



(11)

EP 3 753 891 A1

(12)

EUROPEAN PATENT APPLICATION

(43) Date of publication:
23.12.2020 Bulletin 2020/52

(51) Int Cl.:
B66B 1/32 (2006.01)

(21) Application number: **19180584.5**

(22) Date of filing: **17.06.2019**

(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
Designated Extension States:
BA ME
Designated Validation States:
KH MA MD TN

(72) Inventors:
• **KAUPPINEN, Tuukka**
00330 Helsinki (FI)
• **LAMPINEN, Riku**
00330 Helsinki (FI)
• **KALLIO, Toni**
00330 Helsinki (FI)
• **VIRTA, Veli-Matti**
00330 Helsinki (FI)

(71) Applicant: **KONE Corporation**
00330 Helsinki (FI)

(54) **EMERGENCY BRAKING APPARATUS**

(57) The present invention concerns an emergency braking apparatus, comprising: a hoisting machinery brake (5) configured to engage against a rotating part of an elevator hoisting machinery (2) with a thrust force to apply braking torque to the elevator hoisting machinery (2); and a controller (6) connected to the hoisting machinery brake (5), the controller configured to cause the hoisting machinery brake (5) to engage against a rotating part of an elevator hoisting machinery (2) with a first thrust force (F1) during movement of an elevator car (1) and with a second thrust force (F2) during standstill of an elevator car (1). The first thrust force (F1) is lower than the second thrust force (F2).

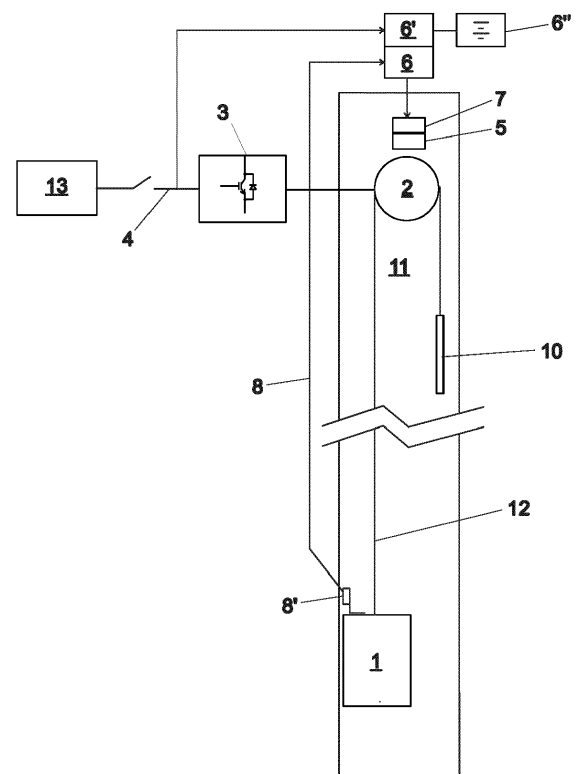


Fig. 1

Description

BACKGROUND

[0001] The present invention relates to solutions for braking movement of an elevator car, in particular in emergency stopping situations of an elevator car.

[0002] Elevator hoisting machinery has electromechanical hoisting machinery brakes. They have a frame part, a brake pad and a thrust spring in between. Thrust spring causes the brake pad to engage against a traction sheave or a rotating axis of the hoisting machinery. This engagement causes braking torque to stop movement of the hoisting machinery and therefore an elevator car. A hoisting machinery normally has two separate hoisting machinery brakes. The brakes may be used in emergency braking to stop the elevator car if an operational anomaly occurs, such as an overspeed situation of the elevator car.

[0003] Elevator may have hoisting ropes to drive and / or suspend elevator car. Traditionally elevator is driven with steel ropes running via the traction sheave of the hoisting machinery. When hoisting machinery brakes are engaged to stop elevator car movement, steel ropes slip on the traction sheave to reduce deceleration of the elevator car.

[0004] Recently new kind of coated hoisting ropes have been introduced. These may be round ropes with a high-friction coating, or belts with high-friction coating, such as a polyurethane coating. Load-carrying parts of the round ropes / belts may be steel cords and / or they can be made of synthetic fibers, such as glass fibers or carbon fibers, for example.

[0005] These new kind of coated hoisting ropes cause a higher friction between the ropes and the traction sheave than traditional steel ropes. Reduction in slipping of the ropes on the traction sheave may lead to excessive deceleration of elevator car in the emergency stopping situation, which is a non-desired condition for the elevator passengers.

SUMMARY

[0006] Objective of the invention is to provide a solution to prevent excessive deceleration of an elevator car. This problem is solved with the emergency braking apparatus of claim 1, the elevator of claim 8 and the method of claim 9. Some embodiments and combinations of different embodiments are presented in dependent claims as well as in description and drawings.

[0007] The first aspect of the invention is an emergency braking apparatus, comprising: a hoisting machinery brake configured to engage against a rotating part of an elevator hoisting machinery with a thrust force to apply braking torque to the elevator hoisting machinery; and a controller connected to the hoisting machinery brake, the controller configured to cause the hoisting machinery brake to engage against a rotating part of an elevator

hoisting machinery with a first thrust force during movement of an elevator car and with a second thrust force during standstill of an elevator car. The first thrust force is lower than the second thrust force. This can mean that braking torque caused by the first thrust force is lower than braking torque caused by the second thrust force.

[0008] Thus an elevator emergency braking apparatus may be provided, which prevents excessive deceleration of an elevator car in an emergency stopping situation. This holds true even if elevator drive unit has failed. The hoisting machinery brake may comprise a suitable energy storage, such as a thrust spring, to generate thrust force. Further, the hoisting machinery brake may comprise a suitable controllable actuator, such as an electromagnet, to provide adjustable counterforce against the thrust force, thus rendering it possible to adjust the thrust force provided by the hoisting machinery brake.

[0009] According to an embodiment, the hoisting machinery brake comprises an electromagnet. The controller comprises a power supply circuit, which comprises: a backup power supply; an input for connecting directly or indirectly to a mains power line; and an output for supplying power to an electromagnet of the hoisting machinery brake. The power supply circuit is configured to supply power from the backup power supply to the electromagnet in case of an operational anomaly of the mains power line. The controller is configured to cause the hoisting machinery brake to engage against a rotating part of an elevator hoisting machinery with the first thrust force during movement of an elevator car and with the second thrust force during standstill of an elevator car in case of an operational anomaly of the mains power line.

[0010] This can mean that an excessive deceleration of an elevator car in an emergency stopping situation can be avoided even in case of an operational anomaly of the mains power line.

[0011] The operational anomaly of the mains power line may be, for example, at least one of: power interruption of the mains power line, voltage sag of the mains power line, abnormal transient in the mains power line, overvoltage of the mains power line.

[0012] According to an embodiment, the controller is configured to switch supply of power from the mains power line to the backup power supply upon determination of an operational anomaly of the mains power line. This can mean that supply of power is switched immediately to the backup power supply such that the emergency braking apparatus remains operational to continuously provide suitable braking torque to avoid short-term excessive deceleration of an elevator car.

[0013] According to an embodiment, the controller comprises an input channel for receiving movement data of an elevator car. According to an embodiment, the controller is configured to adjust the thrust force on the basis of the movement data. This can mean that movement state of elevator car can be determined and first and second thrust force can be provided in accordance with the movement state (i.e. to provide the first thrust force when

elevator car is moving / the second thrust force when elevator car is standstill).

[0014] According to an embodiment, the controller is configured to cause the hoisting machinery brake to engage against a rotating part of an elevator hoisting machinery with a first thrust force when an emergency stopping criteria is fulfilled. This can mean that emergency stopping is initiated with a deceleration of an elevator car that is not excessive and is thus tolerable for the elevator passengers. The emergency stopping criteria may comprise one or more of the following: elevator car is moving and safety chain has been opened; elevator car is moving and operational anomaly of the mains power line is detected; elevator car is moving and elevator safety circuit indicates an operational anomaly; an overspeed situation of an elevator car is detected.

[0015] According to an embodiment, the emergency braking apparatus comprises a sensor for measuring elevator car load, and the controller is configured to select the first thrust force on the basis of the elevator car load.

[0016] According to an embodiment, the controller comprises a control loop configured to adjust the first thrust force on the basis of a deceleration value of an elevator car. This can mean that deceleration of an elevator car can be controlled to be within desired limits. Right amount of the first thrust force can be provided irrespective of operational situation, such as irrespective of elevator car load / elevator balancing situation.

[0017] The second aspect of the invention is an elevator comprising: an elevator car; an elevator hoisting machinery adapted to drive the elevator car; an elevator drive unit configured to supply electrical power from a mains power line to the elevator hoisting machinery; and the emergency braking apparatus according to the first aspect of the invention.

[0018] The third aspect of the invention is a method for braking movement of an elevator car. The method comprises: sensing movement of an elevator car to provide movement data of an elevator car, providing, by an elevator hoisting machinery brake, a first thrust force to apply first braking torque to an elevator hoisting machinery when the movement data indicates that the elevator car is moving, and providing, by an elevator hoisting machinery brake, a second thrust force to apply second braking torque to an elevator hoisting machinery when the movement data indicates that the elevator car is standstill. The first thrust force is lower than the second thrust force. This can mean that the first braking torque is lower than the second braking torque to avoid excessive deceleration of an elevator car.

[0019] Therefore operational state of an elevator car (e.g. moving / standstill) can be determined and braking torque can be provided in accordance with the operational state of the elevator car to prevent excess deceleration of an elevator car in an emergency stopping situation.

[0020] Preferably, the emergency braking apparatus according to the first aspect of the invention is used for performing the method according to the third aspect of

the invention.

[0021] According to an embodiment, the method comprises: determining status of mains power line, and supplying power from the backup power supply to an electromagnet of a hoisting machinery brake, in case of an operational anomaly of the mains power line, to provide the first thrust force during movement of an elevator car and the second thrust force during standstill of an elevator car.

[0022] According to an embodiment, the method comprises: determining from the movement data a deceleration value of an elevator car, and adjusting the first thrust force on the basis of the deceleration value of an elevator car.

[0023] According to an embodiment, the method comprises: providing an emergency stopping criteria, determining an operational state of an elevator, comparing an operational state of an elevator to an emergency stopping criteria, and providing, by an elevator hoisting machinery brake, the first thrust force to apply braking torque to an elevator hoisting machinery when the emergency stopping criteria is fulfilled.

[0024] According to an embodiment, the emergency stopping criteria comprises: elevator car is moving, and operational anomaly of the mains power line is detected. This can mean that emergency stop with a deceleration that is tolerable to an elevator passenger can be performed in case of an operation anomaly of the mains power line.

BRIEF DESCRIPTION OF THE DRAWINGS

[0025] The accompanying drawings, which are included to provide a further understanding of the invention and constitute a part of this specification, illustrate embodiments of the invention and together with the description help to explain the principles of the invention. In the drawings:

FIG. 1 illustrates a sideview of an elevator according to an embodiment.

FIG. 2 illustrates operating parameters of an emergency braking apparatus suitable to the embodiment of Fig. 1.

DETAILED DESCRIPTION

[0026] Figure 1 illustrates an elevator according to an exemplary embodiment. Elevator has an elevator car 1 and a counterweight 10, which are arranged to move vertically in an elevator shaft 11. Alternatively, elevator may be realized without a counterweight. Elevator comprises a hoisting machinery 2 which comprises a traction sheave. Hoisting ropes 12 of the elevator car 1 are engaged with the traction sheave. Hoisting ropes 9 may be round ropes or they may be belts. Load-carrying parts of them may be made of steel and / or of synthetic fibers,

such as glass fibers or carbon fibers, for example. Hoisting ropes 9 may be coated with a high-friction coating, such as a polyurethane coating.

[0027] When traction sheave of the hoisting machinery rotates, elevator car 1 moves in a first vertical direction and the counterweight moves in a second, opposite direction. Hoisting machinery 2 may contain a permanent magnet motor arranged on the same rotating axis with the traction sheave. Instead of permanent magnet motor, the hoisting machinery 2 may contain an induction motor, a reluctance motor, a stator-mounted permanent magnet (SMPM) motor or corresponding alternative.

[0028] Electrical power to the permanent magnet motor of the hoisting machinery 2 may be provided from the mains power line 4 by means of an elevator drive unit 3 (e.g. a frequency converter). The mains power line 4 may be connected or connectable to the power grid 13 via a switch. Elevator drive unit 3 takes care of speed regulation to drive the elevator car 1 between the landings to serve elevator passengers.

[0029] The hoisting machinery is provided with electromechanical hoisting machinery brakes 5, as safety devices to apply braking force to brake rotation of the traction sheave of the hoisting machinery 2 and therefore movement of the elevator car 1. According to the invention, at least one brake 5 is provided; however, as illustrated in fig. 1, there are normally two separate similar brakes 5 arranged to apply braking force to the hoisting machinery 2. It is also possible that there are more than two brakes 5, such as three or four brakes 5. Different kind of brakes 5, such as disc brakes, drum brakes and shoe brakes, are applicable. The brakes 5 may altogether be dimensioned to stop and hold an elevator car with 125% load (25% overload) at standstill in the elevator shaft 1.

[0030] Each of said hoisting machinery brakes 5 may have a frame part, which is fixed to the body of the hoisting machinery 2, and an armature, which is provided with a brake pad, which is arranged to engage the rotating part of the hoisting machinery 2. The frame part contains an electromagnet 7, such as a coil or a winding. The rotating part is provided with a braking surface, such as a brake disc, a drum or a rim, to receive the brake pad. Between the frame part and the armature may be arranged an energy storage, such as a thrust spring, to apply a thrust force. When the thrust force presses the brake pad against the braking surface of the rotating part, friction between brake pad and braking surface causes braking torque being applied to the rotating part of the hoisting machinery 2. Braking torque causes stopping of rotation of the hoisting machinery 2 and thus stopping of an elevator car 1. When electric current is supplied to the electromagnet 7, attraction force between the frame part and the armature causes disengagement of the brake pad from the braking surface and opening of the brake.

[0031] When an elevator car 4 moves in the shaft 11, an operational anomaly may take place that requires emergency stopping of the elevator car 1. Such an op-

erational anomaly of the elevator may be, for example, overspeed situation of an elevator car 1, operational anomaly of the mains power line 4, opening of an elevator safety chain (for example caused by opening of landing door into elevator shaft), or failure of elevator control, such as failure of the elevator drive unit 3. The operational anomaly of the mains power line 4 may be, for example, power interruption of the mains power line 4, voltage sag of the mains power line 4, abnormal transient in the mains power line 4 or overvoltage situation in the mains power line 4. In the emergency stopping situation measures are taken to stop the elevator car 1 when an operational anomaly is detected.

[0032] Therefore, the elevator of fig. 1 comprises an emergency braking apparatus, which comprises said hoisting machinery brakes 5. As disclosed above, the brakes 5 are configured to engage against a braking surface of a rotating part of an elevator hoisting machinery 2 to apply braking torque to the hoisting machinery 2.

[0033] Further, the emergency braking apparatus of fig. 1 comprises a controller 6 connected to the hoisting machinery brakes 5. Controller 6 may comprise a microcontroller, FPGA circuit, microcomputer or corresponding control component. Controller 6 may be designed to fulfill safety code required for elevator safety devices in accordance with elevator safety standards and norms, such as safety norm EN-81. Especially, controller 6 may be designed to fulfill safety integrity level 3 (SIL 3). Controller 6 comprises a power supply circuit 6'. Power supply circuit 6' comprises a power stage, which is connected to the control component. Input of the power stage can be coupled to the mains power line 4 and to a backup power supply 6'', such as to a battery 6''. Output of the power stage is coupled to the electromagnets 7 of the hoisting machinery brakes 5. Through the power stage electric current is supplied in a controlled manner to the electromagnets 7.

[0034] Power stage may be coupled directly to the mains power line 4 or indirectly, for example, via the DC link of the elevator drive unit 3. Power supply circuit 6' contains one or more switches, such as controllable switches and / or diodes. By means of the switches power supply, i.e. source of electrical power, can be switched from the mains power line 4 to the backup power supply 6'', and vice versa.

[0035] Elevator car 1 may be equipped with a sensor or reader 8', to provide movement data of an elevator car 1. Any sensor or reader 8', which is suitable for sensing movement of an elevator car 1, may be used. Such sensor may be, for example, an encoder, acceleration sensor, inductive sensor, a camera, magnetic sensor, optical sensor, acoustic sensor etc.. Sensor or reader 8' is connected to the controller 6 via a communication channel 8. Communication channel 8 may be a data bus or a signal line, for example. Physical medium of the communication channel 8 may be a wire or a wireless link. To improve reliability of the movement data, said sensor or reader 8' and / or said communication channel 8 may be

reduplicated.

[0036] Controller 6 receives information from plurality of devices, such as from an elevator control unit, safety chain, overspeed governor, from limit switches of an elevator car, from the sensor or reader 8', from the drive unit 3, from load weight device etc. to determine operational state of the elevator. Controller 6 also determines movement state of an elevator car 1. If an operational anomaly of the elevator is determined while elevator car 1 is moving, controller 6 concludes fulfillment of an emergency stopping criteria and initiates emergency braking of an elevator car 1.

[0037] Figure 2 illustrates an exemplary emergency stopping situation of an elevator car 1, with emergency braking apparatus of Fig. 1 in operation. In Fig. 2 reference "v" denotes speed of elevator car, "F1" denotes first thrust force and "F2" denotes second thrust force. Term "t" denotes time. In case of fulfillment of an emergency stopping criteria, controller 6 lowers currents of the electromagnets 7, causing brake pads of the hoisting machinery brakes 5 to engage against braking surface of the elevator hoisting machinery 2 with a first thrust force F1 (at moment t1 in fig. 2). First thrust force F1 is selected such that a suitable braking torque will be applied to the elevator hoisting machinery, which braking torque does not cause excessive, non-tolerable deceleration of an elevator car 1. Acceptable amount of deceleration is generally always substantially below 1G (acceleration due to gravity). Preferably, said deceleration is under 0,6G, most preferably under 0,3G. This amount of deceleration does not feel excessive and non-tolerable for the elevator passengers. For example, when an elevator car is moving downwards with a full load, higher first thrust force F1 is selected, to apply higher braking torque, than when the car is moving downwards with a smaller load. In other words, the first thrust force F1 is selected on the basis of elevator car load.

[0038] In case of an operational anomaly of the mains power line 4, the power supply circuit 6' immediately changes source of electrical power of the power stage from the mains power line 4 to the backup power supply 6", such that there are no interruptions in the currents supplied to the electromagnets 7. With this measure desired non-excessive deceleration 9 of elevator car 1 may be achieved.

[0039] During the deceleration, controller 6 observes movement state of the car 1. When controller 6 detects that movement has stopped and car is standstill (moment t2, fig. 2), controller interrupts current to the electromagnets 7, causing thrust force of the brake pads to increase from the magnitude of the first thrust force F1 to the higher magnitude of the second thrust force F2. Thus braking torque increases, ensuring that elevator car 1 remains standstill in the shaft 11.

[0040] In an alternative embodiment, the controller 6 comprises a control loop configured to adjust the first thrust force F1 on the basis of a deceleration value of an elevator car 1. Controller calculates continuously the de-

celeration value, i.e. magnitude of deceleration of the elevator car 1, from the movement data. If the deceleration value indicates that deceleration is lower than desired, controller 6 decreases current of the electromagnets 7, such that first thrust force / braking torque increases. If the deceleration value indicates that deceleration is higher than desired, controller 6 increases current of the electromagnets 7, such that first thrust force / braking torque decreases. This way deceleration of elevator car 1 may be controlled to be in an allowable and non-excessive range. At the same time stopping distance of elevator car 1 remains within allowable limits.

[0041] The invention can be carried out within the scope of the appended patent claims. Thus, the above-mentioned embodiments should not be understood as delimiting the invention.

Claims

1. An emergency braking apparatus, comprising:

a hoisting machinery brake (5) configured to engage against a rotating part of an elevator hoisting machinery (2) with a thrust force to apply braking torque to the elevator hoisting machinery (2); and

a controller (6) connected to the hoisting machinery brake (5), the controller configured to cause the hoisting machinery brake (5) to engage against a rotating part of an elevator hoisting machinery (2) with a first thrust force (F1) during movement of an elevator car (1) and with a second thrust force (F2) during standstill of an elevator car (1), wherein the first thrust force (F1) is lower than the second thrust force (F2).

2. The emergency braking apparatus according to claim 1, wherein the hoisting machinery brake (5) comprises an electromagnet (7); and wherein the controller (6) comprises a power supply circuit (6'), which comprises:

a backup power supply (6");

an input for connecting directly or indirectly to a mains power line (4);

an output for supplying power to an electromagnet (7) of the hoisting machinery brake (5);

and wherein the power supply circuit (6') is configured to supply power from the backup power supply (6") to the electromagnet (7) in case of an operational anomaly of the mains power line (4);

and wherein the controller (6) is configured to cause the hoisting machinery brake (5) to engage against a rotating part of an elevator hoist-

- ing machinery (2) with the first thrust force (F1) during movement of an elevator car and with the second thrust force (F2) during standstill of an elevator car in case of an operational anomaly of the mains power line (4). 5
3. The emergency braking apparatus according to claim 1 or 2, wherein the controller (6) is configured to switch supply of power from the mains power line (4) to the backup power supply (6") upon determination of an operational anomaly of the mains power line (4). 10
4. The emergency braking apparatus according to any of the preceding claims, wherein the controller (6) comprises an input channel (8) for receiving movement data of an elevator car (1). 15
5. The emergency braking apparatus according to claim 4, wherein the controller (6) is configured to adjust the thrust force on the basis of the movement data. 20
6. The emergency braking apparatus according to any of the preceding claims, wherein the controller (6) is configured to cause the hoisting machinery brake (5) to engage against a rotating part of an elevator hoisting machinery (2) with a first thrust force (F1) when an emergency stopping criteria is fulfilled. 25
7. The emergency braking apparatus according to any of the preceding claims, wherein the controller (6) comprises a control loop configured to adjust the first thrust force (F1) on the basis of a deceleration value of an elevator car (1). 30
8. An elevator comprising: 35
- an elevator car (1);
 - an elevator hoisting machinery (2) adapted to drive the elevator car (1);
 - an elevator drive unit (3) configured to supply electrical power from a mains power line (4) to the elevator hoisting machinery (2); and
 - the emergency braking apparatus according to any of claims 1 - 7. 40
9. A method for braking movement of an elevator car (1), the method comprising: 45
- sensing movement of an elevator car (1) to provide movement data of an elevator car (1),
 - providing, by an elevator hoisting machinery brake (5), a first thrust force (F1) to apply first braking torque to an elevator hoisting machinery (2) when the movement data indicates that the elevator car (1) is moving, and 50
- providing, by the elevator hoisting machinery brake (5), a second thrust force (F2) to apply second braking torque to the elevator hoisting machinery (2) when the movement data indicates that the elevator car (1) is standstill, wherein the first thrust force (F1) is lower than the second thrust force (F2).
10. The method according to claim 9, comprising: 55
- determining status of mains power line (4),
 - supplying power from the backup power supply (6") to an electromagnet (7) of the hoisting machinery brake (5), in case of an operational anomaly of the mains power line (4), to provide the first thrust force (F1) during movement of an elevator car (1) and the second thrust force (F2) during standstill of an elevator car (1).
11. The method according to claim 9 or 10, comprising:
- determining from the movement data a deceleration value of an elevator car (1), and
 - adjusting the first thrust force (F1) on the basis of the deceleration value of an elevator car (1).
12. The method according to any of claim 9 - 11, comprising:
- providing an emergency stopping criteria
 - determining an operational state of an elevator
 - comparing an operational state of an elevator to an emergency stopping criteria, and
 - providing, by an elevator hoisting machinery brake (5), the first thrust force (F1) to apply braking torque to an elevator hoisting machinery (2) when the emergency stopping criteria is fulfilled.
13. The method according to claim 12, wherein the emergency stopping criteria comprises:
- elevator car (1) is moving, and
 - operational anomaly of the mains power line (4) is detected.

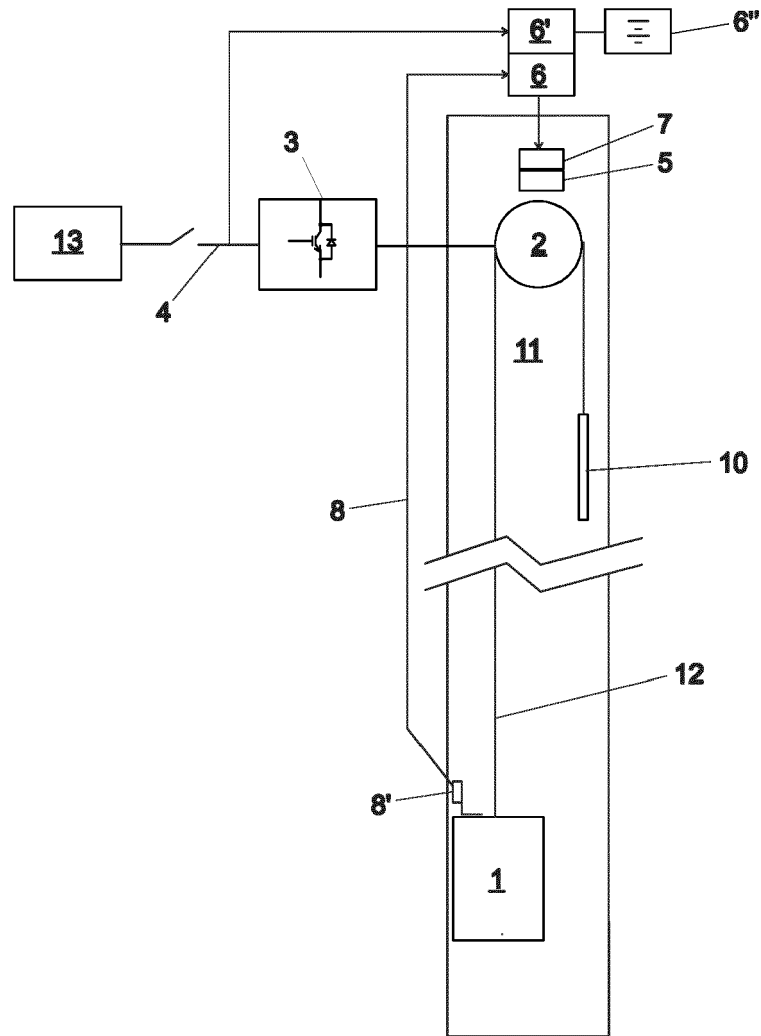


Fig. 1

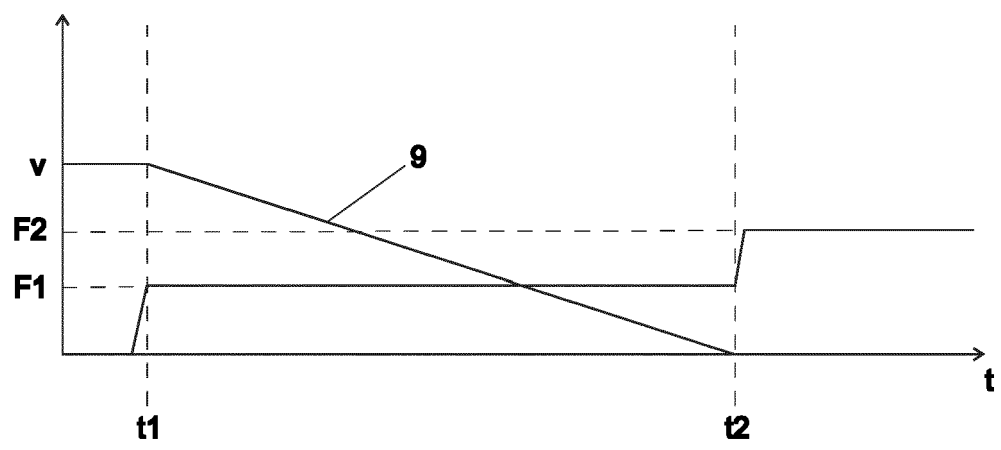


Fig. 2



EUROPEAN SEARCH REPORT

Application Number
EP 19 18 0584

5

10

15

20

25

30

35

40

45

50

55

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 5 244 060 A (TANAKA MASAKATSU [JP] ET AL) 14 September 1993 (1993-09-14) * column 5, lines 13-48 * * column 6, lines 35-47,65 - column 7, line 3 *	1-13	INV. B66B1/32
X	JP H03 243576 A (MITSUBISHI ELECTRIC CORP) 30 October 1991 (1991-10-30) * abstract *	1-13	
A	JP 2001 278572 A (MITSUBISHI ELECTRIC CORP) 10 October 2001 (2001-10-10) * paragraphs [0017], [0018] *	1-13	
			TECHNICAL FIELDS SEARCHED (IPC)
			B66B
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 18 December 2019	Examiner Lenoir, Xavier
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

EPO FORM 1503 03/02 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 19 18 0584

5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

18-12-2019

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5244060 A	14-09-1993	JP H04333487 A	20-11-1992
		US 5244060 A	14-09-1993
JP H03243576 A	30-10-1991	NONE	
JP 2001278572 A	10-10-2001	JP 4439074 B2	24-03-2010
		JP 2001278572 A	10-10-2001