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

(11) EP 3 190 077 A1

# (12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
**12.07.2017 Bulletin 2017/28**

(51) Int Cl.:
***B66B 5/02*** *(2006.01)*

(21) Application number: **16150762.9**

(22) Date of filing: **11.01.2016**

(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:
**MA MD**

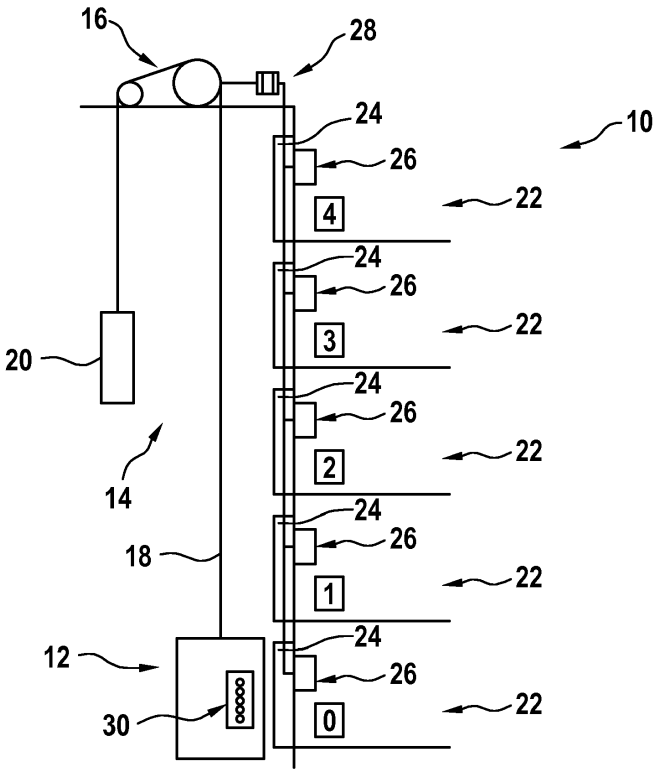
(71) Applicant: **Inventio AG**
**6052 Hergiswil (CH)**

(72) Inventor: **ASHOKAN, Vinay**
**411020 Bopodi, Pune, Maharashtra State (IN)**

## (54) ELEVATOR CONTROL IN CASE OF FIRE

(57) A method for controlling an elevator system (10) comprises: receiving floor calls, a floor call indicating that a person intends to enter and/or leave an elevator car (12) at a target floor (22); receiving floor specific fire indication signals from a plurality of fire detectors (44) adapted for detecting environmental conditions indicating a fire in different floors (22); and rejecting a floor call to a target floor (22), when fire has been detected for the target floor (22) based on the floor specific fire indication signals.

**Fig. 1**




EP 3 190 077 A1

## Description

**[0001]** The present invention relates to a method for controlling an elevator system in case of fire, an elevator control system and an elevator control panel.

**[0002]** Usually, when a fire is detected inside a building, all elevators in the building are moved to a safe floor and stopped. The fire may be indicated to a control system of an elevator either via signals from one or more fire detectors or by a signal from an emergency system, which, for example, may be activated manually with a fire alarm button.

**[0003]** However, there may be a need to use an elevator also in the case of fire, for example, to evacuate persons faster. For example, JP 2009 051613 A1 shows an elevator system with smoke detectors disposed on each floor of the building. When smoke is detected, the smoke is blown with a blower out of the elevator shaft.

**[0004]** Furthermore, there may be a need for more secure elevator systems and/or for elevator systems that may react more flexible in case of a fire.

**[0005]** Such needs may be met with the subject-matter of the independent claims. Advantageous embodiments are defined in the dependent claims.

**[0006]** Ideas underlying embodiments of the present invention may be interpreted as being based, inter alia, on the following observations and recognitions.

**[0007]** A first aspect of the invention relates to a method for controlling an elevator system. An elevator system may comprise an elevator car that is movable vertically in an elevator shaft by an electrical drive and/or that may be stopped at different floors of a building. Furthermore, the elevator shaft may comprise automatically actuatable doors at the floors that may be opened and closed, when the elevator car stops at the floors. Persons that are transported by the elevator car may call the elevator car by using floor control panels situated at the different floors and/or may request for a target floor by using a car control panel inside the elevator car.

**[0008]** The elevator system and in particular the electrical drive and the doors may be controlled by a central control system that is communicatively interconnected with the floor control panels and the car control panel.

**[0009]** In particular, the method may be performed automatically by the elevator system and in particular its central control system.

**[0010]** According to an embodiment of the invention, the method comprises: receiving floor calls, a floor call indicating that a person intends to enter and/or leave an elevator car at a target floor; receiving floor specific fire indication signals from a plurality of fire detectors adapted for detecting environmental conditions indicating a fire in different floors; and rejecting a floor call to a target floor, when fire has been detected for the target floor based on the floor specific fire indication signals.

**[0011]** Summarized, the elevator system may move the elevator car only to those floors, for which no fire has been detected. In such a way, the elevator system also may be used during a fire emergency situation. For example, it may be that the fire is located only on one side of the building. In this case, an elevator system on the other side of the building may detect with fire detectors on each floor that it is not affected by the fire and may be safely used for evacuating the building. It also may be that the elevator system detects that only the two lowest floors are full of smoke. In this case, the elevator car may be used for transporting persons between the other floors, who then only have to use stairways for two floors to leave the building.

**[0012]** In general, the fire detectors may be arranged on all floors at which the elevator car may stop. The fire detectors may be adapted for detecting smoke and/or high temperature indicating fire in the specific floor. For example, when one of the fire detectors detect smoke in a specific floor and/or a temperature above a threshold temperature, this may be interpreted as the detection of fire at this floor.

**[0013]** According to an embodiment of the invention, a floor call to a target floor is rejected, when fire has been detected for a floor between a current floor, the elevator car is currently situated, and the target floor. It also may be that the elevator system rejects moving the elevator car in such a way that it has to pass floors for which fire has been detected.

**[0014]** According to an embodiment of the invention, the method further comprises: in case of the reception of a generic fire indication signal, moving the elevator car to a safe floor, for which no fire has been detected based on the floor specific fire indication signals. For example, the generic fire indication signal may be provided by an emergency system that is not aware of the specific location of the fire, or at least does not provide information of the location of the fire. For example, the emergency system may comprise a plurality of smoke detectors that are attached to ceilings in every room of the building. In the case such a smoke detector detects smoke a generic fire indication signal may be sent from the emergency system to the elevator system, which then may use the fire detectors on its own to more specifically detect the location of the fire.

**[0015]** When the elevator system receives a generic fire indication system, it may move the elevator car to an evacuation floor. If the evacuation floor is itself on fire, which may be detected by the elevator system with the corresponding fire detector, the elevator system may move the elevator car to another floor, for which the specific fire detector does not detect a fire. This may be seen as an evacuation procedure of the elevator system.

**[0016]** According to an embodiment of the invention, the safe floor is selected from a priority list, the priority list comprising an ordered list of preferred floors. For example, the priority list may encode that the first preferred floor is the ground floor, after that the basement and after that the floor above the ground floor, etc. The elevator system may select the safe floor or evacuation floor to be the first floor from the priority list, for which no fire has

been detected.

**[0017]** According to an embodiment of the invention, the generic fire indication signal is based on the floor specific fire indication signals. It also may be that the elevator system starts the evacuation procedure, when a fire is detected in at least one of its floors. It also may be that the elevator system sends a fire indication signal to an emergency system, which then produces a general fire alarm for the building.

**[0018]** According to an embodiment of the invention, the method further comprises: switching to an emergency mode, in case of a generic fire indication signal; and rejecting any floor calls, until a firefighter mode has been activated. It may be that after the reception of a generic or floor specific fire indication signal, the elevator system switches into an emergency mode, in which the evacuation procedure is performed and after that, the elevator only may be used, when activated by specific, for example specially trained persons.

**[0019]** According to an embodiment of the invention, the firefighter mode is manually activatable inside the elevator car by switching a secured switch (for example secured with a lock) and/or by entering a code inside the elevator car. For example, after the elevator car has arrived at the safe floor, a specially trained person may enter the elevator car, may activate the firefighter mode and may use the elevator system to evacuated persons on other floors of the building. It has to be noted that also in this case, the elevator system may reject floor calls to floors, on which fire has been detected. Also in the firefighter mode, the elevator system may not move the elevator car to floors and/or may not even pass floors, on which fire has been detected.

**[0020]** The firefighter mode can be manually activated by a trained customer/attendant after evacuation procedure is completed successfully, using a switch placed inside the elevator car itself. This manual triggering may enable persons inside the building to move the elevator in the elevator shaft before the firefighter arrives.

**[0021]** According to an embodiment of the invention, a floor call is triggered with a button of a car control panel inside the elevator car and/or with a button of a floor control panel provided at a specific floor. The car control panel may provide the secured switch and/or an interface for entering a code to activate the firefighter mode. The floor control panel may provide a button for generating a floor call for the floor at which the floor control panel is provided and/or may comprise one of the fire detectors that produce the floor specific fire indication signals.

**[0022]** A further aspect of the invention relates to a central controller for an elevator system, the central controller being adapted for performing the method as described in the above and in the following. For example, the central controller may comprise a processor and software, which, when being executed by the processor, is adapted for performing the method.

**[0023]** A further aspect of the invention relates to a (floor) control panel for an elevator system. For example, the control panel may be adapted to be integrated into a wall besides automatically opening doors of the elevator system and/or to be integrated into a frame of these doors.

**[0024]** According to an embodiment of the invention, the control panel comprises: a user interface for calling an elevator car to a specific floor; a (local) electronic controller for receiving a signal from the user interface and for sending a floor call to a central controller of the elevator system; a fire detector for detecting environmental conditions indicating a fire in the specific floor; and a housing for accommodating the user interface, the electronic controller and the fire detector and for mounting the control panel at the specific floor; wherein the electronic controller is adapted for receiving a fire indication signal from the fire detector and for sending the (floor specific) fire indication signal to the central controller. In other words, the fire detector for a specific floor may be integrated into the corresponding control panel on the same floor.

**[0025]** The user interface may comprise one or more buttons to be pushed by a person for calling the elevator car. It also may comprise a loudspeaker and/or a display.

**[0026]** According to an embodiment of the invention, the fire detector comprises a smoke sensor and/or a temperature sensor. In other words, environmental conditions indicating a fire may be smoke and/or a temperature above a threshold temperature. It has to be noted that a fire indicating signal may be generated by the local electronic controller, when either smoke or a temperature above a threshold temperature is detected or when both conditions are fulfilled. The fire indicating signal also may be based on a combination of temperature and smoke to confirm a presence of fire on the floor.

**[0027]** It shall be noted that possible features and advantages of embodiments of the invention are described herein partly with respect to a monitoring device, partly with respect to an elevator arrangement comprising such monitoring device and partly with respect to a method for operating such monitoring device. One skilled in the art will recognize that the features may be suitably transferred from one embodiment to another and features may be modified, adapted, combined and/or replaced, etc. in order to come to further embodiments of the invention.

**[0028]** In the following, advantageous embodiments of the invention will be described with reference to the enclosed drawings. However, neither the drawings nor the description shall be interpreted as limiting the invention.

Fig. 1 schematically shows an elevator system with a control system according to an embodiment of the invention.

Fig. 2 schematically shows a control panel according to an embodiment of the invention.

Fig. 3 shows a flow diagram for a method for controlling an elevator system according to an embodi-

ment of the invention.

**[0029]** The figures are only schematic and not to scale. Same reference signs refer to same or similar features.

**[0030]** Fig. 1 shows an elevator system 10, which comprises an elevator car 12 that may be moved by an electrical drive 16 in an elevator shaft 14. For moving the elevator car 12, the drive 16 may move the traction medium 18, which is connected to the elevator car 12 and a counterweight 20.

**[0031]** The elevator system 10 and in particular the elevator shaft 14 is part of a building with several floors 22. In each floor, the elevator system 10 comprises an automatically openable and closable door 24 and a floor control panel 26 for calling the elevator car 12. The respective floor control panel 26 may be mounted near the corresponding door 24 to a wall of the floor 22 and/or may be integrated in a frame of the door 24.

**[0032]** Furthermore, the elevator system 10 comprises a central controller 28, which is adapted for controlling the drive 16 and the doors 24. The central controller 28 may be communicatively interconnected with each of the floor control panels 26 and with a car control panel 30 inside the elevator car 12.

**[0033]** During a normal operation of the elevator system 10, a person may generate a floor call by using a user interface of a floor control panel 26 (such as a button), which is then sent to the central controller 28. The central controller 28 then may move the elevator car 12 to the specific floor 22, from which the floor call was sent, may open and close the corresponding door 24, such that the person can enter the elevator car 12. The person then may generate a further floor call with the car control panel 30, which is sent to the central controller 28. After that, the central controller 28 may move the elevator car 12 to the selected floor 22 and may again open and close the door 24, such that the person can leave the elevator car 12.

**[0034]** Fig. 2 shows a floor control panel 26 of the elevator system 10 of Fig. 1. It has to be noted that all of the floor control panels 26 of the system 10 may be designed like shown in Fig. 2.

**[0035]** The floor control panel 26 comprises a housing 32, which houses an electronic controller 34 and which provides a user interface 36. The user interface 36 may comprise one or more buttons 38, which may be pushed by a person for generating a floor call and optionally for selecting the direction (up or down), he wishes to go with the elevator car 12. Furthermore, the user interface 36 may comprise a display 40, for example for displaying the actual position of the elevator car, the actual movement direction, etc., and/or a loudspeaker 42, which also may provide information to a person in front of the user interface 36, such as that the elevator has arrived at the corresponding floor 22.

**[0036]** Inside the housing 32, the floor control panel 26 comprises a fire detector 44, which is adapted for detecting environmental conditions indicating a fire on the specific floor, the floor control panel 26 is arranged. The fire detector 44 may comprise a smoke sensor 46 and/or a temperature sensor 48. The housing may comprise dedicated openings 50 (for example on the interface side), such that smoke and/or heated air may come close to the sensors 46, 48.

**[0037]** The electronic controller 34 may receive a signal from the user interface 36, for example, that one of the buttons 38 has been pushed and may generate a floor call signal therefrom. This floor call signal then may be sent by the electronic controller 34 to the central controller 28. The floor call signal may comprise a floor number of the floor, where the elevator car should be moved to.

**[0038]** The electronic controller 34 also may receive a signal from the fire detector 44, for example that smoke was detected by the smoke sensor 46 and/or the current temperature sensed by the temperature sensor 48. When smoke has been detected and/or when the temperature sensed by the temperature sensor 48 is higher than a threshold temperature, the electronic controller 34 may decide that there is fire on its floor 22. In this case, the electronic controller 34 may generate a floor specific fire indication signal and may send it to the central controller 28. The floor specific fire indication signal may comprise the floor number of the floor 22, where the fire has been detected.

**[0039]** Fig. 3 shows a flow diagram for a method that may be performed by the central controller 28.

**[0040]** In step S10, the elevator system 10 is in normal operation mode, as described above, the central controller may receive floor calls, wherein a floor call indicates that a person intends to enter and/or leave an elevator car 12 at a target floor 22. For example, a floor call may be triggered with the car control panel 30 inside the elevator car 12 and/or with the floor control panel 26 provided at a specific floor 22.

**[0041]** Furthermore, in step S10, the central controller 10 may regularly receive floor specific fire indication signals from the fire detectors 44 of the floor control panels 26. As long as all floor specific fire indication signals do not indicate fire, the elevator system 10 may continue to operate in normal operation mode.

**[0042]** In step S10, the central controller 28 receives a generic fire indication signal and switches into an emergency mode. The generic fire indication signal may be sent from an emergency system, which, for example, may be activated manually by a person inside the building. It is also possible that the reception of a floor specific fire indication signal from any of the floors is interpreted as a generic fire indication signal.

**[0043]** In the emergency mode, the central controller 28 moves the elevator car 12 to a safe floor 22. A safe floor is a floor 22, for which no fire has been detected based on the floor specific fire indication signals.

**[0044]** The safe floor may be selected by the central controller 28 from a priority list, the priority list comprising an ordered list of preferred floors. For example, the

ground floor may be the most preferred floor and may be selected, when there is no fire detected for the ground floor. When there is fire detected on the ground floor, the central controller 28 may switch to the next preferred floor, when there is also fire detected for this floor, the central controller 28 may switch to the next preferred floor on the priority list, etc.

**[0045]** It has to be noted that a preferred floor also may not be selected by the central controller 28, when the elevator car 12 has to pass a floor, for which fire has been detected, for moving to the preferred floor.

**[0046]** When the elevator car 12 has arrived at the safe floor 22, the elevator system 10 stays in the emergency mode and rejects any floor calls, until a firefighter mode has been activated.

**[0047]** For example, when a person inside the elevator car 12 pushes a button of the car control panel 30 for another floor 22, this push is ignored and the elevator car 12 stays at the safe floor. Also, when a person pushes one of the buttons 38 of the floor control panel 26 on another floor, this push is ignored and the elevator car 12 stays at the safe floor.

**[0048]** In step S 14, the central controller 28 receives a trigger signal to enter a firefighter mode.

**[0049]** For example, this trigger signal may be generated by the car control panel 30, when a specific person activates a secured switch of the car control panel 30 (which, for example is secured with a mechanical key) and/or when the specific person enter a code into a user interface of the car control panel 30.

**[0050]** When the central controller 28 is in the firefighter mode, floor calls may be accepted based on specific rules.

**[0051]** For example, it may be that a floor call to a target floor 22 is rejected, when fire has been detected for the target floor 22 based on the floor specific fire indication signals. The elevator controller 28 will not move the elevator car 12 to a floor 22, for which it receives a fire indication signal.

**[0052]** Furthermore, a floor call to a target floor 22 may be rejected, when fire has been detected for a floor between a current floor, the elevator car 12 is currently situated, and the target floor. The elevator controller 28 will not move the elevator car in such a way that it has to pass a floor, for which a fire indication signal is received.

**[0053]** It also may be possible that during the firefighter mode, floor calls from floor control panels 26 are not accepted. Only floor calls generated from the car control panel 30 may be accepted by the central controller 28.

**[0054]** Finally, it should be noted that the term "comprising" does not exclude other elements or steps and the "a" or "an" does not exclude a plurality. Also elements described in association with different embodiments may be combined. It should also be noted that reference signs in the claims should not be construed as limiting the scope of the claims.

List of reference signs

**[0055]**

| | |
|---|---|
| 10 | elevator system |
| 12 | elevator car |
| 14 | shaft |
| 16 | drive |
| 18 | traction medium |
| 20 | counterweight |
| 22 | floor |
| 24 | door |
| 26 | floor control panel |
| 28 | central controller |
| 30 | car control panel |
| 32 | housing |
| 34 | electronic controller |
| 36 | user interface |
| 38 | button |
| 40 | display |
| 42 | loudspeaker |
| 44 | fire detector |
| 46 | smoke sensor |
| 48 | temperature sensor |
| 50 | openings |

## Claims

**1.** A method for controlling an elevator system (10), the method comprising:

receiving floor calls, a floor call indicating that a person intends to enter and/or leave an elevator car (12) at a target floor (22);
receiving floor specific fire indication signals from a plurality of fire detectors (44) adapted for detecting environmental conditions indicating a fire on different floors (22);
rejecting a floor call to a target floor (22), when fire has been detected for the target floor (22) based on the floor specific fire indication signals.

**2.** The method of claim 1,
wherein a floor call to a target floor (22) is rejected, when fire has been detected for a floor between a current floor, the elevator car (12) is currently situated, and the target floor.

**3.** The method of claim 1 or 2, further comprising:

in case of reception of a generic fire indication signal:

moving the elevator car (12) to a safe floor, for which no fire has been detected based on the floor specific fire indication signals.

4. The method of claim 3, wherein the safe floor is selected from a priority list, the priority list comprising an ordered list of preferred floors.

5. The method of claim 3 and 4, wherein the generic fire indication signal is based on the floor specific fire indication signals.

6. The method of one of claims 3 to 5, further comprising:

switching to an emergency mode, in case of reception of a generic fire indication signal;
rejecting any floor calls, until a firefighter mode has been activated.

7. The method of claim 6, further comprising:

wherein the firefighter mode is manually activatable inside the elevator car.

8. The method of one of the preceding claims, wherein a floor call is triggered with a car control panel (30) inside the elevator car (12) and/or with a floor control panel (26) provided at a specific floor (22).

9. A central controller (28) for an elevator system (10), the central controller (28) being adapted for performing the method of one of the preceding claims.

10. A control panel (26) for an elevator system (10), the control panel (26) comprising:

a user interface (36) for calling an elevator car (12) to a specific floor (22);
an electronic controller (34) for receiving a signal from the user interface (36) and for sending a floor call to a central controller (28) of the elevator system (10);
a fire detector (44) for detecting environmental conditions indicating a fire on the specific floor (22); and
a housing (32) for accommodating the user interface (36), the electronic controller (34) and the fire detector (44) and for mounting the control panel (26) at the specific floor (22);
wherein the electronic controller (34) is adapted for receiving a fire indication signal from the fire detector (44) and for sending the fire indication signal to the central controller (28).

11. The control panel (26) of claim 10, wherein the fire detector (44) comprises a smoke sensor (46) and/or a temperature sensor (48).

Fig. 1

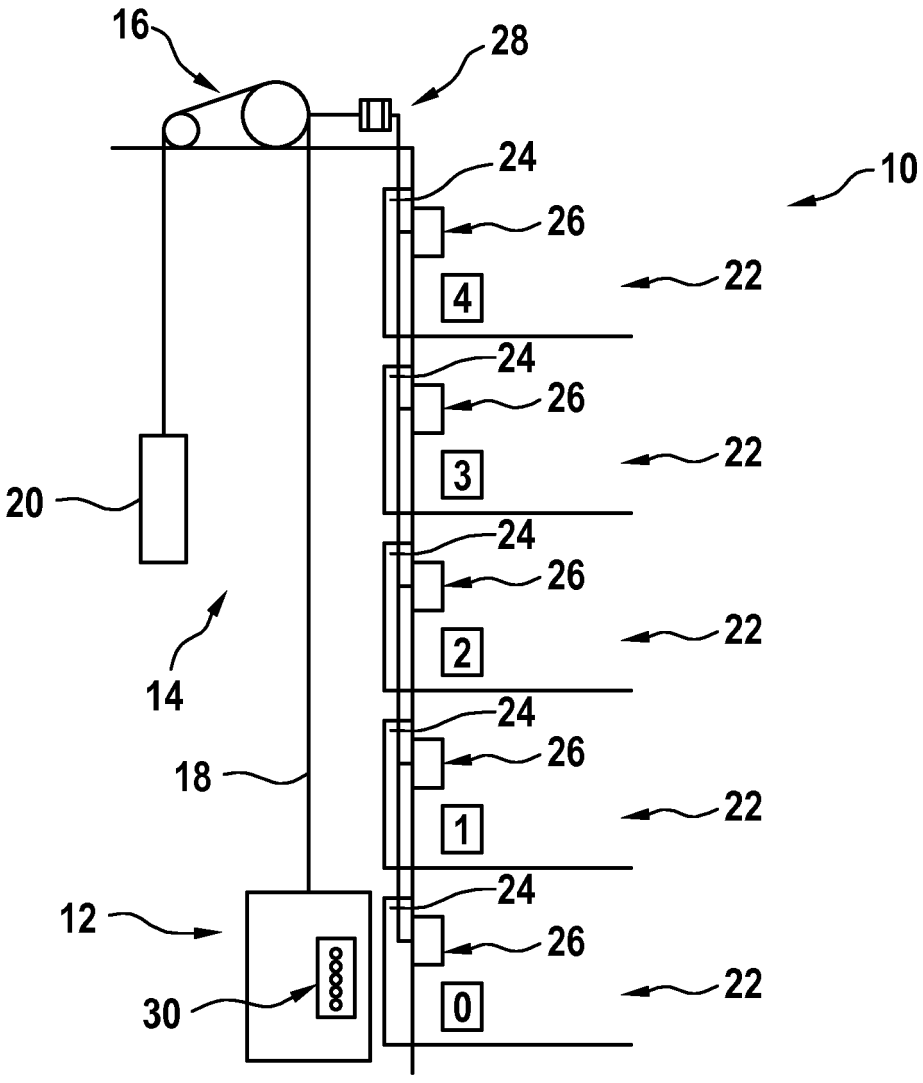

16
28
24
10
26
22
4
24
26
22
3
20
24
26
22
2
14
24
18
26
22
1
24
12
26
22
0
30

Fig. 2

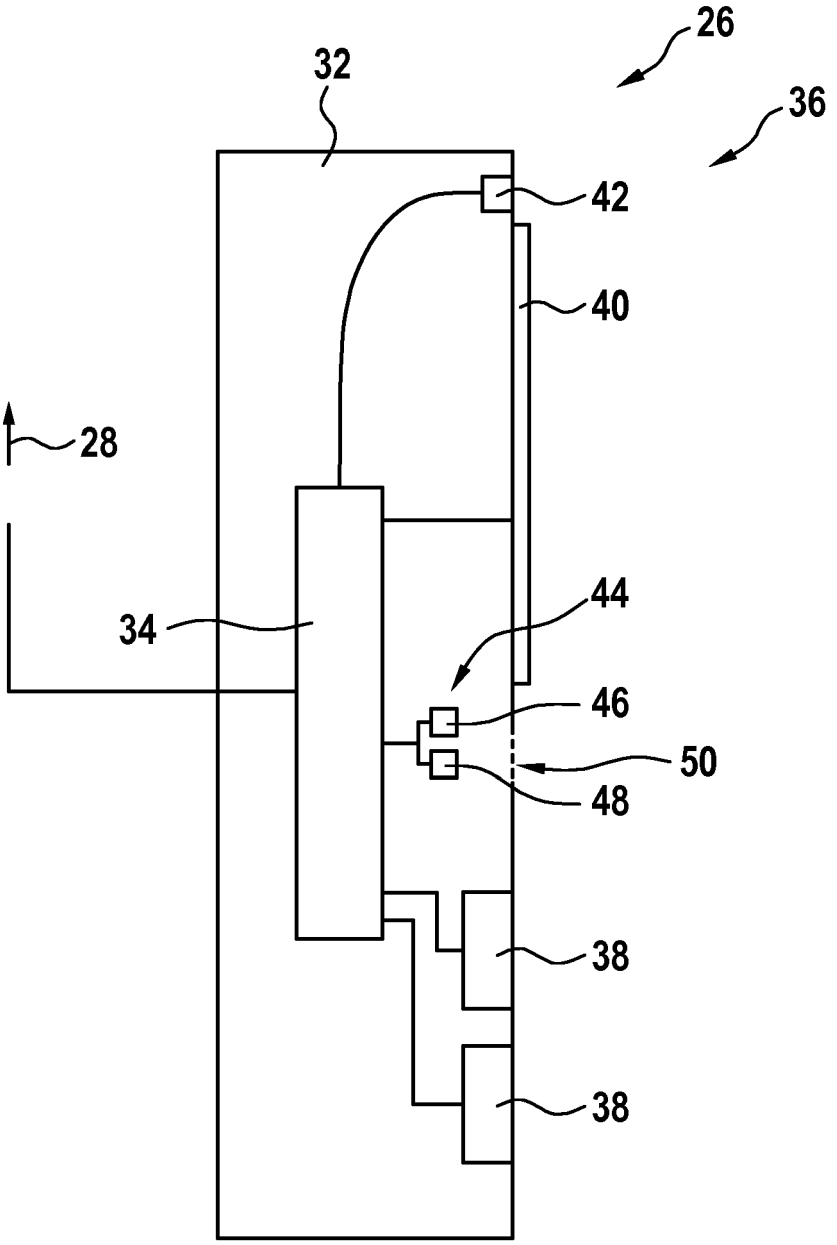
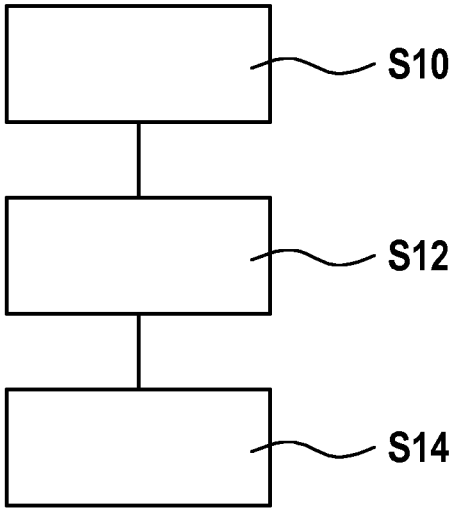


Fig. 3



Europäisches Patentamt
European Patent Office
Office européen des brevets

# EUROPEAN SEARCH REPORT

Application Number
EP 16 15 0762

## 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<br>Y | EP 1 930 279 A1 (MITSUBISHI ELECTRIC CORP [JP]) 11 June 2008 (2008-06-11)<br>* paragraphs [0011], [0013], [0014], [0035] - [0037]; figures 1,3-5 * | 1-5,8-10<br>6,7,11 | INV.<br>B66B5/02 |
| X<br>Y | JP 2003 276964 A (MITSUBISHI ELECTRIC CORP) 2 October 2003 (2003-10-02)<br>* abstract; figure 3 *<br>& DATABASE WPI<br>Week 200369<br>Thomson Scientific, London, GB;<br>AN 2003-727239<br>& JP 2003 276964 A (MITSUBISHI ELECTRIC CORP) 2 October 2003 (2003-10-02)<br>* abstract * | 1,2,8-10<br>11 | |
| Y | US 2011/155516 A1 (MASON CHRISTOPHER JOHN [US]) 30 June 2011 (2011-06-30)<br>* paragraphs [0027] - [0030]; figure 2 * | 6,7 | |
| Y,D | JP 2009 051613 A (MITSUBISHI ELECTRIC CORP; MITSUBISHI ELEC BUILDING TECHN) 12 March 2009 (2009-03-12)<br>* abstract * | 11 | TECHNICAL FIELDS SEARCHED (IPC)<br>B66B |

The present search report has been drawn up for all claims

| Place of search | Date of completion of the search | Examiner |
|---|---|---|
| The Hague | 14 July 2016 | Miklos, Zoltan |

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 03.82 (P04C01)

## ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 16 15 0762

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.

14-07-2016

| Patent document cited in search report | Publication date | Patent family member(s) | Publication date |
|---|---|---|---|
| EP 1930279 A1 | 11-06-2008 | CN 101061052 A | 24-10-2007 |
| | | EP 1930279 A1 | 11-06-2008 |
| | | JP 5025933 B2 | 12-09-2012 |
| | | JP 2007091379 A | 12-04-2007 |
| | | KR 20070067166 A | 27-06-2007 |
| | | WO 2007037031 A1 | 05-04-2007 |
| JP 2003276964 A | 02-10-2003 | JP 4171236 B2 | 22-10-2008 |
| | | JP 2003276964 A | 02-10-2003 |
| US 2011155516 A1 | 30-06-2011 | AU 2010338566 A1 | 05-07-2012 |
| | | BR 112012015858 A2 | 21-06-2016 |
| | | CA 2785874 A1 | 07-07-2011 |
| | | CN 102712445 A | 03-10-2012 |
| | | EP 2519464 A1 | 07-11-2012 |
| | | ES 2457547 T3 | 28-04-2014 |
| | | HK 1176047 A1 | 23-05-2014 |
| | | KR 20120112660 A | 11-10-2012 |
| | | SG 181945 A1 | 30-07-2012 |
| | | US 2011155516 A1 | 30-06-2011 |
| | | WO 2011079975 A1 | 07-07-2011 |
| JP 2009051613 A | 12-03-2009 | JP 4889594 B2 | 07-03-2012 |
| | | JP 2009051613 A | 12-03-2009 |

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

## REFERENCES CITED IN THE DESCRIPTION

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

### Patent documents cited in the description


- JP 2009051613 A **[0003]**