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(54) Electronic circuit for a door control unit, control unit and control board therefor

(57) The present invention concerns an electronic circuit (20) for a door control unit, the circuit comprising operating means (32, 33) configured to operate a door in order to open and/or close it, and control means (21) connected to the operating means and configured to control the actuation of the operating means and to detect and store at least the number of actuations of the door. The electronic circuit further includes signalling means (25, 25a, 25b, 25c) arranged to signal that said number of actuations has attained at least one predetermined number of actuations. The signalling enables applying guarantee and programmed maintenance conditions related with the actual number of actuations of the door. The invention also concerns the related door control unit (12) and door control board.

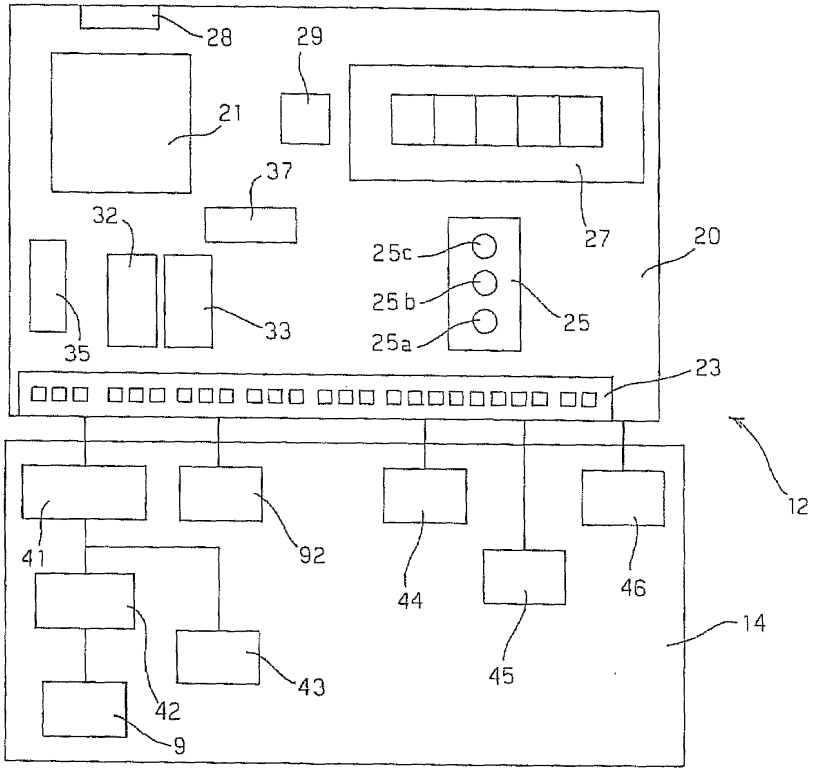

Fig. 2

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Description

TECHNICAL FIELD

[0001] The present invention generally relates to an electronic circuit for a control unit, to a control unit comprising the electronic circuit and to a control board for opening and closing a door.

[0002] More particularly, the present invention relates to an electronic circuit or electronic device to be applied to a control unit of a control board in order to control, for instance by means of relays (deviation voltage free contacts), the opening and closing of a so-called automatic door.

[0003] It is herein pointed out that, throughout the present description, the term "door" or "automatic door" is to be intended in broad sense, and is meant to include rolling shutters, doors for driveways, gates and any other automatically controlled device allowing or preventing access to determined areas.

PRIOR ART

[0004] Control boards for controlling the opening and closing of automatic doors are well known.

[0005] The prior art control boards generally include a control unit arranged to control the functions of the automatic door, safety devices, such as a main switch for stopping the door, and a set of connections to devices configured to both supply the control unit with power and control, by interacting with the control unit, the various functions of the automatic door.

[0006] In the prior art control boards, there are provided connections to means of different kinds, such as photocells, end-of-stroke detectors, safety flaps, infrared or radio detectors, which are for instance arranged, under the control of the control board, to:

- actuate the door opening and closing by means of suitable motors;
- stop the door movement if the presence of a body, a vehicle or any other object is detected in the movement path of the door or rolling shutter;
- switch on, for instance in intermittent manner, light signalling devices when the door is moving.

[0007] In the prior art control boards, the control units preferably also include a plurality of ancillary contacts that can be configured to control additional devices depending on whether, for instance, the automatic door is open, is closed, is being opened or is being closed.

[0008] The Applicant has realised that the prior art automatic doors, controlled by a control board with an electronic control unit, have a common problem: maintenance is not programmed depending on the actual wear of the electronic, electromechanical and/or mechanical parts, but is programmed based on predetermined time intervals (months, years). The same remark applies of course to the guarantee that generally, for the automatic doors, is valid for a predetermined time period.

[0009] In synthesis, the Applicant has realised that the maintenance or the guarantee, set according to predetermined time intervals, do not take into account several factors, namely:

- the automatic doors, depending on their application, can undergo amounts of daily operations that are different depending on the field of use: for instance, the doors of a carrier can be operated tens of times a day, whereas the doors of a workshop can be operated only a few times a day;
- the automatic doors can have different sizes in respect of length, height and weight, so that the wear of the electronic and mechanical parts of the control boards, the control units and the doors can vary as the above characteristics vary:

- the automatic doors are installed in different kinds of environments, for instance dusty, wet, high temperature or low temperature environments, so that the average operating life thereof can vary independently of the period of use.

[0010] According to the Applicant, the whole of the above problems cannot be faced if the guarantee or the maintenance are set according to predetermined time intervals,

DESCRIPTION OF THE INVENTION

[0011] It is an object of the present invention to provide an electronic circuit for a control unit that allows solving in simple and cheap manner the problem of the guarantee and the programmed maintenance of the automatic doors and the control boards of the control units.

[0012] According to the present invention, the above object is achieved through the electronic circuit for a control unit having the features defined in the appended claims.

[0013] The present invention also concerns a door control unit and a door control board.

[0014] The claims are integral part of the technical teaching provided herein in respect of the invention.

[0015] In accordance with a preferred embodiment, the electronic circuit for a door control unit includes detecting means arranged to detect the number of actuations of an automatic door and signalling means arranged to signal that the number of actuations has attained a predetermined value.

[0016] In accordance with another feature of the present invention, the signalling means include a plurality of LED's of different colours, e.g. green, orange and red LED's, which can be selectively switched on to indicate progressive thresholds for the number of door actuations and the possible need for precautionary maintenance interventions.

[0017] In accordance with another feature of the present invention, the electronic circuit includes a display arranged to display the number of door actuations.

[0018] The control board according to the invention includes a box housing the electronic circuit and signalling elements, located on an outer wall of the box and associated with signalling means of the electronic circuit, whereby the attainment of a predetermined number of actuations is signalled outside the box.

BRIEF DESCRIPTION OF THE FIGURES

[0019] The above and other features of the present invention will become apparent from the following description of a preferred embodiment, made by way of non limiting example with reference to the accompanying drawings, in which elements denoted by a same or similar numerical reference correspond to components having the same or similar function and construction, and in which:

- Fig. 1 is a general diagram of an automatic door with a control board; and
- Fig. 2 shows a door control unit.

DESCRIPTION OF A PREFERRED EMBODIMENT

[0020] Referring to Fig. 1, a control board 10 includes electrical connections 7 and suitable motors 9 for actuating and controlling the opening and closing of an automatic door 5.

[0021] Control board 10 further includes: a body or box 11, preferably equipped with a door 19 that can be opened for instance by means of a handle 96 having associated therewith, for instance, a disconnecting switch 41; a plurality of switches 14 arranged to cause and/or control the operation of the automatic door; and a control unit 12.

[0022] Preferably, box door 19 has control devices 91, 92, 95, 97, which can be accessed from the outside by a user and are arranged to control automatic door 5.

[0023] The control devices for instance include, among other devices, a safety/emergency pushbutton 91 arranged to switch off the power supply.

[0024] Body 11 of control board 10 has, preferably internally, control unit 12 that is connected, through electrical connections, to switches 14 and is arranged to actuate and control the movements of door 5.

[0025] In accordance with a preferred embodiment, switches 14 in control board 10, of known type, include:

- disconnecting component 41 arranged to switch off the power supply to motors 9 of door 5; such a component is preferably included in body 11 of board 10;
- a remotely controlled switch 42 arranged to actuate the door opening: such a component is preferably included in body 11 of board 10 and it can be operated by means of a pushbutton 92 provided on box door 19;
- a remotely controlled switch 43 arranged to actuate the door closing: such a component is preferably included in body 11 of board 10 and it can be operated, for instance, by means of the same pushbutton 92 actuating the opening, a different pushbutton or an external remote control device;
- one or more end-of-stroke photocells 45, arranged to stop the door opening or closing; such a component is preferably located near the door;
- one or more hit detectors or safety flaps 46 arranged to detect bodies interfering with the door movements and to stop the door; such a component is preferably located on the door itself.

[0026] Control unit 12, in the preferred embodiment, includes an electronic circuit 20 with a microprocessor 21, for instance microcontroller model PIC16F819 manufactured by company Microchip Technology Inc. Preferably, microprocessor 21 has stored therein program modules arranged to control the operation of door 5 and, more particularly, to count and store the number of openings/closings (actuation cycles or actuations) of door 5.

[0027] Electronic circuit 20 in control unit 12 further includes contacts and connections 23 to different elements in board 10, mains fuses 35 and low voltage fuses 37, as well as, for instance, a door opening relay 32 and a door closing relay 33, all such components being of known type. More particularly, relays 32 and 33 are controlled, in known manner, by microprocessor 21 that is connected, through contacts and connections 23, with pushbutton 92 for opening/closing door 5. The door opening and closing relays are also connected in known manner, through contacts and connections 23, to remotely controlled switches 42 and 43, which actually operate motor 9 so that it opens and closes door 5.

[0028] In the preferred embodiment, electronic circuit 20 in control unit 12 also includes a set of LED's (Light Emitting Diodes) 25, preferably of different colours, for instance three LED's 25a, 25b and 25c with green, orange and red colour, respectively, whose switching on is selectively controlled by microprocessor 21 depending on the number of actuations of door 5, which number is stored in microprocessor 21.

[0029] In the preferred embodiment the set of LED's 25 represents a warning light arranged to indicate the number of door actuations and to signal that, for instance, such a number of actuations has attained such a value that maintenance of door 5 and/or board 10 associated with door 5 is required.

[0030] Preferably, the various numbers of actuations that have been set and that are arranged to cause the selective switching on of the LED's, and the numbers of actuations that are detected or counted are stored in a non-volatile memory, for instance a flash memory in microprocessor 21 or outside the microprocessor, so that the numbers of actuations that have been set and detected remain stored therein, even in the absence of pow-

er supply.

[0031] In accordance with other embodiments, electronic circuit 20 in control unit 12 includes, in alternative or in addition to the set of LED's (warning light) 25, a display 27, of known type, arranged to display at least the number of actuations of door 5.

[0032] Most preferably, control unit 12 further includes a reset device 29, for instance a key-protected device, arranged to enable resetting the number of actuations, for instance upon a maintenance or repair intervention carried out by specialised staff.

[0033] In further embodiments, the control unit includes a connector 28, for instance a serial connector, in order to enable programming microprocessor 21 and/or setting limits associated with the number of actuations, which limits take into account the environmental conditions of use of automatic door 5.

[0034] In yet further embodiments, warning light 25 and/or display 27, besides being included in electronic circuit 20 in control unit 12, are provided also on box door 19, so as to enable each user of the automatic door to know through such devices, denoted 95 and 97 respectively, the need, if any, for maintenance of the automatic door.

[0035] Preferably, at least one LED 95c is provided on external door 19 and is arranged to take a red colour when a predetermined number of actuations is exceeded.

[0036] The operation of the control board and the control unit described hereinbefore is as follows.

[0037] In the design phase of control board 10, three numbers of actuation cycles (cycles or actuations), e.g. 0 cycles, 9,500 cycles and 10,000 cycles, are preferably stored into the memory of microprocessor 21.

[0038] During operation, electronic circuit 20, under the control of microprocessor 21, detects the number of actuations and keeps green LED 25a on if, upon a comparison with the numbers of actuations having been set and stored, the detected actuations are in the range 0 to 9,499 cycles, in the example.

[0039] If, as a result of a comparison, microprocessor 21 detects for instance that 9,500 cycles have been attained, electronic circuit 20 controls for instance the switching off of green LED 25a and the switching on of orange LED 25b, until 9,999 cycles are attained.

[0040] If, upon a comparison of the detected actuations with the number having been set and stored, the attainment for instance of 10,000 cycles is detected, electronic circuit 20 controls for instance the switching off of orange LED 25b and the switching on of red LED 25c.

[0041] The switching on of red LED 25c in electronic circuit 20 and external red LED 95c signals the need for maintenance interventions by specialised staff on parts of the control board and/or the automatic door.

[0042] Once the maintenance intervention has been completed, the specialised staff will reset the number of detected actuations by means of reset device (key) 29, so that the count can start again from value 0 stored for instance in the memory of microprocessor 21.

[0043] Of course, in case of particularly severe operating conditions of the door, the specialised staff can reduce, by using for instance connector 28, the stored number of cycles so as to provide for more frequent maintenance interventions.

[0044] Even if the use of a multi-LED signalling device has been envisaged in the description, the skilled in the art can readily appreciate that the signalling may also be performed by means of a polychromatic LED or by means of acoustic signals.

[0045] Thanks to the provision of the warning light, the manufacturer of the automatic door and the control board may set the guarantee period based upon the actual use of the door.

[0046] On the other side, the user can take the cycles of use of the door under control and can timely request maintenance interventions.

[0047] The maintenance interventions will enable the specialised staff to reset the actuation counter so that subsequent programmed maintenance interventions can be carried out based on the actual use.

[0048] Thus, the provision of the warning light results in a number of advantages both for the manufacturer of the automatic doors and the associated control boards, and for the users of such equipment.

[0049] Obvious changes and modifications to the above description in respect of size, shape, materials, components, circuit elements, connections and contacts, as well as in respect of the details of the illustrated circuitry and construction are possible without departing from the spirit of the invention as set forth in the following claims.

Claims

1. An electronic circuit for a door control unit, comprising:

   - operating means (32, 33) configured to operate a door (5) to open and/or close it;
   - control means (21) connected to the operating means and configured to control the actuation of the operating means;

   characterised in that said control means (21) are configured to detect and store at least the number of actuations of the door (5); and **in that** signalling means (25, 25a, 25b, 25c) are provided, which are arranged to signal that said number of actuations has attained at least one predetermined number of actuations.

2. The electronic circuit as claimed in claim 1, **characterised in that** said signalling means are light signalling means and comprise one or more light elements, in particular LED's.

3. The electronic circuit as claimed in claim 2, **characterised in that** said light elements include LED's of different colours, in particular three different colours.

4. The electronic circuit as claimed in claim 3, **characterised in that:**

- said at least one predetermined number of actuations is representative of at least one threshold; and
- said control means are arranged to cause the selective switching on of one of the colours depending on whether said number of actuations:
- is between a first and a second threshold;
- is between the second and a third threshold;
- has attained the third threshold.

5. The electronic circuit as claimed in claim 1, **characterised in that** said signalling means include a display (27) arranged to display at least said number of actuations.

6. The electronic circuit as claimed in any preceding claim, **characterised in that** said control means (21) have at least said one predetermined number and said number of actuations stored in a non-volatile memory.

7. The electronic circuit as claimed in any preceding claim, **characterised by** a reset device (29) configured to reset the number of actuations of the door (5).

8. The electronic circuit as claimed in any preceding claim, **characterised in that** said at least one predetermined number of actuations is adjustable depending on the operating conditions of the door.

9. A control unit for a control board (10) for an automatic door (5), wherein the control unit comprises connecting means (23) connectable to means (14) for actuating said automatic door (5) and is **characterised by** an electronic circuit as claimed in any of claims 1 to 8.

10. A control board for an automatic door (5), comprising:

- a box (11); and
- a door (19) closing said box (11);

the board being **characterised in that** it comprises an electronic circuit as claimed in any of claims 1 to 8, and **in that** said box closing door (19) has, at a visible location, at least one signalling element (95, 97) connected to said electronic circuit (20) and arranged to signal that the door has been actuated at least one predetermined number of times.

11. The control board as claimed in claim 10, **characterised in that** said signalling element is a light signalling element.

12. The control board as claimed in claim 10, **characterised in that** said signalling element is a light signalling element and includes a plurality of light elements of different colours which can be selectively switched on by said electronic circuit.

13. The control board as claimed in any of claim 10 to 12, **characterised in that** said signalling element includes at least one display (27) arranged to display at least the number of actuations of said automatic door.

14. The control board as claimed in any of claim 10 to 12, **characterised in that** said box closing door further includes:

- at least one emergency pushbutton (91);
- at last one door actuation pushbutton (92);

said pushbuttons being connected to said electronic circuit (20).

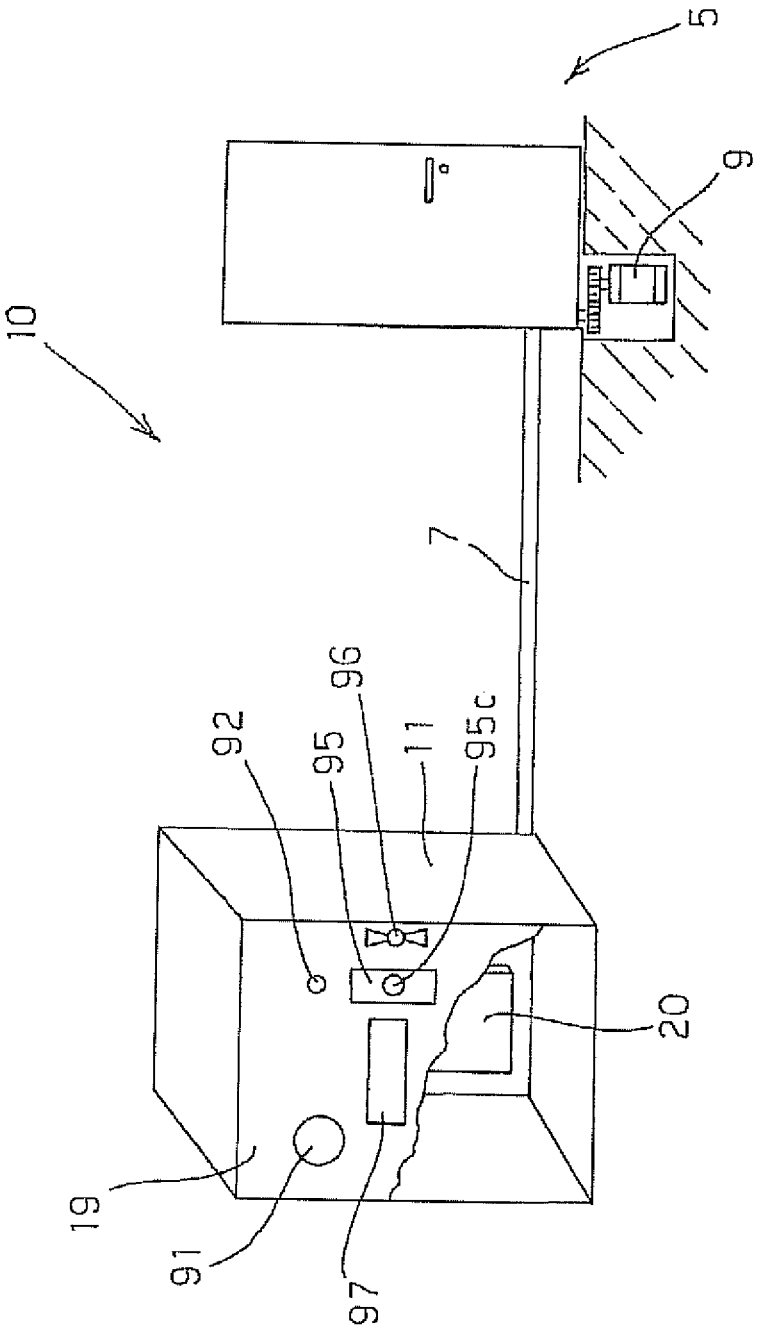
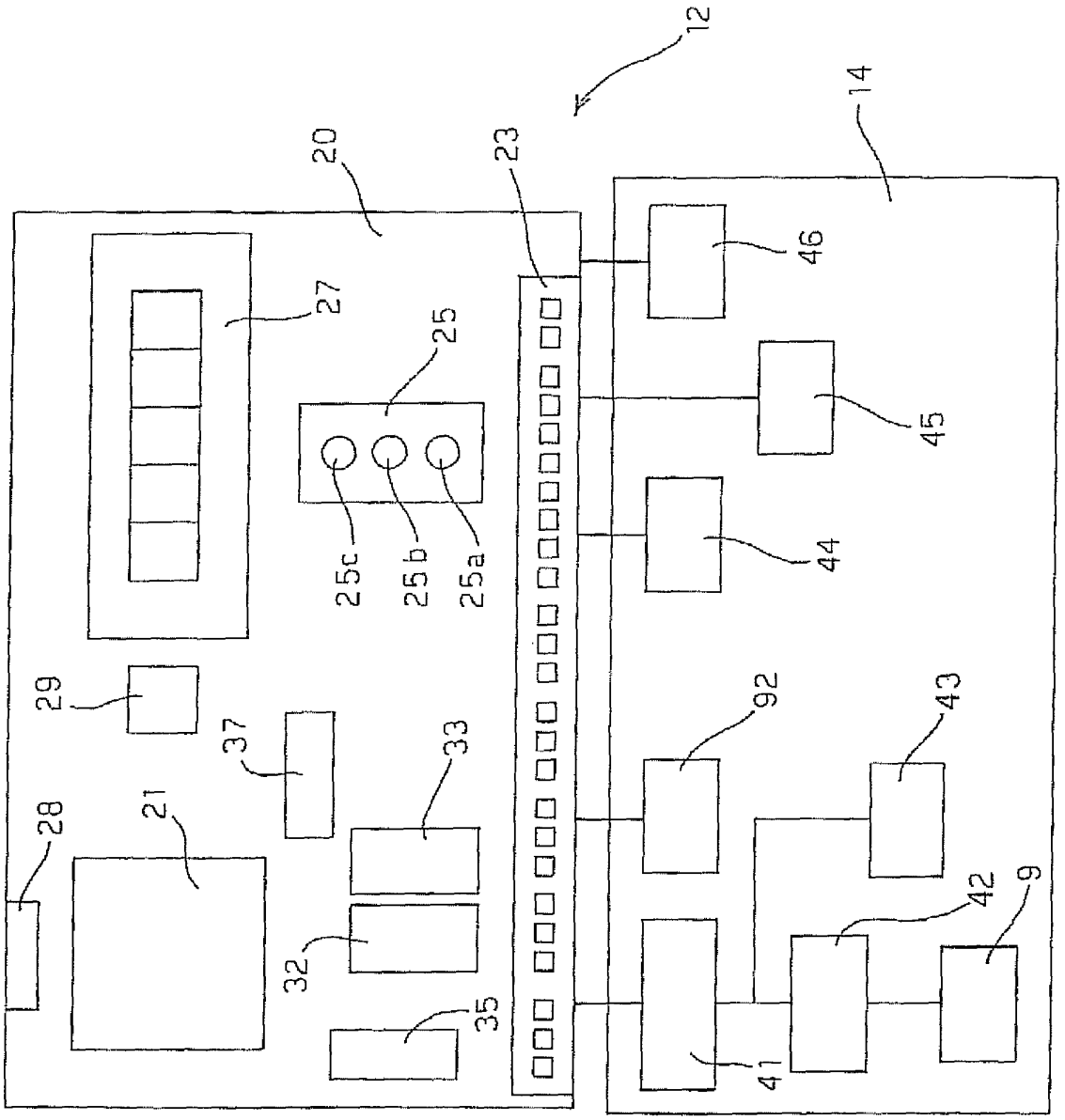


Fig. 1


12
14
20
23
46
45
44
27
25
25c
25b
25a
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37
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92
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28
21
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9
32
35
41

Fig. 2

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EUROPEAN SEARCH REPORT

Application Number
EP 09 15 0011

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	DE 195 31 323 A1 (GEZE GMBH & CO [DE]) 18 April 1996 (1996-04-18) * abstract * * column 2, line 5 - line 59 * * column 3, line 38 - line 49 * * column 8, line 11 - line 58 * * figures 1,2 * -----	1-14	INV. G07C1/32 G07C3/04 G07C9/00
A	DE 197 16 763 A1 (VAILLANT JOH GMBH & CO [DE]) 11 December 1997 (1997-12-11) * abstract * * column 1, line 18 - line 50 * * column 2, line 25 - line 33 * * column 3, line 68 - column 4, line 4 * -----	1-14	

TECHNICAL FIELDS SEARCHED (IPC)
G07C E05B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	16 April 2009	Stenger, Michael

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 09 15 0011

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
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16-04-2009

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
DE 19531323 A1	18-04-1996	NONE	
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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82