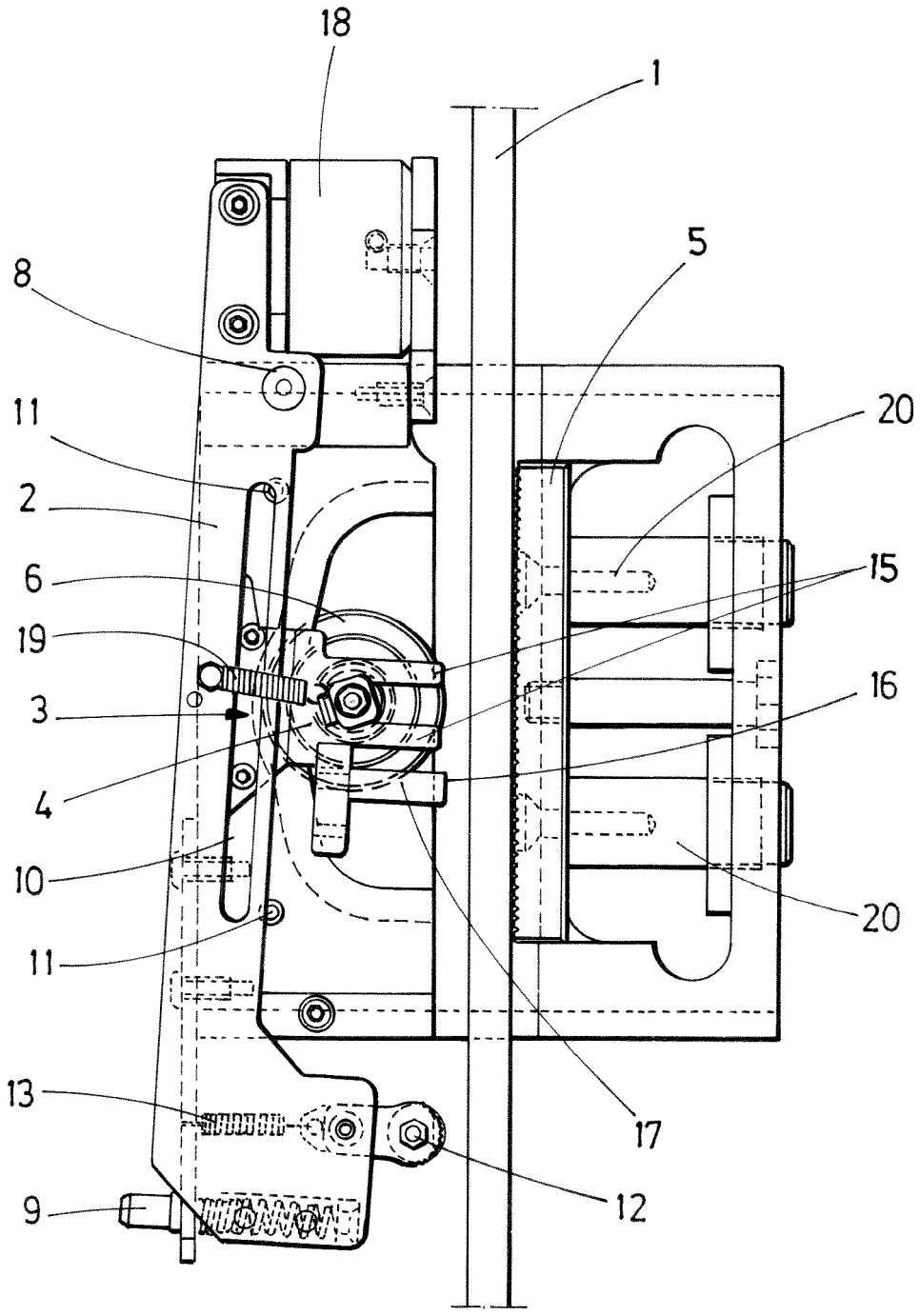

FIG.1

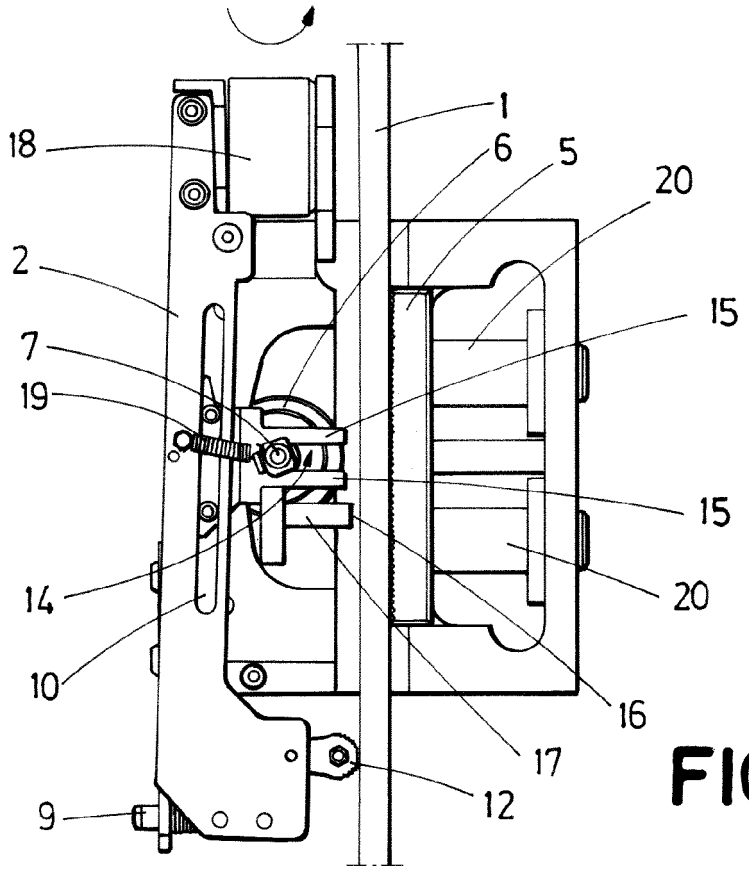
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FIG.2

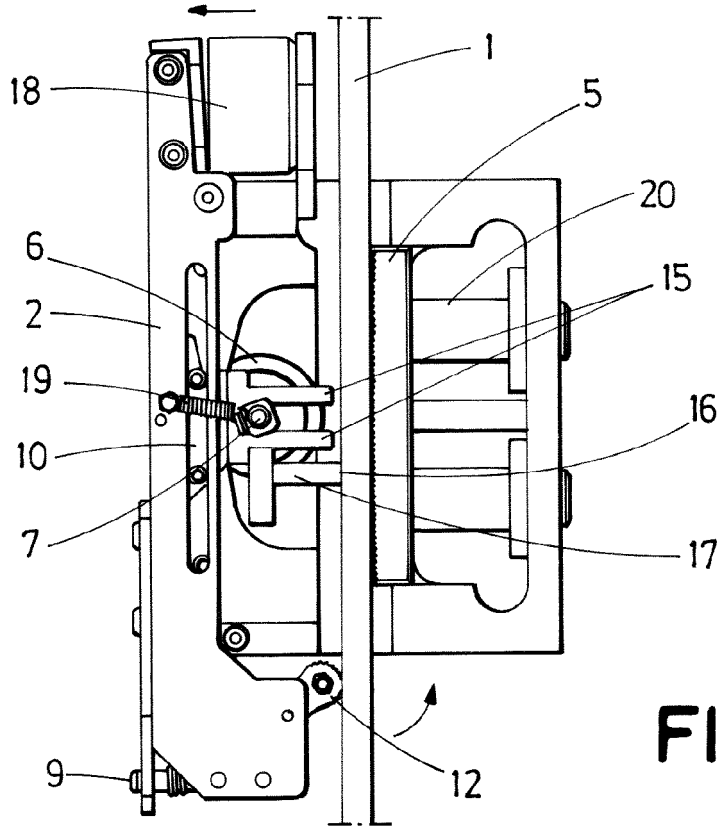
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FIG.3

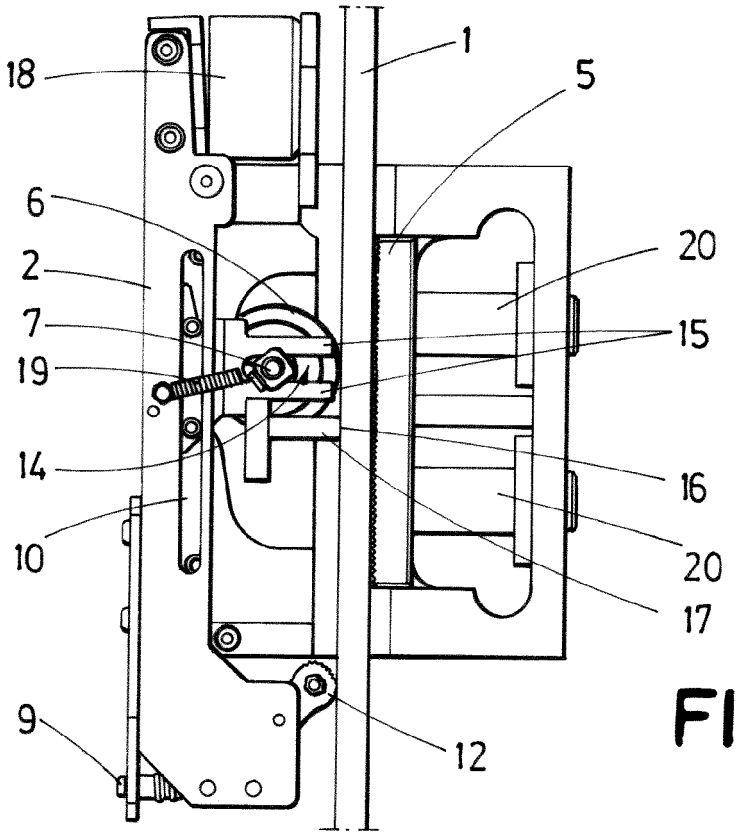
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FIG.4

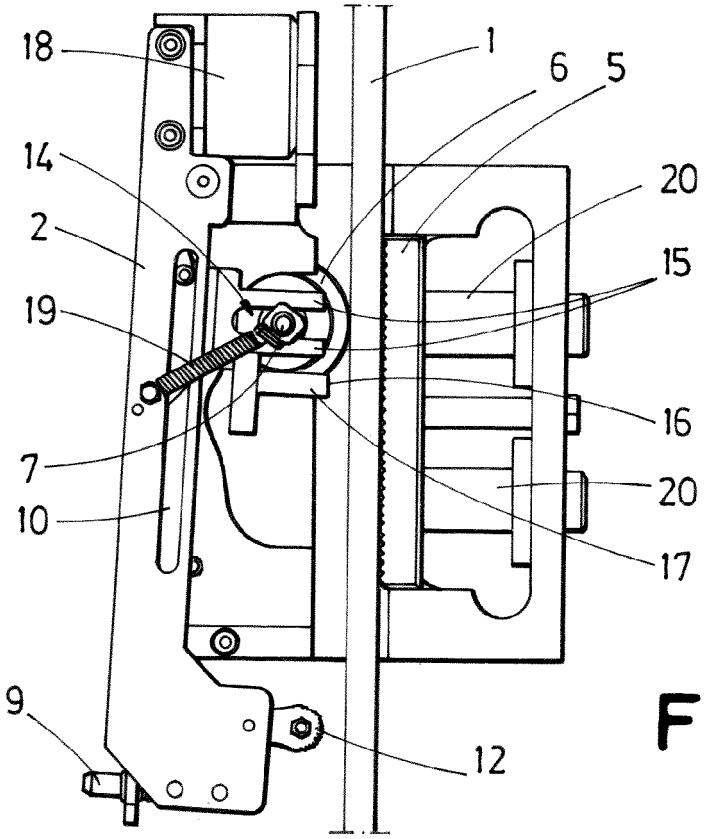
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FIG.5

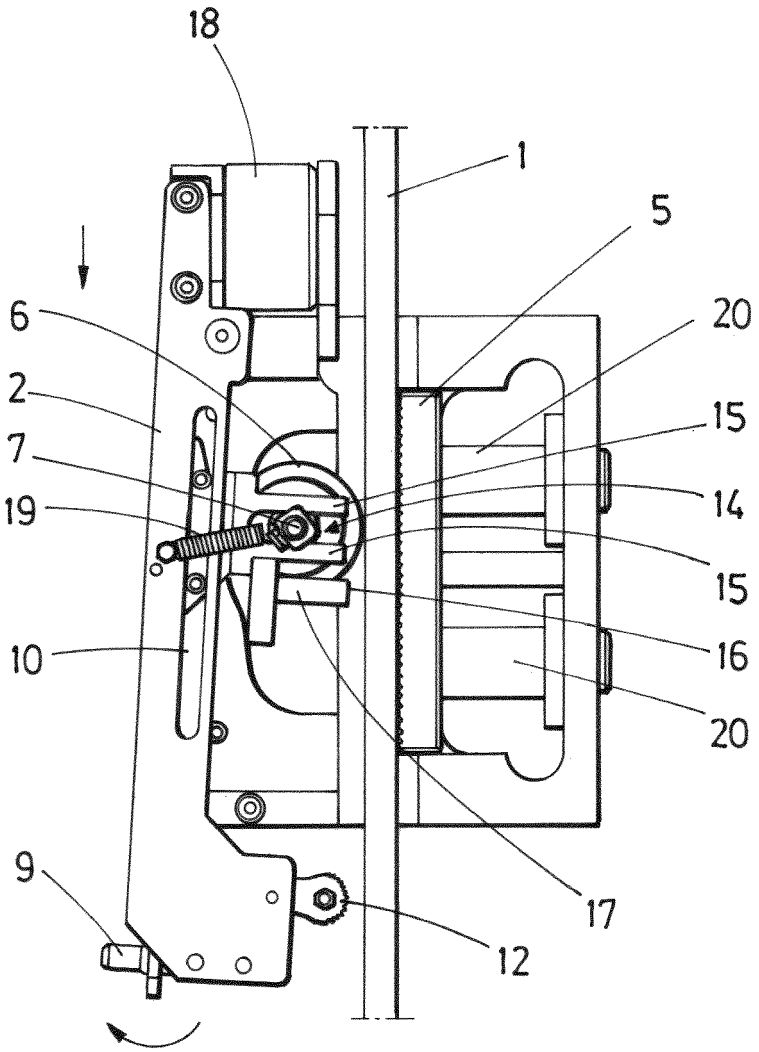

FIG.6

REFERENCES CITED IN THE DESCRIPTION

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