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(71) Applicant: **STEM S.r.l.**
27010 Cura Carpignano (Pavia) (IT)

(72) Inventors:
- **Moro, Fabio**
  27100 Pavia (IT)
- **Moro, Simone**
  27100 Pavia (IT)

(74) Representative: **Giugni, Valter**
PROPRIA S.r.l.,
Via Mazzini 13
33170 Pordenone (IT)

(54) Electrically powered control arrangement, in particular for lifts, elevators and the like

(57) Electrically powered control arrangement, in particular for lifts, elevators and the like, comprising a plurality of monostable sensors (2) adapted to guide a car (3) into alignment with the floors, and at least a bistable sensor (4) adapted to identify the end-of-travel condition of the car (3) at the extreme top and bottom floors and to issue a corresponding signal to a control unit (5) of the car (3); the control arrangement also comprises circuit means (6) adapted to continuously record the signal delivered by the bistable sensor (4) and to keep the last so recorded signal in store even in the case of a power failure, so as to deliver it to the control unit (5) upon restoration of the power supply.

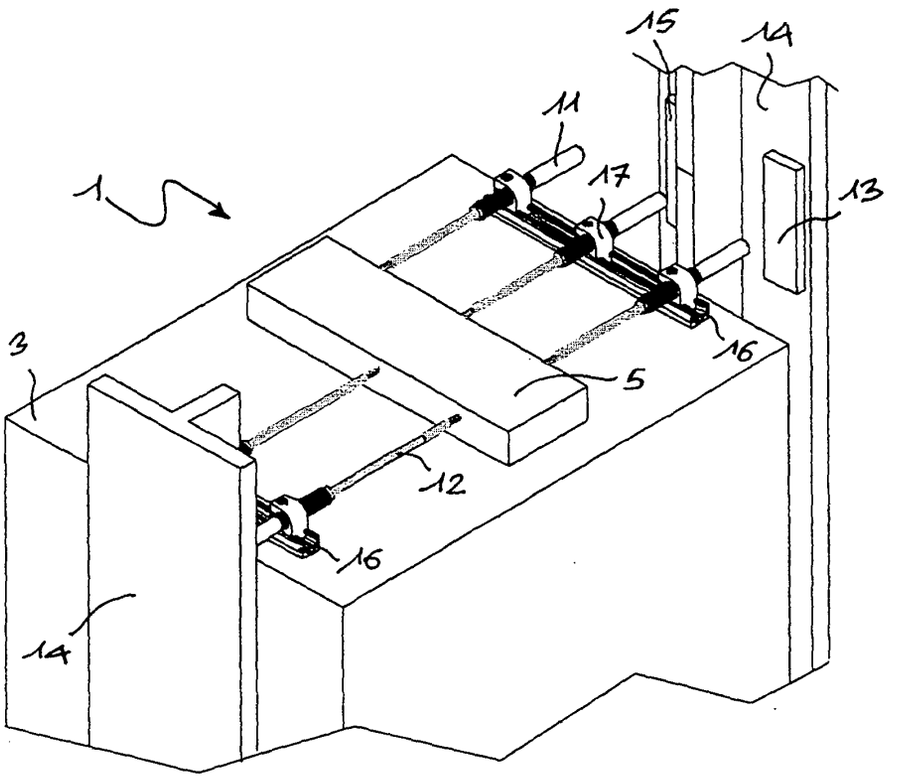


FIG.1

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Description

[0001] The present invention refers to an arrangement adapted to control the main functions of a cage or car, in particular a car of a lift, elevator or similar apparatus, concerning the displacements and the position thereof.

[0002] Some of the arrangements that are currently used to such purpose make use of sensors based on the generally known Hall effect, i.e. the development of a potential difference across the opposite sides of a semiconductor or metal strip, through which an electric current is caused to flow, and which is exposed to a magnetic field perpendicular to the plane thereof in a manner that is proportional to the current density, the magnetic field and a coefficient that depends on the nature of the material.

[0003] These sensors feature a considerable sensitivity to magnetic fields generated by activating magnets arranged all along the lift shaft, owing to them being permanently associated to a polarization magnet, the magnetic field of which, while being insufficient in view of generating said Hall effect, adds up to the magnetic field of the activating magnet, so as to enable the latter to effectively perform its task even if it is placed at a certain distance from said sensor, with which it has no connection at all from a mechanical point of view. Monostable-type Hall-effect magnetic sensors, which only become and stay activated just as long as the sensors dwells within the magnetic field of the activating sensor, are used to guide the lift into proper alignment to the various floors. Bistable-type sensors, on the contrary, are used to detect and indicate the end-of-travel condition of the lift car, owing to them being constantly kept in an activated state all along the lift shaft and being only switched into a de-activated state, by means of appropriate magnets, when the lift moves beyond the last floor but one both upwards and downwards. Should no such switchover or change of state take place, the lift car might enter an overtravel condition, in which case it would cause the mechanical end-of-travel devices to be activated, which are provided as an ultimate safety provision, under resulting immediate stop of the same car.

[0004] In such a kind of application, bistable Hall-effect sensors have a drawback in that they are not able to keep a state of de-activation thereof in store in the case of a power failure. Owing to the fact that, when the power supply is restored, these sensors are anyway returned into the activated state thereof, they can therefore deliver an incorrect end-of-travel signal that would cause the safety devices to trip. So, for instance, if the power supply fails when the lift car is between the penultimate and the last floor, either upwards or downwards, when the power supply is eventually restored, the sensor is returned into the activated state thereof and the car, upon reaching the last floor either way would enter the above-mentioned overtravel condition.

[0005] It therefore is the object of the present invention to provide an electrically powered control arrangement, in particular for lifts and elevators, which does away with the drawbacks of prior-art solutions.

[0006] Within this general object, it is a purpose of the present invention to provide a control arrangement, which is capable of storing and maintaining the end-of-travel indication even in the case of a power failure, so as to deliver the correct signal upon restoration of the power supply.

[0007] Still another purpose of the present invention is to provide a control arrangement, which is capable of ensuring a maximum extent of safety and reliability during each and any step of displacement and operation of the lift car.

[0008] Finally, an equally important purpose of the present invention is to provide a control arrangement, which is simple in its construction and capable of being produced competitively from a cost-related point of view.

[0009] According to the present invention, these aims and advantages, along with further ones that will emerge from the following description, are reached in a control arrangement incorporating the features and characteristics as recited in the appended claims 1 et seq.

[0010] Features and advantages of the present invention will anyway be more readily understood from the description of a preferred, although not sole embodiment that is given below by way of non-limiting example with reference to the accompanying drawings, in which:

- Figure 1 is a perspective schematical view of a control arrangement according to the present invention;
- Figure 2 is a view similar to the preceding one, illustrating the sensors of the control arrangement according to the present invention;
- Figure 3 is a side elevational view of the bistable sensor of the control arrangement according to the present invention; and
- Figure 4 is a front elevational view of the bistable sensor of the control arrangement according to the present invention.

[0011] With reference to the above-noted Figures, the control arrangement according to the present invention, as generally indicated at 1, comprises a plurality of monostable Hall-effect magnetic sensors 2 adapted to guide a car 3 into alignment with the various floors, and at least a bistable Hall-effect magnetic sensor 4 adapted to indicate the end-of-travel condition of the lift car 3 at the extreme top and bottom floors to a control unit 5 of the car 3.

[0012] According to the invention, the control arrangement also comprises circuit means 6 adapted to continuously record the signal delivered by the bistable sensor 4 and to keep the last so recorded signal in store even

in the case of a power failure, so as to deliver it to the control unit 5 upon restoration of the power supply.

[0013] The magnetic Hall-effect proximity sensors consist of an integrated circuit 7 that includes a Hall-generator energized by a control current, a trigger circuit and a transistor amplifier to generate and issue an output signal. The integrated circuit 7 is mounted on a support printed-circuit board 8, which defines a power supply circuit 9 supplying the control current, and on which there is mounted a permanent magnet 10. The printed-circuit support board 8, with all the pertaining electronics and the permanent magnet 10, is housed in a hermetically sealed protection casing 11, which is penetrated by a connection cable 12.

[0014] The Hall generator delivers an output voltage that is proportional to both the control current flowing across it and the magnetic field in which it is immersed. In the sensors of the monostable-type 2, the permanent magnet 10, which is arranged near the Hall generator, provides a polarization magnetic field that is by itself insufficient to activate the Hall generator, but causes the sensitivity of the sensor 2 to increase when the latter comes near an activating magnet 13 arranged along the guide members 14 of the car 3 in the lift shaft. Thus, the monostable sensor 2 delivers its signal just as long as the same sensor 2 is within the magnetic field created by the activating magnet 13.

[0015] The permanent magnet 10 that is provided in the bistable Hall-effect magnetic sensor 4 generates a magnetic field having such a strength as to be effective in increasing the sensitivity of the Hall generator, which is already performing as a bistable device inherently. The Hall generator, which stays active all along the shaft of the lift, is de-activated as soon as the sensor meets with a NORTH-polarity magnetic field generated by a bipolar magnet 15 (having both north and south poles on the same face) arranged along the guide members 14 of the car 3 in the lift shaft. When moving for instance upwards, the Hall generator, upon moving beyond said bipolar magnet 15 (the pole sequence of which is therefore SOUTH-NORTH, so that the subsequent downward movement will enable the same magnet 15 to re-activate the sensor), outputs an OFF signal to the sensor. Under normal operating conditions, such signal is inherently kept in store, i.e. preserved by the bistable Hall-effect device 4, while the circuit means 6 introduced according to the invention enable such signal to be kept in store and preserved by said device even under temporary power-supply failure conditions. Without the provision of these circuit means 6, in fact, the Hall-generator would in such circumstances output an ON signal that would be incorrect.

[0016] The control arrangement that is the subject of this patent application is adapted to control the main functions concerning the displacements and the position of the car 3 of the lift or elevator, and is installed outside the car 3 itself by means of a bracket-like support 16, on which there are mounted the various sensors 2, 4 with the aid of fastening means 17 that allow for the position of the same sensors 2, 4 to be adjusted relative to the support bracket 16.

[0017] The sensors 2, 4 are arranged near the guide members 14 of the car 3 of the lift, along which there are provided the magnetic elements 13,15 that interact with the sensors 2, 4 to detect and indicate the position of the same car 3. The connecting cable 12 ensures the power supply to the sensors 2, 4 and receives and carries the output signals delivered by the integrated circuit 7 to the control unit 5.

[0018] In the example being considered, the control arrangement includes three monostable Hall-effect magnetic sensors, which are provided in a horizontally aligned arrangement and cooperate with the activating magnets 13 of the lift or elevator installation to issue a series of signals that indicate the various situations, such as the presence of the lift car 3 at the floor, the point at which the travelling speed of the same car 3 has to be accelerated or decelerated and the zone at which the re-alignment has be carried out, to the control unit 5.

[0019] The control arrangement further includes two bistable Hall-effect magnetic sensors 4 of the afore described kind, which are provided in a horizontally aligned arrangement and cooperate with the bipolar magnets 15 situated in correspondence of the top and bottom floors to output pairs of ON/OFF signals that indicate the end-of-travel condition to the control unit 5.

[0020] According to the present invention, the circuit means 6 included in the control arrangement are preferably arranged inside, i.e. built into the bistable sensors 4, as connected directly to the printed-circuit board 8 between the permanent magnet 10 and the power-supply circuit 9. In an advantageous manner, these circuit means 6 comprise a microprocessor adapted to continuously record the output signal issued by the integrated circuit 7 and keep, i.e. preserve it in store. Thus, this microprocessor performs as an interface between the integrated circuit 7 and the control unit 5, and is capable, under temporary power-supply failure conditions, of keeping in store, i.e. preserving the last signal delivered to it, and then sending such signal to the control unit 5 as soon as the power supply is restored.

[0021] As already hinted afore, the two bistable sensors 4 of the control arrangement have the task of identifying the end-of-travel condition of the lift car. All along the lift shaft, both bistable sensors 4 output an ON signal. When the lift car is moving upwards, as soon as it moves beyond the bipolar magnet 15 provided between the last floor but one and the top floor, one of the two bistable sensors, i.e. the one defined as upward-displacement sensor, delivers an OFF signal owing to the magnetic field which it is moving across, whereas the other bistable sensor, i.e. the one defined as downward-displacement sensor, keeps delivering an ON signal. An OFF signal is on the contrary delivered by the downward-displacement bistable sensor when the car 3 reaches the first or bottom floor, owing again to the effect

of an appropriate bipolar magnet 15, whereas the upward-displacement bistable sensor keeps issuing an ON signal.

[0022] This twofold indication is effective in informing the control unit that the upward or downward end-of-travel condition, as the case may be, has been reached, and that, the next time that it is going to be operated, the car 3 has therefore to necessarily travel downwards or upwards, respectively.

[0023] In the case that a power failure event happens to occur while the lift car 3 is arriving at the top floor or at the bottom floor, the upward-displacement and downward-displacement bistable sensors 4, respectively, would lose their OFF signal and, upon restoration of the power supply, would automatically deliver an ON signal. As a result, the control unit 5 would identify and record a non-existing overtravel condition and activate the mechanical end-of-travel devices provided as an ultimate safety provision, which therefore trip to almost immediately cause the car 3 to stop with a corresponding abrupt rebound.

[0024] The microprocessor, which both bistable sensors 4 are provided with, makes sure that the ON/OFF signal states are preserved correspondingly in the case of a power supply failure, by continuously supervising the state of the Hall-effect sensor and storing each time the preceding state in its memory, thereby effectively preventing the ultimate safety systems from inappropriately and dangerously becoming activated and tripping.

[0025] The operation of the microprocessor is ensured by the power-supply circuit 9 that, further to protecting the integrated circuit 7, enables a PNP-type or NPN-type output to be provided on the printed-circuit board, i.e. an output with four soldering pools or contacts 18: one for the power supply, one for the grounding contact and the other two in accordance with the kind of output provided. In an advantageous manner, both the bistable sensors 4 and the monostable sensors 2 are provided with LED-based indicator means 19 connected to the printed-circuit board 8 downstream of the microprocessor, so as to enable the state of the output signal to be indicated and read visually.

[0026] Fully apparent from the above description is therefore the ability of the the present invention to effectively reach the afore cited aims and advantages by providing a control arrangement that most correctly and reliably identifies and indicates the end-of-travel condition in case of power failure events.

[0027] It will of course be appreciated that the control arrangement according to the present invention, as described above, may be subject to a number of modifications or may be embodied in a number of different manners without departing from the scope of the invention, and that various component parts among the above-indicated ones may furthermore be replaced with technically equivalent counterparts.

[0028] In addition, it should be noticed that the materials used, as well as the shapes and the sizing of the individual items of the arrangement of the invention, may each time be selected so as to more appropriately meet the particular requirements or suit the particular application.

Claims

1. Electrically powered control arrangement, in particular for lifts, elevators and the like, comprising a plurality of monostable sensors (2) adapted to guide a car (3) into alignment with the floors, and at least a bistable sensor (4) adapted to identify the end-of-travel condition of the car (3) at the extreme top and bottom floors and to output a corresponding signal to a control unit (5) of the car (3), **characterized in that** said control arrangement also comprises circuit means (6) adapted to continuously record the signal delivered by said bistable sensor (4) and to keep the last so recorded signal in store even in the case of a power failure, so as to deliver it to said control unit (5) upon restoration of the power supply.

2. Control arrangement according to claim 1, **characterized in that** said bistable sensor (4) comprises a bistable Hall-effect sensor consisting of an integrated circuit (7) that includes a Hall generator energized by a control current, a trigger circuit and a transistor amplifier to generate and issue an output signal, said integrated circuit (7) being mounted on a printed-circuit support board (8), which defines a power-supply circuit (9) supplying the control current, and on which there is mounted a permanent magnet (10), said printed-circuit support board (8) being housed in a hermetically sealed protection casing (11), which is penetrated by a connection cable (12) connecting it with said control unit (5).

3. Control arrangement according to claim 1 or 2, **characterized in that** it comprises at least two bistable Hall-effect sensors that cooperate with bipolar magnets (15), situated in correspondence of the extreme top and bottom floors in the lift shaft, to output pairs of ON/OFF signals that indicate the top and bottom end-of-travel condition to the control unit (5), said signals being recorded and stored by said circuit means (6) and kept in store even under power failure conditions to be then sent to the control unit (5) as soon as the power supply is restored.

4. Control arrangement according to any of the preceding claims or combination thereof, **characterized in that** said circuit means (6) are connected to the printed-circuit board (8) of said at least a bistable Hall-effect sensor between the permanent magnet (10) and the power-supply circuit (9).

5. Control arrangement according to any of the pre-

ceding claims or combination thereof, **characterized in that** said circuit means (6) comprise a microprocessor adapted to continuously record the output signal issued by said integrated circuit (7) and preserve it in store, said microprocessor performing as an interface between the integrated circuit (7) and the control unit (5), and being capable of sending the last so recorded and stored signal to the control unit (5) upon restoration of the power supply.

6. Control arrangement according to any of the preceding claims or combination thereof, **characterized in that** said bistable sensors are provided with LED-based indicator means (19) connected to the printed-circuit board (8) downstream of said circuit means (6), so as to enable the state of the output signal to be displayed visually.

7. Control arrangement according to any of the preceding claims or combination thereof, **characterized by** what has been described and illustrated in and with reference to the accompanying drawings.

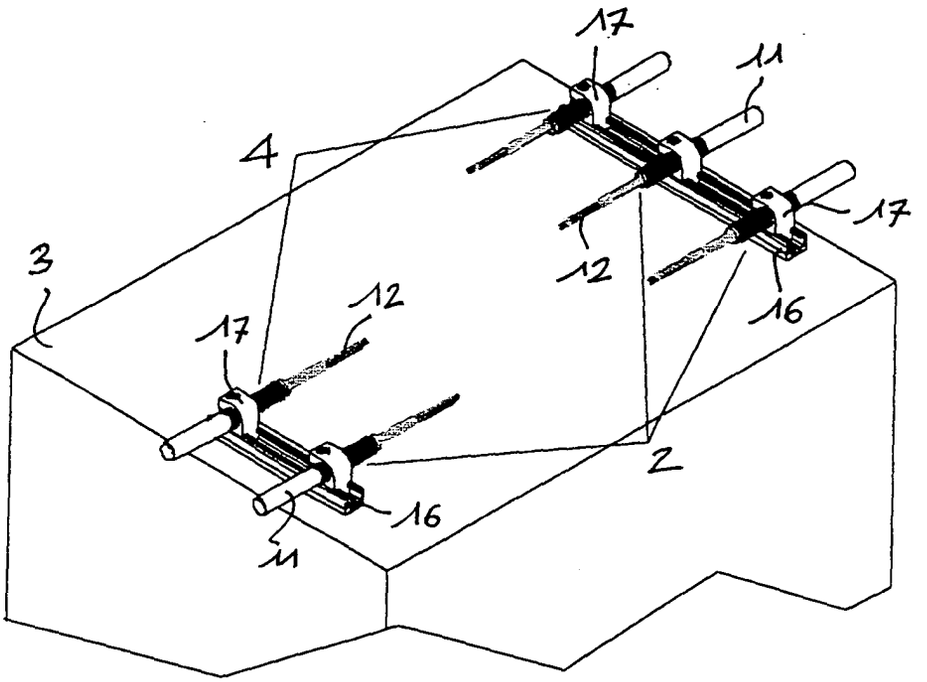


FIG. 2

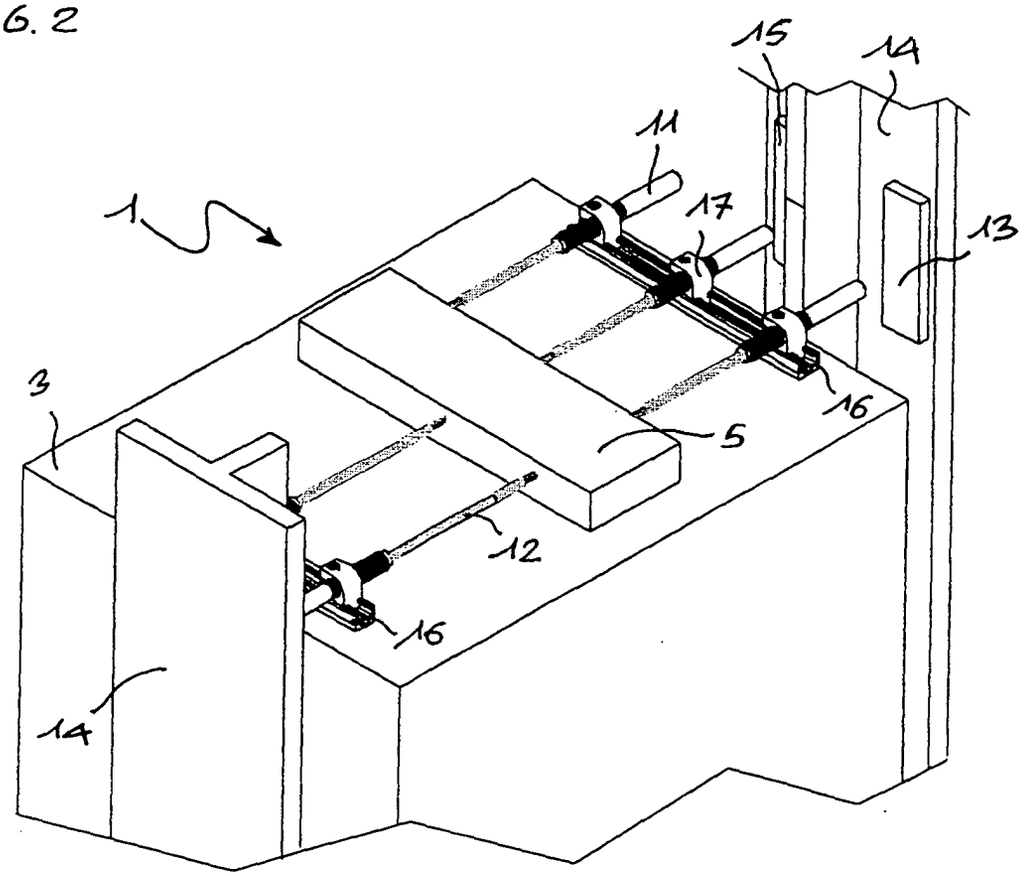


FIG. 1

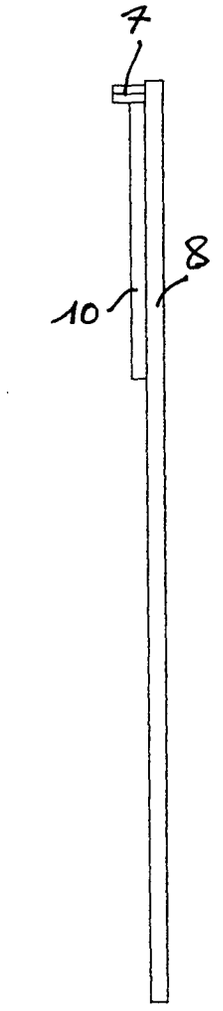


FIG. 3

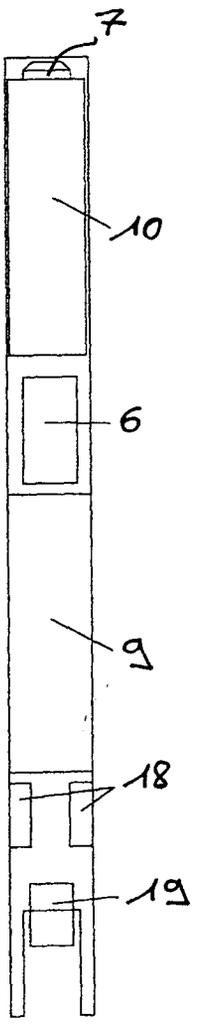


FIG. 4

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EUROPEAN SEARCH REPORT

Application Number
EP 03 02 9546

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
Y	PATENT ABSTRACTS OF JAPAN vol. 2002, no. 10, 10 October 2002 (2002-10-10) & JP 2002 167133 A (TOSHIBA CORP), 11 June 2002 (2002-06-11) * abstract *	1	B66B1/34 H01H36/00
Y	US 4 754 851 A (SUZUKI SHIGEHIKO) 5 July 1988 (1988-07-05) * column 4, line 45-53 *	1	
A	US 5 313 026 A (YOULA JEAN ET AL) 17 May 1994 (1994-05-17) * page 22, column 3, line 50-61; figure 1 *	1	
A	DE 44 01 977 A (WEBER STEUERUNGSTECHNIK GMBH) 27 July 1995 (1995-07-27) * the whole document *	1	
A	US 5 522 480 A (HOFMANN HANS P) 4 June 1996 (1996-06-04) * the whole document *	2	TECHNICAL FIELDS SEARCHED (Int.Cl.7) H01H B66B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
MUNICH	25 May 2004	Mäki-Mantila, M

CATEGORY OF CITED DOCUMENTS

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