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(54) **Actuation process and device in an emergency situation in elevator apparatuses**

(57) The invention relates to a device and actuation process in emergency situations in elevators and envisages that in any emergency situation that may occur in an elevator, either due to overspeed, jerk, uncontrolled movements of the car, free-fall of the car due to breaking of the traction ropes, lack of supply voltage, etc., instead of the car being stopped at the moment in which this emergency situation occurs and trapping the passengers, the process envisages the car being able to continue moving up or down according to the travel direction until it reaches the next floor, opening the doors of the car so that the passengers can get out and indicating the inoperative state of the elevator from that moment on.

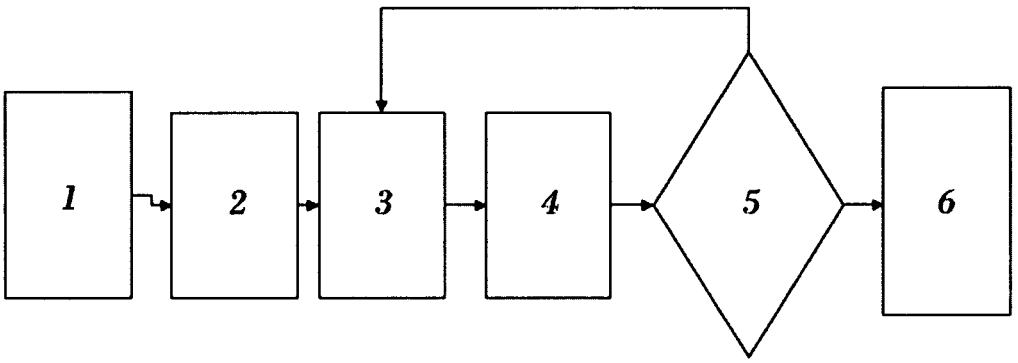

FIG. 1

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Description

Object of the Invention

[0001] The object of the invention relates to an actuation process in an emergency situation in elevator apparatuses, as well as to the device for carrying out said actuation process in case of emergency in such elevator apparatuses.

[0002] With the device and process proposed by the invention, it is achieved that the actuation mechanisms, which would take the car to a floor, open the doors so that the passengers can get out and leave the elevator inoperative until technical services can fix the reasons that led to this emergency situation, begin operating in an emergency situation in the elevator.

[0003] This device would prevent the passengers from being trapped the car and thereby prevent possible panic situations among them since at no time will the passenger feel like he or she has been in danger when in the elevator.

Background of the Invention

[0004] In current elevator apparatuses, when an emergency situation occurs either due to overspeed, uncontrolled movements of the car, free-fall of the same due to breaking of the traction ropes, opening of a contact corresponding to an element belonging to the safety series, situations generating that the braking function commences due to an operation malfunction, power supply cutoff, etc.... the operation stops supplying power to the machine until it completely stops and/or actuates the braking device arranged in the car.

[0005] If one or more passengers is being transported in the car at that time, this situation causes them to be trapped therein, resulting in possible panic situations among the passengers until they are finally rescued by the firefighters, building janitors, specialized staff from the companies responsible for the maintenance of those elevators or any other person skilled to carry out this rescue.

[0006] As stated, in a best-case scenario the passengers who are trapped at that time inside the car feel that they have lost a certain amount of time during the rather considerable period in which they were trapped, but it is normal for them to feel like they have been put in a risk situation with an unpredictable outcome since they lack information at those moments as to what has happened to the elevator and for many people it causes a panic situation since they are in a small, enclosed area and have suddenly stopped in the elevator, preventing them from leaving the elevator.

[0007] The systems developed up until now for actuation in cases of emergency by the elevator are based on detecting these emergency situations as quickly and reliably as possible to then act on the stop mechanisms of the elevator, attempting to not put the elevator passengers at risk. What occurs in this case is that if the car is located at the height of the door on the floor, the passenger could manually open the doors and leave the car, but the normal case is that this does not occur and the car is not located at the height of the door, the passenger therefore being trapped therein.

[0008] Patent application US2005/0269163 relating to a method for supervising the safety conditions of an elevator stands out. This process and system envisages that the movement or travel parameters of the car are constantly taken and compared with parameters obtained from a second sensor in the driving means. If this comparison shows that there is a deviation between these two parameters the emergency stop is initiated. The controlled parameters are position, speed and acceleration and these parameters can be taken in the car and in the traction means of the elevator, comparing them to one another.

[0009] European patent application EP-1670710 relates to a brake mechanism for an elevator activated in response to an electronic control signal to prevent movement of an elevator car under predetermined conditions. This invention only relates to the constructive shape of the braking device and to a method of activating the braking device, consisting of identifying the need to activate the braking operation and generating an electronic control signal activating the stop mechanism.

[0010] Patent application WO00/39015 relates to an electronic overspeed governor device suitable for controlling the overspeed of the elevator, activated by means of controlling the speed of the elevator car, comparing it with a threshold speed at which the car is to travel. These signals are treated by a microprocessor and in the event of deviation between both values, the actuation device of the elevator brake is triggered. This system does not envisage stopping the car on a floor or immediately evacuating the passengers, therefore as in the previous cases the passenger will have felt upset from knowing that he or she has been in a risk situation with the subsequent stopping of the elevator car until being rescued.

[0011] Patent application WO2006/072428 envisages an elevator and elevator control device. This elevator comprises a system for detecting signals used to determine an absolute position of the car, a control circuit for detecting the signal used, for determining the speed or deceleration of the car and a circuit for evaluating the signals of the detection system and of the control circuit. Based on the input signals, the evaluation circuit compares the speed of the car, taking into account the position of the car with a predetermined internal value, activating the braking device when the value is not within the predetermined parameters.

[0012] None of the documents of the state of the art envisages that, before detecting an emergency situation, the elevator car continues with its lift or descent operation, stops on a floor, allows the opening of the doors to evacuate the passengers and remains in standby for the system to be repaired or checked by maintenance teams,

the users not detecting at any time that they have been in a risk situation since the car does not abruptly stop or leave the passengers trapped in the car.

[0013] Patent application US2004/0173413 relates to a method for preventing an overspeed of the load of an elevator by means of braking and stopping thereof such that passengers are never trapped therein. This invention only envisages acting on the elevator when an overspeed occurs, which overspeed can cause deceleration in the stops, causing a very evident psychological panic effect among passengers. This system further envisages the sequential actuation of three or more braking systems on the elevator making the speed of the elevator decrease, but in the event of entering the calculated speed limits it does not act, stopping the elevator, but rather continues with the normal operation of the elevator. If the problem which has occurred is not corrected, it may result in an elevator failure malfunction with greater consequences generating a breakdown with a more costly repair.

Description of the Invention

[0014] The actuation process in an emergency situation in elevator apparatuses can be summarized by the fact that before detecting any emergency situation in the elevator installation, movement of the elevator car is allowed before reaching the floor immediately above or below it if there is one, causing the car to stop at that moment, causing the opening of the doors so that passengers can leave the car and placing the elevator or car in the stop situation until the maintenance services can verify how and what caused the emergency situation and fix whatever caused this emergency situation in the elevator itself.

[0015] This process can be completed by means of activating a visual and/or acoustic signal of the non-operative situation of the apparatus and even this emergency activation can trigger an automatic warning from the installation to a control center that the elevator apparatus has experienced an emergency situation that has stopped it.

[0016] The process of the invention envisages the following steps:

- Detecting an emergency situation in the moving elevator.
- Activating the trigger function when detecting an emergency situation.
- Inhibiting the remaining braking systems of the elevator.
- Activating the braking function of the elevator arranged in the elevator car.
- Activating the function of halting the car at the height of the floor.
- Manual or automatic opening of the doors to facilitate evacuating the users.

[0017] The first critical point in the installation consists of detecting that the elevator is in an emergency situation. This detection of an emergency situation basically occurs because the elevator car acquires an overspeed or because the car acquires a jerk depending on the positioning of the car in the elevator shaft.

[0018] The process of detecting the emergency situation in the elevator comprises carrying out the following operations by the system:

- obtaining the position and/or travel of the car inside the elevator shaft and comparing it with reference position values.
- detecting the car speed and comparing it with a reference speed value.
- detecting the car acceleration and comparing it with a reference acceleration value.

[0019] The car position of the elevator apparatus is detected by means of obtaining multiple measurements of the location of the car in the elevator shaft which are sent to a microprocessor comparing them with one another and with pre-established reference position values. Several suppositions can result with these measurements.

[0020] A first supposition is that the measured values are within the pre-established limits; therefore no emergency situation actuation of the elevator is triggered.

[0021] A second supposition is that the measured position values exceed the pre-established limits previously recorded in the system, in which case the trigger device of the elevator is actuated.

[0022] A third supposition may result from the fact that the measured position values in the car do not coincide, in which case the automatic car stop device is actuated wherever such car is located.

[0023] The process of detecting the speed of the car of the elevator apparatus is another operation used for detecting emergency situations. The speed of the car is detected by means of obtaining multiple values which are compared with one another and with a pre-established reference speed value.

[0024] This comparison can reach multiple suppositions that should be analyzed.

[0025] A first supposition that may occur arises in the case the measured speed values coincide and are above the pre-established reference speed, in which case the trigger device of the elevator is actuated, taking the car to a floor, opening the doors and placing it in an emergency situation.

[0026] A second supposition which may occur is in the case the measured speed values do not coincide, in which case the automatic car stop device is actuated wherever the car is located.

[0027] The process of detecting the jerk of the car of the elevator apparatus is another operation used for detecting emergency situations. The jerk of the car is detected by means of obtaining multiple values which are

compared with one another and with a pre-established reference acceleration value.

[0028] This comparison can reach multiple suppositions which should be analyzed.

[0029] A first supposition that may occur arises in the case the measured acceleration values coincide and are above the pre-established reference acceleration, in which case the trigger device of the elevator is actuated, taking the car to a floor, opening the doors and placing it in an emergency situation.

[0030] A second supposition that may occur arises in the case that the measured acceleration values do not coincide, in which case the emergency stop device is actuated, halting the car wherever it is located.

[0031] The position, speed and acceleration measurements can be calculated by each position sensor installed in the elevator car, since the position will be a function, the speed will be the first derivative of that function and the acceleration will be the second derivative of that function, therefore the microprocessor with the signal from the same sensor will be able to know the position, speed and acceleration of the elevator car and will be able to calculate by means of the successive values obtained from the multiple measurements, the overspeed and jerk values at every point of the car path, detecting if an overspeed or jerk is occurring at that specific point of the path depending on the pre-established values previously recorded in the system.

[0032] It can be said that the instantaneous speed at a given moment is the derivative of space as a function of time at that moment and the instantaneous acceleration is the derivative of speed as a function of time at a given moment.

[0033] The position, speed and acceleration measurements can likewise be calculated by each acceleration sensor installed in the elevator car, since the acceleration will be a function, the speed will be the temporal integration of said function and the position will be the second integration of that function.

[0034] Likewise, the position, speed and acceleration measurements can be calculated by each speed sensor installed in the elevator car, since the speed will be a function, the acceleration will be the temporal derivative of said function and the position will be the integration of that function.

[0035] Activating the trigger device when detecting an emergency situation occurs when the system detects an overspeed or jerk, input of the braking function being sent at that moment, capable of slowing down the car to a reference speed that is equal to or less than the rated speed of the car, thereby preventing the abrupt stopping of the car, which would make the passengers uncomfortable, and a progressive and controlled deceleration of the elevator car occurring. Once the car speed is slowed down to the reference speed it enters in the floor stop control mode, in which the car is halted upon passing through the floor established for its halting.

[0036] One problem that may exist would be that at the time the emergency situation occurs the car is close to a floor, therefore the system would have to decelerate very abruptly since the space that would be left for traveling would be small for the speed of the car at those moments, in which case it is envisaged that the value of the deceleration caused by the braking device in the car should be equal to or less that one time the force of gravity; therefore in that case and if the system calculates that a greater deceleration should occur, the calculation is carried out for it to stop in the immediately next floor above or below it, whereby the deceleration would be less than the force of gravity and therefore adjusting the braking force to that subsequent stop. In the event that there is no next floor, the stopping would occur with the defined maximum acceleration.

[0037] The braking device or function of the car, which device is included in such car, can be the all-or-nothing type. This means that the device acts either with maximum force or with null force. In this case, the braking force is controlled by successive activations and deactivations of the braking function over time, depending on input of the braking function provided from the next floor car stop control function.

[0038] The braking device or function of the car, which device is included in such car, can be a variable type. This means that the device acts with different intermediate degrees of intensity with regard to the maximum force. In this case, the braking force is controlled by variations of the braking function over time, depending on input of the braking function provided from the next floor car stop control function.

[0039] In cases of variable force braking devices, the braking force applied on the brake device can correspond to a mathematical function that can be linear discontinuous or linear continuous with regard to the input of the braking function received from the floor stop control function. In cases of linear continuous function, the case of progressive force, which allows greater braking capacity for high speeds, is emphasized.

[0040] Activating the emergency device can be carried out in a number of ways, for example automatically, i.e., the system detects overspeed or jerk and triggers the emergency device with no manual intervention from anyone. The device itself evaluates and decides the need to act in emergency situations.

[0041] Another way of activating it would be by means of automatic activation governed by an emergency situation with the car stopped between two floors. In this case the safety device receives the command from the main control of the elevator to initiate the operation of taking the elevator to the next floor and initiate evacuation.

[0042] The actuation can likewise be manual, for which purpose an external person or operator performs an action which triggers the floor rescue sequence by braking.

[0043] There are generally two braking systems in elevator apparatuses: a brake arranged in the car intended for overspeed situations and a brake arranged in the traction unit intended for keeping the elevator stopped in nor-

mal operation situations and in some emergency situations due to the uncontrolled movement of the car in the upwards direction. The brake of the traction unit is normally operated by means of two different mechanisms: desire of the main control of the elevator or by the opening of the safety series in potential danger situations. The presence of the brake of the traction unit may interfere in the floor level stop mission since its braking action would be added to that of the car device and could cause the apparatus to stop before reaching the desired level.

[0044] To that end, actuation on the braking device of the traction unit is conditional to and/or differs from the objective of obtaining a floor level stop, i.e., the essential purpose of the device consists of a floor stop in order to perform the emergency evacuation; therefore the system checks that this is possible at the moment that the actuation due to an emergency situation occurs, since if it calculates that the operation can be immediately initiated, it is, but it may be advisable for the actuation to be delayed in time and not occur immediately because it is far from a floor stop, for which purpose the system chooses at that time to delay the operation.

[0045] In conventional embodiments, the brake of the traction unit depends on power contactors of the vertical operation, which are in turn conditioned by the safety series. For the invention, the action of the brake must be able to be inhibited from the car device, thereby preventing the dual braking actuation from being able to stop the elevator car before it reaches a floor stop.

[0046] In an optimized embodiment, the car braking method and device could also replace the functions of the braking device of the unit.

[0047] Once the elevator is halted after an emergency situation, an automatic warning is triggered from the installation to a control center, for example warning that the elevator is inoperative, with passengers evacuated, and even envisaging the possibility of being able to send elevator parameters allowing technical services to detect the reasons for which the emergency situation has occurred so as to be repaired more quickly, or even to be repaired from the central office.

[0048] Once the elevator is halted after an emergency situation, the inoperative situation of the apparatus is reported by means of visual and/or acoustic signally so that it is not used by new passengers and so that they can see at all times that the elevator is inoperative, requiring them to use alternative means of going up or down in the building. This signal can be a simple illuminated announcement indicating that the elevator is out of service, to a verbal message warning that the elevator must not be used because it is out of service.

[0049] The actuation device in an emergency situation in elevator apparatuses is also an object of the invention, the device having as a fundamental feature the fact that it is connected independently and separately from the supply voltage of the brake of the vertical traction unit and of the supply and/or control electrical elements of the motor drive, since this device acts on the car regardless of what occurs in the elevator machinery. This feature is essential since the device is integrated in and acts directly on the car, not like that which occurs in conventional devices in which the actuation is directly on the machinery to brake it in the event that the overspeed or a jerk in the car occurs.

[0050] In order to be integrated and act directly on the elevator car, the safety device comprises an auxiliary electric power source which acts on the brake incorporated therein and on the electronics associated to the actuation device which will regulate the braking force by virtue of the floor chosen to evacuate the passengers.

[0051] It must finally be pointed out that the braking device keeps the car steady at the floor level in the event of load variations thereof, activating the car braking device when the car is halted, acting with enough force so that the maximum load variation in the car does not cause any movement therein.

Brief Description of the Drawings

[0052] To complete the description being made and for the purpose of aiding to better understand the features of the invention, a set of drawings is attached to this specification as an integral part thereof which shows the following in an illustrative and non-limiting manner:

Figure 1 depicts a functional block diagram of the floor stop emergency device of the invention.

Figure 2 depicts a block diagram of the braking operation at the end of the travel.

Figure 3 depicts a block diagram of the detection device of the floor stop emergency device of the invention.

Figure 4 depicts a block diagram of actuating the floor stop emergency device of the invention due to jerk or overspeed.

Figure 5 depicts the block diagram of the floor stop control.

Figure 6 depicts a diagram comparing the state of the art and the invention in actuating the car brake and inhibiting the brake of the traction unit.

Figure 7 schematically depicts different braking functions that the floor stop emergency device of the invention can adopt.

Detailed Description of a Preferred Embodiment of the Invention

[0053] The actuation device and process in emergency situations in elevators proposed by the invention envisages that in any emergency situation that may occur in an elevator, either due to overspeed, jerk, uncontrolled movements of the car, free-fall of the car due to breaking of the traction ropes, lack of supply voltage, etc.... instead of the car being stopped at the moment in which this emergency situation occurs and trapping the passengers, the process envisages the car being able to con-

tinue moving up or down according to the travel direction until it reaches the next floor, opening the doors of the car so that the passengers can get out and indicating the inoperative state of the elevator from that moment on.

[0054] With this movement and travel of the car from the moment in which the emergency situation occurs until it stops on a floor, no movement other than that pertaining to the normal travel and braking of the car will be perceived, therefore the passenger will never perceive that he or she may have been exposed to a dangerous situation.

[0055] Figure 1 depicts a diagram of the functions associated to the actuation device in an emergency situation in elevator apparatuses. Block (1) depicts the function of detecting an emergency situation, which function is carried out with the set of overspeed and jerk sensors with the corresponding controls associated thereto. When this function of detecting an emergency is triggered, block (2) is actuated, in which block the trigger function of the emergency process that is physically carried out by the control is depicted.

[0056] Block (3) depicts the function of inhibiting the remaining braking systems, thereby preventing the motor braking system from being added to the car braking system and being able to not brake right at the floor height. Block (4) depicts the car braking function which is exerted by the brake plus the actuator assembly arranged in the car.

[0057] This system is associated to the function of halting on a floor, depicted in block (5) and which is exerted by the control plus actuator plus brake assembly and which until it is not located at floor height, it does not make the elevator car stop. At the same time the elevator car halts on a floor, the function of opening the doors (6) is activated, which function achieves opening such doors manually or automatically and thereby evacuating the possible people who may have been traveling in the car.

[0058] Figure 2 depicts a block diagram of the braking operation at the end of the travel, in which the position (7) in which the car is located is transmitted, this position being compared in (8) with the situation of the floors and if it coincides, the car (9) is stopped, and if it does not coincide the command is transmitted to the main control of the elevator (46) responsible for changing the position of the car by means of a power supply from the motor or by means of incorporating auxiliary batteries in order to change the position of the car, until the position of the car coincides with the position of the plan of the chosen floor, at which time the floor stop of the car (9) is performed.

[0059] Figure 3 depicts a block diagram of the detection device of the floor stop emergency device of the invention, with the possible actuations that can be carried out with it. The sensor device incorporated in the elevator is depicted in (47).

[0060] If the position, speed, acceleration or jerks occurring in the car are above the pre-established limit as occurs in (10), it is proposed to initiate the braking (13) so that the actuator (16) is ordered to brake (17) the car and the operation triggered in the elevator being reported to the sensor device.

[0061] A second possibility (11) is that regardless of the position, the car has a speed or acceleration or a surge or jerk value is produced therein that is above those stipulated as being normal, in which case the initiation of the braking (14) is proposed so that the actuator (16) is ordered to brake (17) the car and the operation triggered in the elevator being reported to the sensor device.

[0062] In addition, the position (12) of the car is being calculated at all times, and if this position is the floor position, it proposes acting on the brake (15) so that the actuator (16) is ordered to brake (17) the car and the operation triggered in the elevator being reported to the sensor device. In the event that the position is not the floor position, the force on the brake is released for the purpose of searching for the selected floor.

[0063] Figure 4 depicts a block diagram of the actuation due to jerk or overspeed of the floor stop emergency device of the invention. The main control of the elevator in normal operation is depicted in (18), which main control orders the sensor device to take successive "n" measurements (19) (20) (25), etc..., at each instant from at least two reader elements, and successively compares the "n" measurements (21). In the event that the measurements are similar they are compared (22) if that measurement is equal to or greater than the established reference measurement. In the event of being less than the established reference safety measurement it returns a signal to the control device of the elevator (18) indicating that the operation of the elevator is correct. In the event that the calculated speed is greater than the reference speed, input of the braking function is given to (24) from the main control device of the elevator so that it reduces the speed and the control of that measurement is shown in (26) so that at the moment that it is under the threshold the main control of the elevator is informed of this fact, and if it continues to be higher, the floor stop operation is triggered, for which purpose it checks (27) if the position of the car is on a floor; if it is, the car (28) is stopped; if it is not, a comparison of the speed measurement of the car is carried out (29) and it is compared if it continues to be above the threshold and, whether it is negative (30) or positive (31), it enters in the floor stop loop, comparing the position of the car with the speed at which the car is traveling and the deceleration of the car to cause the floor stop.

[0064] In the event that the calculated deceleration is greater than the force of gravity the system will choose the floor that is immediately above or below it, recalculating the deceleration that the car must experience for the final stop thereof.

[0065] A variant of the triggering of the actuation system is shown in (23) and it would be at the point in which measurement 1 (19) or measurement 2 (20) or the successive measurements obtained do not coincide, in which case the car automatically stops wherever it is,

either on a floor or between floors, for the safety of the elevator, such that the safety brake is actuated on the guides since it means there was an error in the reading.

[0066] Even though this diagram has been mentioned for the case of overspeed, it is similar in the case of jerks

[0067] Figure 5 depicts the block diagram of the floor stop control and (32) depicts the initiation of the rescue operation. This rescue operation evaluates (36) that whether or not the position, speed and acceleration are above the braking reference; if not (37), it orders reducing the braking force and if they are, it orders (38) increasing the braking force until the position, speed and acceleration coinciding with the stop are achieved in (39) and the end (40) of the rescue operation occurs; and if these values are not achieved, they are communicated to the control of the rescue operation to increase the braking force.

[0068] Three modes of initiating the floor rescue control are shown in (33), (34) and (35).

[0069] The automatic autonomous activation due to an emergency situation with the car moving is shown in (33). The safety device evaluates and decides the need for actuation due to an emergency situation because:

- The current position has exceeded an end position close to the ends of the path or points of collision of the car
- The speed of the car is greater than the established trigger speed
- The current acceleration is greater than the established trigger acceleration
- The position and speed are greater than the trigger position and speed.
- The position, speed and acceleration are greater than the trigger position, speed and acceleration.
- The speed and acceleration are greater than the trigger speed and acceleration.
- The position and acceleration are greater than the trigger position and acceleration.
- The surge or jerk value of the car is greater than the trigger surge or jerk value.

[0070] The automatic activation ordered due to an emergency situation with the car stopped between two floors is shown in (34). In this case the safety device receives the command from the main control of the elevator to initiate the action by means of releasing the brake, searching for the floor position and controlling the speed and acceleration so that they do not exceed the pre-established speed and acceleration, and when it reaches a floor the brake is actuated, halting the car, opening the doors and allowing the passengers to get out.

[0071] The manual activation is shown in (35) in which an external person or operator performs and action which triggers the floor rescue sequence due to braking. In the event that the car is moving, it will look for the next floor in order to stop and open the doors, whereas if the car is stopped between two floors the brake is released, looking for the next floor, and when it reaches the floor the movement of the car is stopped.

[0072] Figure 6 schematically depicts the operation of the braking means of the elevator, thus for example the supply means of the safety of the elevator are expressed in (41), which according to the traditional process indicated in the figure with a solid line activates the safety series associated to the elevator (42) which would act by interrupting the supply of the vertical operation contactors (43) of the elevator and they would actuate the brake of the traction unit (44) upon interrupting the supply thereof and allow the braking action to be carried out as a result of the force exerted by a spring. The invention is focused on the incorporation of the inhibitor (45) of the brake of the traction unit, thereby preventing the actuations of the car brake from being added to that of the traction unit, which could lead to an uncontrolled braking action that could cause the apparatus to stop before reaching the desired floor level.

[0073] Figure 7 schematically depicts the different braking functions that the floor stop emergency device of the invention can adopt, therefore the upper figure depicts the all-or-nothing type braking device or function of the car. In this solution the device acts either with maximum force or null force and the braking force is controlled by several activations and deactivations of the braking function over time, depending on input of the braking function provided from the next floor car stop control function, as shown in the mentioned Figure 7 in the upper graph.

[0074] The second, third and fourth graphs in Figure 7 show the variable type braking device or function of the car. In this solution the device acts with different intermediate degrees of intensity with regard to the maximum force and the braking force is controlled by variations of the braking function over time, depending on input of the braking function provided from the next floor car stop control function.

[0075] In cases of variable force braking devices, the braking force applied on the brake device can correspond to a mathematical function that can be linear proportion, such as that of Figure 2 in which the braking force is proportional to the input of the braking function received from the floor stop control function.

[0076] The third graph shown in Figure 7 depicts the case of linear continuous function with progressive force, which shows the exponential curve which allows greater braking capacity for high speeds, i.e., the braking force exponentially increases with the speed of the car.

[0077] Finally, the fourth graph of Figure 7 depicts the non-linear braking function in which there are different sections in which the graph of the braking function depending on the speed acquires different slopes depending on the sections or intervals of speed at which the car can move.

[0078] The variable (c) is determined by the function of "halting the car on a floor" and is calculated depending on the current and previous value of a variable or of a set of variables that can be the speed of the car, the

position of the car, the acceleration of the car, the derivative of the acceleration of the car and of the type of braking function used.

Claims

1. Actuation process in an emergency situation in elevator apparatuses which comprises

   - detecting an emergency situation in the moving elevator;
   - activating the trigger function when detecting an emergency situation;
   - inhibiting the remaining braking systems of the elevator;
   - activating the braking function in an elevator car arranged in the elevator car;
   - activating the function of halting the car at the height of the floor through the action of the braking function;
   - manual or automatic opening of the doors to facilitate evacuating the users.

2. Actuation process in an emergency situation in elevator apparatuses according to claim 1, **characterized in that** detecting an emergency situation in the elevator comprises

   - obtaining the position and/or travel of the car inside the elevator shaft and comparing it with reference position values;
   - detecting the car speed and comparing it with a reference speed value;
   - detecting the car acceleration and comparing it with a reference acceleration value.

3. Actuation process in an emergency situation in elevator apparatuses according to claim 2, **characterized in that** the car position of the elevator apparatus is detected by means of obtaining multiple measurements that are compared with one another and with pre-established reference position values.

4. Actuation process in an emergency situation in elevator apparatuses according to claims 2 and 3, **characterized in that** in the case the measured position values coincide and the pre-established limits are exceeded, the trigger device of the elevator is actuated.

5. Actuation process in an emergency situation in elevator apparatuses according to claims 2 and 3, **characterized in that** in the case the measured position values do not coincide, the automatic stopping of the car wherever such car is located is actuated.

6. Actuation process in an emergency situation in elevator apparatuses according to claim 2, **characterized in that** the car speed of the elevator apparatus is detected by means of obtaining multiple measurements which are compared with one another and with a pre-established reference speed value.

7. Actuation process in an emergency situation in elevator apparatuses according to claims 2 and 6, **characterized in that** in the case the values of the measured positions coincide and are not outside of the pre-established reference positions and the measured speed values coincide and are not above the pre-established reference speed, and the values of the measured accelerations coincide and are not above the pre-established reference acceleration, the elevator continues with the load lift or descent operation.

8. Actuation process in an emergency situation in elevator apparatuses according to claims 2 and 6, **characterized in that** in the case the measured speed values coincide and are above the pre-established reference speed, the trigger device of the elevator is actuated.

9. Actuation process in an emergency situation in elevator apparatuses according to claim 2, **characterized in that** the car acceleration of the elevator apparatus is detected by means of obtaining multiple measurements which are compared with one another and with a pre-established reference acceleration value.

10. Actuation process in an emergency situation in elevator apparatuses according to claims 2 and 9, **characterized in that** in the case the values of the measured accelerations coincide and are above the pre-established reference acceleration, the trigger device of the elevator is actuated.

11. Actuation process in an emergency situation in elevator apparatuses according to claim 1, **characterized in that** activating the trigger device when detecting an emergency situation occurs when detecting an overspeed or jerk with regard to the reference acceleration or speed of the car, an input being sent to the braking function which is capable of generating a force capable of slowing down the car to a reference speed that is equal to or less than the rated speed of the car.

12. Actuation process in an emergency situation in elevator apparatuses according to claim 11, **characterized in that** once the car speed is slowed down to the reference speed it enters the floor stop control mode, in which the car is halted upon passing through the floor established for its halting.

13. Actuation process in an emergency situation in elevator apparatuses according to claim 1, **characterized in that** activating the braking device of the elevator arranged in the elevator car achieves the deceleration and/or total stop of the car on a floor.

14. Actuation process in an emergency situation in elevator apparatuses according to claims 1 and 2, **characterized in that** when detecting an emergency situation in the elevator and until the car stops, depending on the location of the elevator car, the load difference between car and counterweight and the overspeed or jerk of the car, the system calculates the deceleration that the car must be subjected to and the braking force for stopping the car at the height of the next floor.

15. Actuation process in an emergency situation in elevator apparatuses according to claim 14, **characterized in that** if the deceleration calculated for stopping the car on a floor is greater than one time the force of gravity, the calculation of the deceleration and of the braking force is carried out with regard to the floor immediately above or below, if there is one.

16. Actuation process in an emergency situation in elevator apparatuses according to claim 1, **characterized in that** the actuation on the car braking device is the all-or-nothing type.

17. Actuation process in an emergency situation in elevator apparatuses according to claim 1, **characterized in that** the braking force is variable in intensity depending on input of the braking function.

18. Actuation process in an emergency situation in elevator apparatuses according to claims 1 to 17, **characterized in that** the actuation on the braking device of the traction unit is conditional to and/or differs from with the objective of stopping at the level of a floor.

19. Actuation device in an emergency situation in elevator apparatuses **characterized by** its capacity of acting independently and separately on the supply voltage of the brake of the vertical traction unit.

20. Actuation device in an emergency situation in elevator apparatuses according to claim 12 to 17, **characterized in that** it keeps the car steady at the floor level due to the load variations thereof by activating the car braking device when the car is halted.

21. Actuation apparatus acting under a process in emergency situations according to claims 1 to 18, **characterized in that** the braking means thereof are located exclusively in the elevator car.

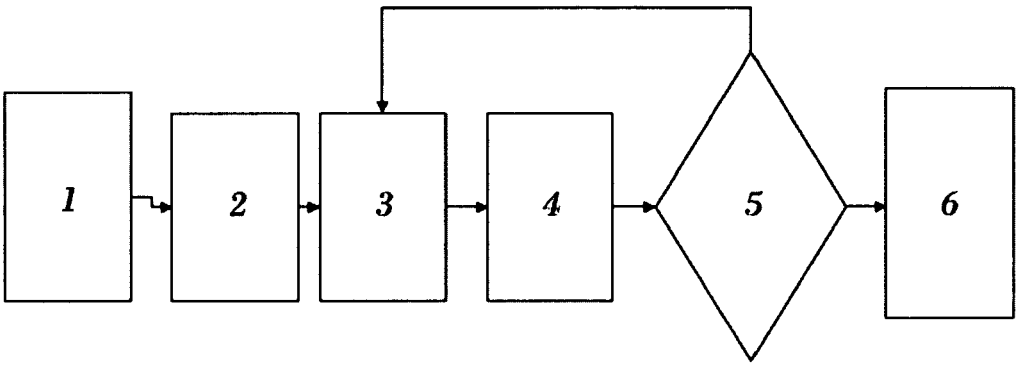


FIG. 1

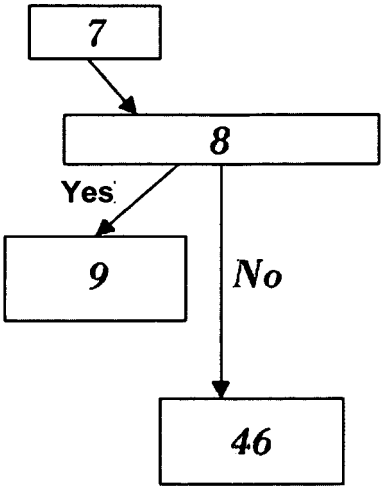


FIG. 2

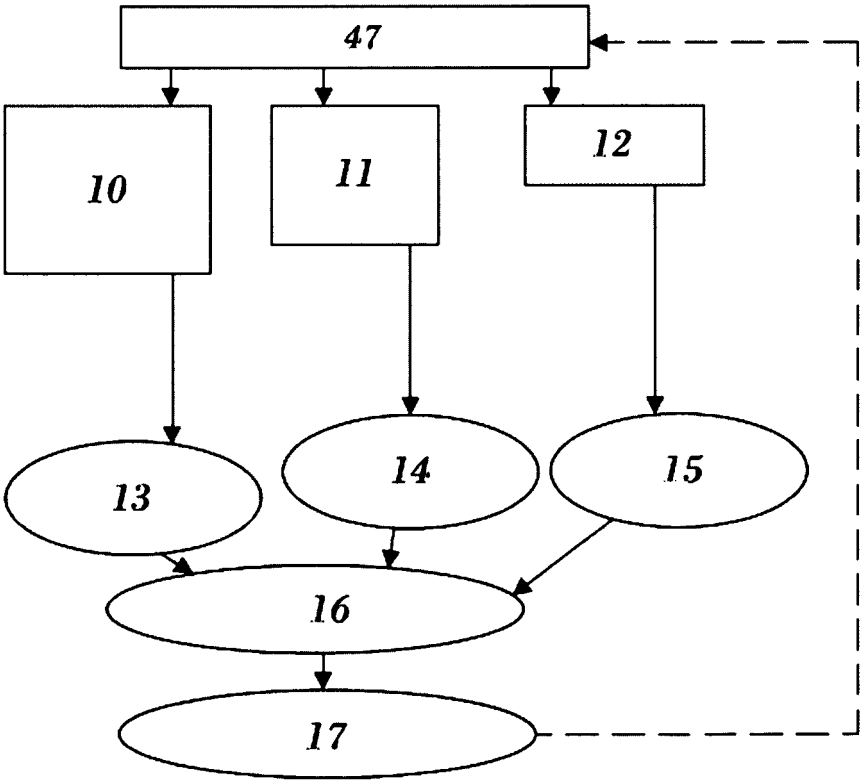


FIG. 3

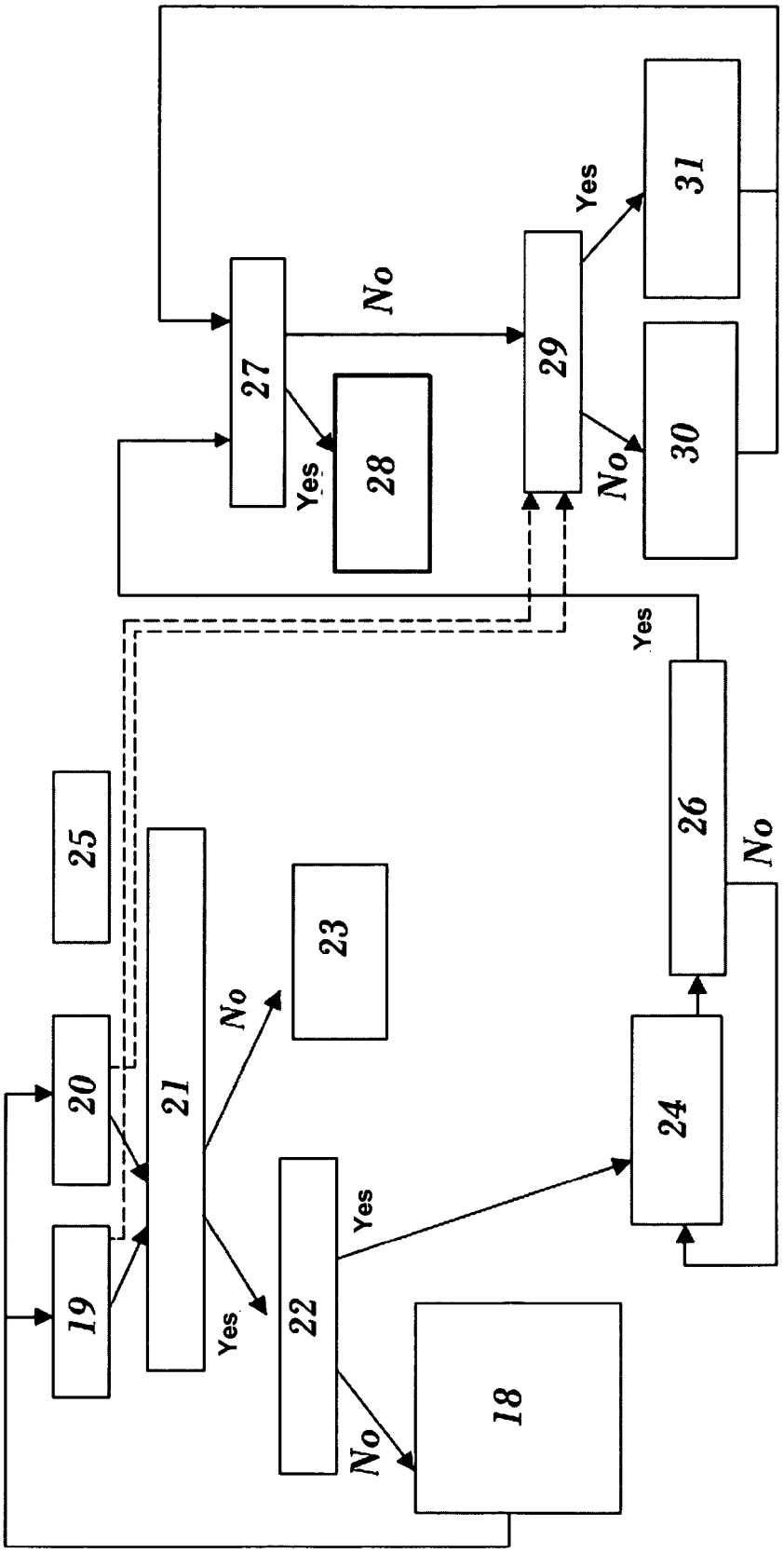


FIG. 4

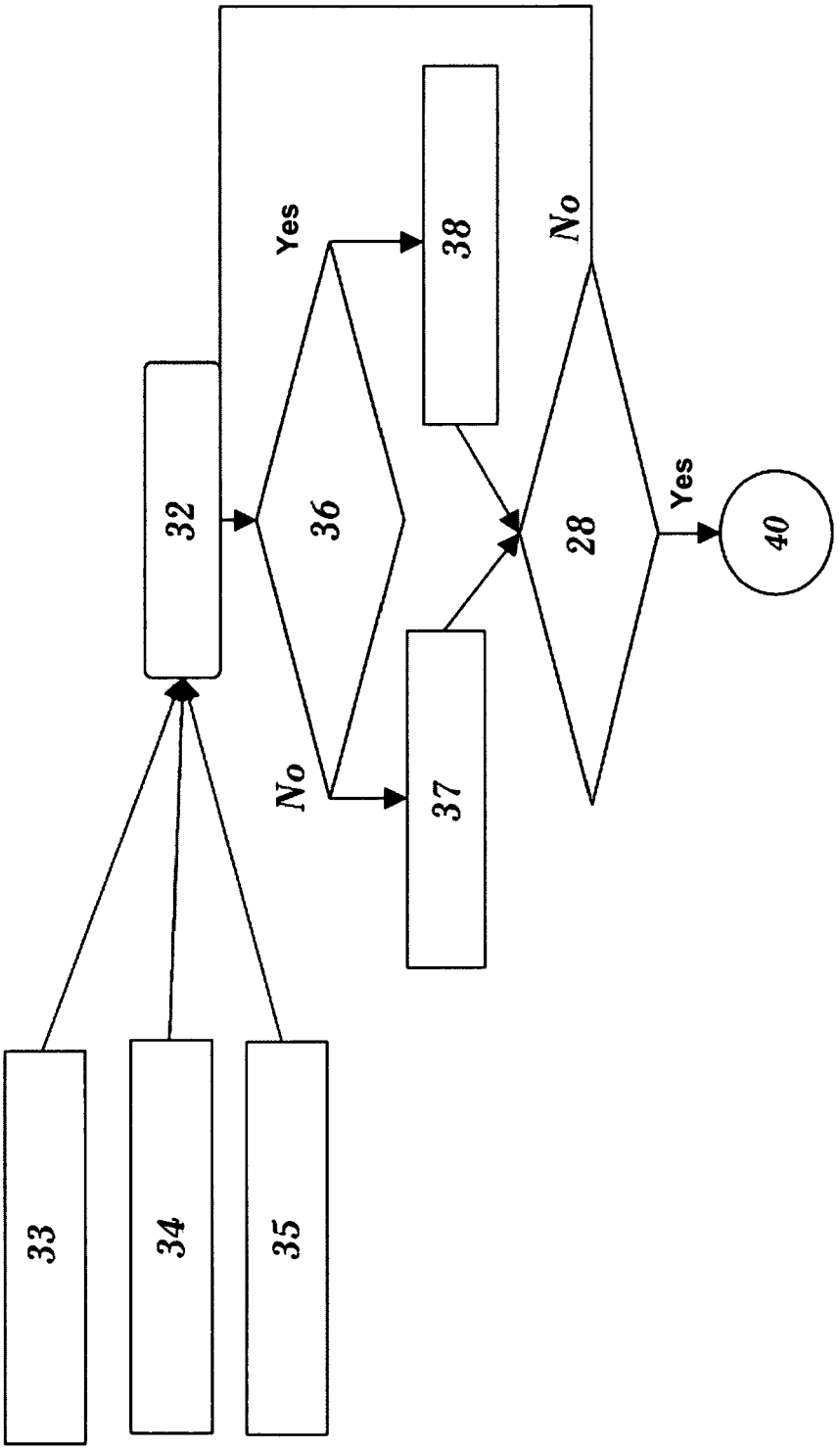


FIG. 5

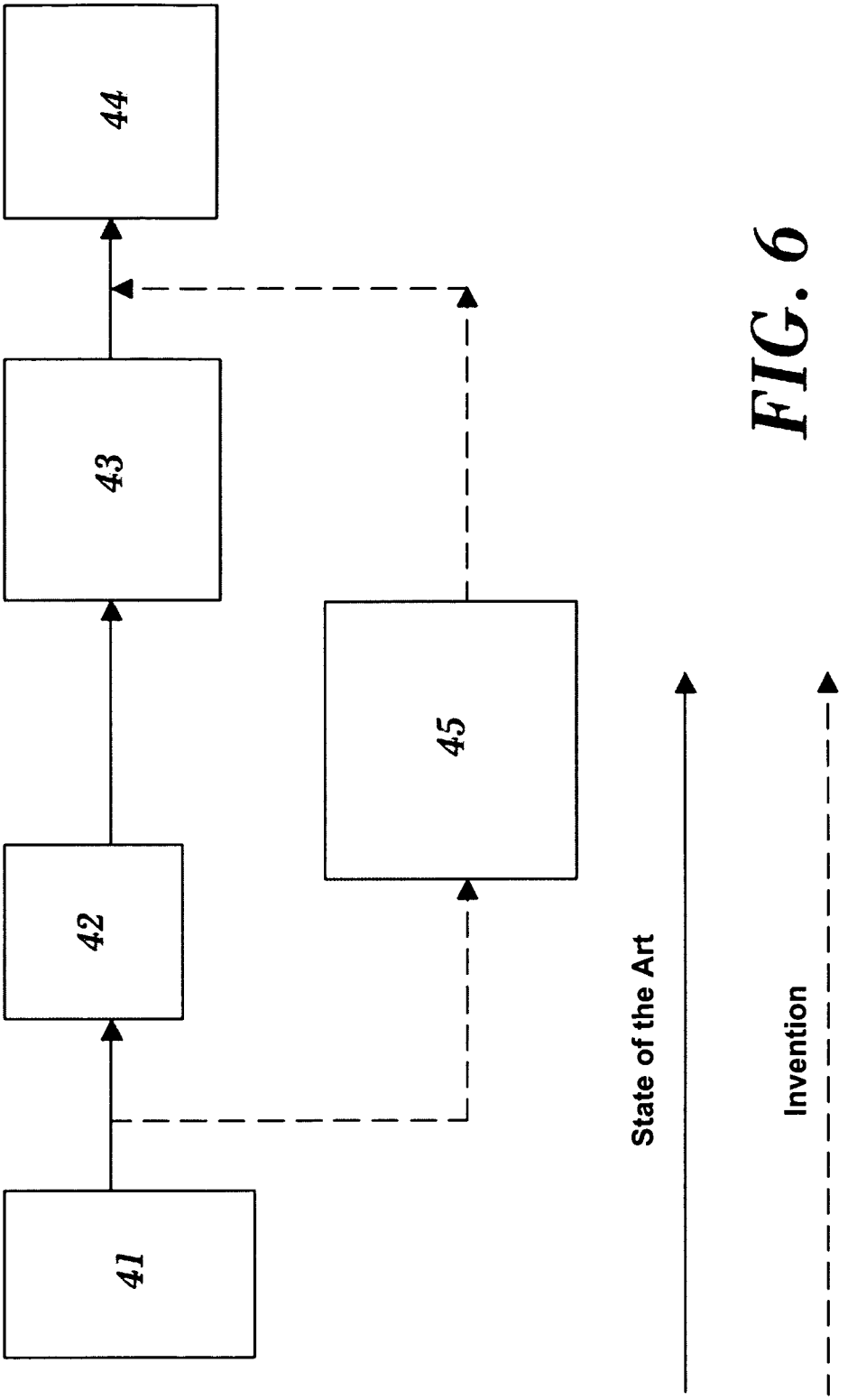
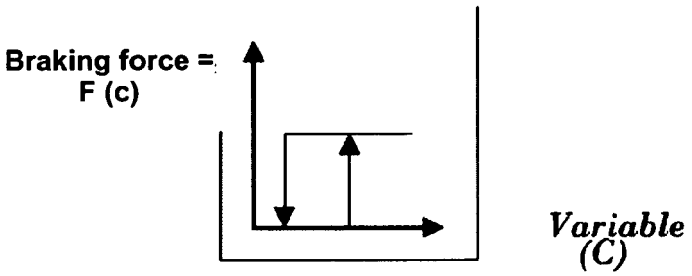
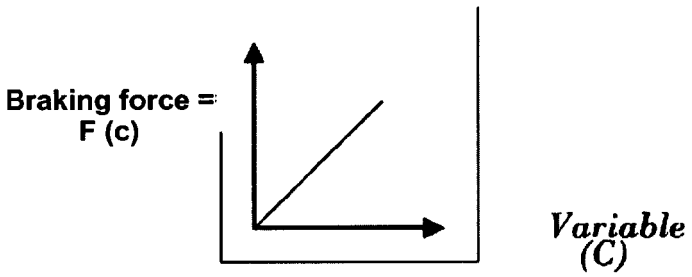


FIG. 6

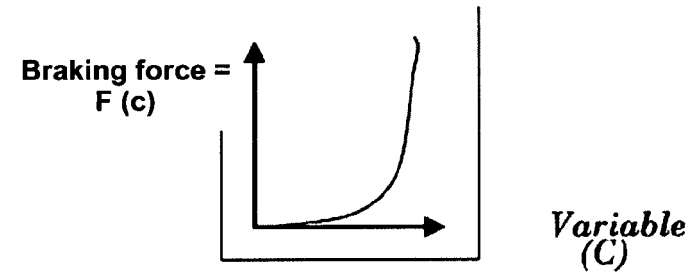
All-or-nothing braking force



Linear proportional braking force



Progressive braking function



Non-linear braking function

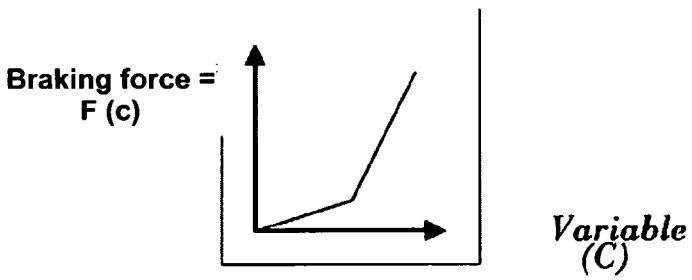


FIG. 7

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EUROPEAN SEARCH REPORT

Application Number
EP 08 38 0234

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 2005/269163 A1 (ANGST PHILIPP [CH]) 8 December 2005 (2005-12-08) * page 1, paragraph 5; figures 1,2,6 * * page 2, paragraphs 20,22,25-27 * * page 3, paragraphs 30,33,34,37,38 * * page 4, paragraphs 42,46; claims 4,5 * -----	1-16,18, 20,21	INV. B66B5/02
X	US 2006/137941 A1 (ANDREJAK JEAN-MARIE [FR] ET AL) 29 June 2006 (2006-06-29) * abstract; claims 1,5; figure 1 * * page 1, paragraphs 10,12,15; claim 1 * * page 2, paragraphs 30,33,43 * * page 3, paragraphs 48,49,51-53 * -----	1,6,7, 13-16, 18,19,21	
X	GB 1 469 576 A (HITACHI LTD) 6 April 1977 (1977-04-06) * page 2, columns 1,2, lines 25-52,76-124 * * page 4, column 1, lines 4-25 * -----	1,17,19	
			TECHNICAL FIELDS SEARCHED (IPC) B66B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	3 December 2008	Iuliano, Emanuela

CATEGORY OF CITED DOCUMENTS

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03-12-2008

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2005269163 A1	08-12-2005	AU 2005202382 A1	22-12-2005
		BR PI0501986 A	24-01-2006
		CA 2508904 A1	02-12-2005
		CN 1704325 A	07-12-2005
		JP 2005343696 A	15-12-2005
		MX PA05005819 A	12-12-2005
		NZ 540443 A	27-10-2006
US 2006137941 A1	29-06-2006	CN 1796260 A	05-07-2006
		EP 1674417 A1	28-06-2006
		FR 2880009 A1	30-06-2006
GB 1469576 A	06-04-1977	HK 16778 A	07-04-1978
		JP 1078571 C	25-12-1981
		JP 50060958 A	26-05-1975
		JP 56020271 B	12-05-1981
		MY 22978 A	31-12-1978

EPO FORM P0459

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Patent documents cited in the description

- US 20050269163 A **[0008]**
- EP 1670710 A **[0009]**
- WO 0039015 A **[0010]**
- WO 2006072428 A **[0011]**
- US 20040173413 A **[0013]**