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(54) Title: ELECTRONIC SIGNALLING DEVICE FOR LOW VOLTAGE SWITCHBOARDS

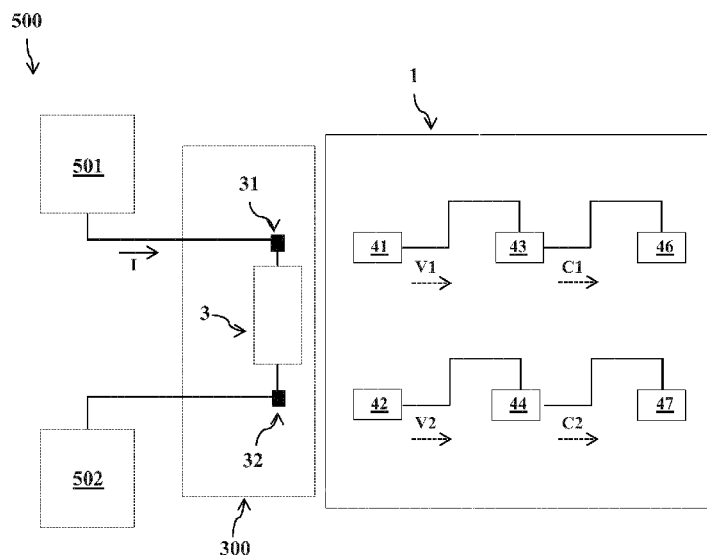


FIG. 1

(57) Abstract: An electronic signalling device for low voltage switchboards operatively couplable to a protection circuit for low voltage switchboards. The aforesaid electronic signalling device is able to detect and signal triggering of a fuse device of said protection circuit while maintaining galvanic separation from the terminals of said fuse device.



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— *of inventorship (Rule 4.17(iv))*

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ELECTRONIC SIGNALLING DEVICE FOR LOW VOLTAGE SWITCHBOARDS

DESCRIPTION

The present invention relates to an electronic signalling device for low voltage switchboards (i.e. for voltages below 1 kV AC and 1.5 kV DC), of single-phase or three-phase type.

The use of accessory devices installable in a switchboard in order to protect a section thereof from possible overcurrents, for example short circuit overcurrents, is widely known.

Accessory devices of this type typically comprise a fuse device electrically connectable between a section of switchboard upstream (for example a line conductor of a single-phase or three-phase electric line) and a section of switchboard downstream (for example an electronic power supply device).

Generally, an electronic signalling device is electrically connected to the fuse device in order to detect and signal any tripping of this latter.

Typically, the electronic signalling device is connected in parallel to the terminals of the fuse device and comprises a current limiting circuit connected in series with a light emitting device (for example an LED or neon light device).

In the presence of intense overcurrents, the fuse device triggers, interrupting the conductive path between its connection terminals. The current supplied by the section of switchboard upstream of the fuse device tends to pass through the electronic signalling device, connected in parallel. This current, appropriately reduced by the current limiting circuit, activates the light emitting device that thus signals triggering of the fuse device.

Electronic signalling devices of the type described have the disadvantage of offering a conductive path between the sections of switchboard upstream and downstream of the fuse device, even when this latter has been triggered.

In practice, these devices prevent complete galvanic separation between the terminals of the fuse device, which would instead be required in the case of triggering of this latter.

The main task of the present invention is to provide an electronic signalling device for low voltage switchboards that enables the aforesaid disadvantages to be overcome.

Within this task, another object of the present invention is to provide an electronic signalling device that is capable of detecting and signalling triggering of a fuse device, coupleable thereto, without compromising galvanic separation between the sections of switchboard connected upstream and downstream of the same fuse device.

A further object of the present invention is to provide an electronic signalling device that is easy to install, also on existing switchboards.

Yet another object of the present invention is to provide an electronic signalling device that is

easy and inexpensive to manufacture at industrial level.

This task and these objects, together with other objects that will be more apparent from the subsequent description and from the accompanying drawings, are achieved, according to the invention, by an electronic signalling device for low voltage switchboards according to claim 1 and the related dependent claims.

Further characteristics and advantages of the present invention will be more apparent with reference to the description given below and to the accompanying figures, provided purely for explanatory and non-limiting purposes, wherein:

- Fig. 1 schematically illustrates an embodiment of the electronic signalling device according to the present invention;
- Fig. 2 schematically illustrates a further embodiment of the electronic signalling device according to the present invention;
- Figs. 3-4 schematically illustrate some embodiments of accessory devices for low voltage switchboards comprising the electronic signalling device according to the present invention;
- Fig. 5 schematically illustrates a possible further embodiment for sensor means included in the electronic signalling device according to the present invention.

With reference to the aforesaid figures, the present invention relates to an electronic signalling device 1 (hereinafter “electronic device”) for low voltage switchboards.

The electronic device 1 is operatively couplable to a protection circuit 300 (of the fuse type) for low voltage switchboards.

The protection circuit 300 (which can be of known type) comprises at least one fuse device 3. As will be better described hereunder, operative coupling between the electronic device 1 and the aforesaid protection circuit 300 can be produced during industrial manufacturing or during installation of the aforesaid devices on a switchboard.

The fuse device 3 comprises a first and second connection terminal 31, 32 and is electrically connectable between a first section of switchboard 501 (for example a line conductor of a single-phase or three-phase electric line) and a second section of switchboard 502 (for example an electronic power supply device).

The fuse device 3 is arranged to interrupt the conductive path between the sections of switchboard 501, 502 in the case in which the circulating current I exceeds a predefined threshold value.

According to the invention, the electronic device 1 comprises sensor means 41, 42 adapted to detect the electric field in a region of space in proximity of the fuse device 3, when the

electronic device 1 is operatively coupled to this latter.

In particular, the sensor means 41, 42 are adapted to detect the electric field in a region of space in proximity of at least one of the connection terminals 31, 32 of the fuse device 3, maintaining galvanic separation from the aforesaid fuse device (in particular without being in electrical contact with its connection terminals).

Advantageously, the sensor means 41, 42 are adapted to generate detection signals V1, V2 indicative of the electric field detected.

The sensor means 41, 42 are advantageously positioned in proximity of one or more connection terminals 31, 32 (without being in electrical contact with these latter), when the electronic device 1 is operatively coupled to the fuse device 3.

The detection signals V1, V2 are therefore indicative of the electric voltage present at the terminals 31, 32 of the fuse device 3, measured with respect to a predefined reference.

If the direction of the current circulating between the sections of switchboard 501-502 is known, the sensor means 41, 42 can be arranged to detect the electric field in proximity of only one of the connection terminals 31, 32.

Preferably, the sensor means 41, 42 are arranged to detect the electric field in proximity of both the connection terminals 31, 32.

According to the invention, the electronic device 1 comprises one or more light emitting devices 46, 47, 48.

Advantageously, the light emitting devices 46, 47, 48 are activatable/deactivatable by appropriate input control signals C1, C2, C3.

According to the invention, the electronic device 1 comprises electronic interface means 43, 44, 45, electrically connected to the sensor means 41, 42 and to the light emitting devices 46, 47, 48.

The electronic interface means 43, 44, 45 are adapted to receive the detection signals V1, V2 from the sensor means 41, 42 and to generate control signals C1, C2, C3 for the light emitting devices based on the detection signals V1, V2.

In this way, they are capable of adjusting the activation/deactivation state of the light emitting devices 46, 47, 48 based on the input detection signals V1, V2 received by the sensor means 41, 42 and, therefore, based on the electric voltage values present at the terminals 31, 32 of the fuse device 3.

Preferably, the sensor means 41, 42 comprise one or more electrodes 410, 420 connected to the electronic interface means 43, 44, 45.

Each of these electrodes can be formed by a conductive pad 410, 420 deposited on at least one

printed circuit substrate 430.

These conductive pads are advantageously positioned in proximity of one or more of the connection terminals 31, 32 (without being in electrical contact with these latter and therefore being galvanically separated from the protection circuit 300), when the electronic device 1 is operatively coupled to the protection circuit 300.

Preferably, the light emitting devices 46, 47, 48 are emitting device of LED type.

Preferably, the electronic interface means 43, 44, 45 consist of electronic circuits capable of conditioning (for example amplifying, filtering, adapting) the detection signals V1, V2 generated by the sensor means 41, 42.

These conditioning circuits can be of analog or digital type or comprise a digital processing device, for example a microprocessor.

Advantageously, the electronic interface means 43, 44, 45 and the light emitting devices 46, 47, 48 can be mounted on the same substrate 430 as the conductive pads 410, 420 (Fig. 5).

In this case, the electrical connections between the various components consist of conductive tracks 440, 450 deposited on the substrate 430 of the electronic device 1.

As illustrated above, the electronic device 1 is arranged so as to maintain galvanic separation from the protection circuit 300 (in particular from the fuse device 3), couplable thereto.

This means that the electronic device 1 is arranged so that there are no conductive paths between its components and the components of the protection circuit 300.

In particular, the electronic device 1 is arranged so that there are no conductive paths connecting the sensor means 41, 42, the light emitting devices 46, 47, 48 and/or the electronic interface means 43, 44, 45 with the connection terminals 31, 32 of the fuse device 3.

Preferably, the components of the electronic device 1 are electrically connectable (for example to be supplied with power) to a third section of switchboard (not illustrated) electrically isolated with respect to the sections of switchboard 501, 502.

Preferably, the sensor means of the electronic device 1 comprise a first and second sensor element 41, 42 adapted to detect the electric field respectively in proximity of the terminals 31, 32 of the fuse device 3, when the electronic device 1 is operatively coupled to this latter.

Preferably, each of the sensor elements 41, 42 consists of a respective conductive pad 410, 420 deposited on a printed circuit substrate 430 (which can also be a single substrate for both the conductive pads) and advantageously positioned in proximity of a respective connection terminal 31, 32, when the electronic device 1 is operatively coupled to the fuse device 3.

According to an embodiment of the invention (Fig. 1), the electronic device 1 comprises a first and second sensor element 41, 42 electrically connected to a first and second interface

circuit 43, 44, in turn electrically connected to a first and second light emitting device 46, 47, respectively.

The first and second interface circuit 43, 44 are adapted to receive first and second detection signals V1, V2 from the first and second sensor element 41, 42, respectively.

The interface circuits 43, 44 are also adapted to generate first and second control signals C1, C2 for the first and second light emitting device 46, 47, based on the aforesaid detection signals V1, V2, respectively.

Operation of the electronic signalling device 1, in this embodiment, is particularly simple.

In the case in which the fuse device 3 is integral (not triggered), each sensor element 41, 42 sends detection signals V1, V2 indicative of the presence of an electric voltage having values within a normal operating interval.

In this case, each interface circuit 43, 44 generates control signals C1, C2 for the corresponding light emitting device 46, 47, so that this latter visually signals normal operating conditions (for example device 46, 47 off).

In the case in which the fuse device 3 is interrupted (triggered) or is not present, at least one sensor element 41, 42 sends detection signals V1, V2 indicative of the presence of an electric voltage having values that are not within the normal operating interval.

The corresponding interface circuit 43, 44 generates control signals C1, C2 to activate the respective light emitting device 46, 47, so that this latter visually signals fault conditions (for example device 46 and/or 47 on).

From the above, it is evident that, in the embodiment described in Fig. 3, the electronic device 1 comprises two circuit loops operating substantially independently and capable of signalling triggering of the fuse device 3, detecting the electric voltage at a respective connection terminal 31, 32 of the same fuse device, without being in electrical contact with this latter.

Naturally, the signalling logic of the normal or faulty operating conditions could vary from those described, as a function of contingent operating requirements.

According to another embodiment of the invention (Fig. 2), the electronic device 1 comprises a first and second sensor element 41, 42 electrically connected to a first and second interface circuit 43, 44, respectively.

The electronic device 1 comprises a third interface circuit 45, electrically connected to the first and second interface circuit 43, 44 and a third light emitting device 48, electrically connected to the interface circuit 45.

The first and second interface circuit 43, 44 are adapted to receive first and second detection signals V1, V2, sent by the first and second sensor element 41, 42, respectively.

The first and second interface circuit 43, 44 are also adapted to generate first and second logic signals L1, L2 for the interface circuit 45, based on the aforesaid detection signals V1, V2.

The interface circuit 45 is suitable to receive first and second logic signals L1, L2 and to generate third control signals C3 for the light emitting device 48, based on the logic signals L1, L2.

Also in this embodiment, operation of the electronic device 1 is somewhat simple.

In the case in which the fuse device 3 is integral (not triggered), each sensor element 41, 42 sends detection signals V1, V2 indicative of the presence of an electric voltage having values in a normal operating interval.

Both the interface circuits 43, 44 therefore generate logic signals L1, L2 having a value indicative of normal operating conditions (for example, both the signals L1, L2 are at a “high” or “low” logic value).

In the case in which the fuse device 3 is interrupted (triggered) or not present, at least one sensor element 41, 42 sends detection signals V1, V2 indicative of the presence of an electric voltage having values not included in a normal operating interval.

The interface circuits 43, 44 therefore generate logic signals L1, L2 having a different value (for example, the signal L1 is in a “high” logic state while the signal L2 is in a “low” logic state, or vice versa) or both having a value indicative of a fault condition (for example, both signals L1, L2 are at a “low” or “high” logic value).

The interface circuit 45 advantageously operates as a logic block of the AND or NAND type.

In the case in which it receives input logic signals L1, L2 both having a value indicative of normal operating conditions, the interface circuit 45 generates control signals C3 to activate the light emitting device 48, so that this latter visually signals the normal operating conditions (for example device 48 off).

In the case in which it receives input logic signals L1, L2 having a different value or logic signals both having a value indicative of fault conditions, the interface circuit 45 generates a control signal C3 to activate the light emitting device 48, so that this latter visually signals fault conditions (for example device 48 on).

Naturally, the signal generation logic L1, L2, C3 and the signalling logic of the normal or faulty operating conditions could vary with respect to those described as a function of contingent operating requirements.

A further aspect of the present invention relates to an accessory device 101, 102 for low voltage switchboards comprising the electronic signalling device 1.

The accessory device 101, 102 advantageously comprises an enclosure 400 that defines an

inner volume in which the electronic device 1 is housed.

Advantageously, the light emitting devices 46, 47, 48 of the electronic device 1 are positioned at appropriate windows or housings (not shown) of the enclosure 400 so as to be visible externally to the same enclosure.

The accessory device 101, 102 is installable in a low voltage switchboard by means of fixing screws or other analogous connection means or by means of snap-on connection means (of plug-in type).

In an embodiment (Fig. 3), the accessory device 101 comprises a protection circuit 300 provided with at least one fuse device 3 and housed in the inner volume defined by the enclosure 400.

The electronic device 1 is arranged so as to be operatively coupled to the protection circuit 300, in particular to the fuse device 3, maintaining galvanic separation.

It is evident how in this embodiment of the invention, operative coupling between the electronic device 1 and the related circuit 300 is produced during industrial manufacturing of the accessory device 101.

In this embodiment, the accessory device 101 is configured as accessory fuse protection device provided with a signalling system (the electronic device 1) of triggering of the fuse.

In another embodiment (Fig. 4), the accessory device 102 is operatively couplable to a further accessory device 103 comprising a protection circuit 300 provided with a fuse device 3.

The accessory devices 102, 103 are operatively couplable to each other so that the electronic device 1 is operatively coupled with the protection circuit 300, in particular with the fuse device 3, maintaining galvanic separation.

Preferably, the enclosure 400 of the accessory device 102 comprises a wall 401 for coupling with a wall of the enclosure of the accessory device 103.

Preferably, the sensor means 41, 42 of the electronic device 1 are positioned in proximity of the coupling wall 401 so as to be positioned in proximity of the connection terminals 31, 32 of the fuse device 3, when the accessories 102, 103 are operatively coupled.

It is evident how in this embodiment of the invention, operative coupling between the electronic device 1 and the related circuit 300 is produced during operative installation of the accessory device 102.

In this embodiment, the accessory device 102 is configured as accessory signalling device couplable to an accessory fuse protection device. It is evident how it is particularly suitable for installation in existing switchboards (retrofitting).

A further aspect of the present invention relates to a low voltage switchboard 500 comprising

a protection circuit 300 that comprises at least one fuse device 3, and the electronic signalling device 1 operatively coupled to said protection circuit and galvanically separated from said protection circuit.

It has been seen in practice that the electronic signalling device 1 according to the present invention allows the task to be satisfied and the set objects to be achieved.

The electronic device 1 is capable of effectively detecting and signalling triggering (or even lack of installation) of a fuse device, coupled thereto.

The electronic device 1 is arranged so that it does not offer any conductive path between the sections of electric switchboard connected to the fuse device.

Therefore, galvanic separation between these sections of switchboard is not compromised once the fuse device has been triggered.

The electronic device 1 is simple to install, even on existing switchboards.

The electronic device 1 has a relatively simple structure, easy to manufacture at industrial level, at competitive costs with respect to prior art devices.

CLAIMS

1. An electronic signalling device (1) for low voltage switchboards, operatively couplable to a protection circuit (300) for low voltage switchboards, characterized in that it comprises:
 - sensor means (41, 42) capable of detecting an electric field in a region of space in proximity of a fuse device (3) of said protection circuit (300), when said electronic signalling device is operatively coupled to said protection circuit;
 - one or more light emitting devices (46, 47, 48);
 - electronic interface means (43, 44, 45), electrically connected to said sensor means and to said light emitting devices, said electronic interface means being adapted to receive detection signals (V1, V2) from said sensor means and being adapted to generate control signals (C1, C2, C3) for said light emitting devices (46, 47, 48), based on said detection signals.
2. The electronic signalling device according to claim 1, characterized in that said sensor means (41, 42) are capable of detecting an electric field in a region of space in proximity of at least one terminal (31, 32) of said fuse device (3).
3. The electronic signalling device according to claim 2, characterized in that said sensor means comprise a first and second sensor element (41, 42) capable of detecting an electric field in regions of space in proximity of a first and second terminal (31, 32) of said fuse device (3), respectively.
4. The electronic signalling device according to claim 3, characterized in that said electronic interface means comprise:
 - a first and second interface circuit (43, 44), electrically connected to said first and second sensor (41, 42), respectively;
 - a first and second light emitting device (46, 47), electrically connected to said first and second interface circuit (43, 44), respectively;
 said first and second interface circuit (43, 44) being adapted to receive first and second detection signals (V1, V2) from said first and second sensor element (41, 42), respectively;
 said first and second interface circuit (43, 44) being adapted to generate first and second control signals (C1, C2) for said first and second light emitting device (46, 47), based on said first and second detection signals (V1, V2), respectively.
5. The electronic signalling device according to claim 3, characterized in that said electronic interface means comprise:

- a first and second interface circuit (43, 44), electrically connected to said first and second sensor (41, 42), respectively;
- a third interface circuit (45), electrically connected to said first and second interface circuit (43, 44);
- a third light emitting device (48), electrically connected to said third interface circuit (45);

said first and second interface circuit (43, 44) being adapted to receive first and second detection signals (V1, V2) from said first and second sensor (41, 42), respectively;

said first and second interface circuit (43, 44) being adapted to generate first and second logic signals (L1, L2), based on said first and second detection signals (V1, V2), respectively;

said third interface circuit (45) being adapted to receive said first and second logic signals (L1, L2) and to generate third control signals (C3) for said third light emitting device (48), based on said first and second logic signals (L1, L2).

6. The electronic signalling device according to one or more of the preceding claims, characterized in that said sensor means (41, 42) comprise one or more conductive pads deposited (410, 420) on one or more printed circuit substrates (430) and electrically connected to said electronic interface means (43, 44, 45), said conductive pads being positioned in proximity of at least one connection terminal (31, 32) of said fuse device (3), when said electronic signalling device is operatively coupled to said fuse device.
7. The electronic signalling device according to one or more of the preceding claims, characterized in that said light emitting devices (46, 47, 48) are LED devices.
8. An accessory device (101, 102) for low voltage switchboards characterized in that it comprises an electronic signalling device (1) according to one or more of the preceding claims.
9. The accessory device (101) according to claim 8, characterized in that it comprises a protection circuit (300) that comprises a fuse device (3), said electronic signalling device (1) being operatively coupled to said protection circuit and being galvanically separated from said protection circuit.
10. The accessory device (102) according to claim 8, characterized in that it is operatively couplable to a further accessory device (103) comprising a protection circuit (300) that comprises a fuse device (3), so that said electronic signalling device (1) is operatively coupled with said protection circuit (300) and galvanically separated from said protection circuit.

11. A low voltage switchboard (500) comprising a protection circuit (300) that comprises a fuse device (3) characterized in that it comprises an electronic signalling device (1) according to one or more of claims 1 to 7, operatively coupled to said protection circuit (300) and galvanically separated from said protection circuit.

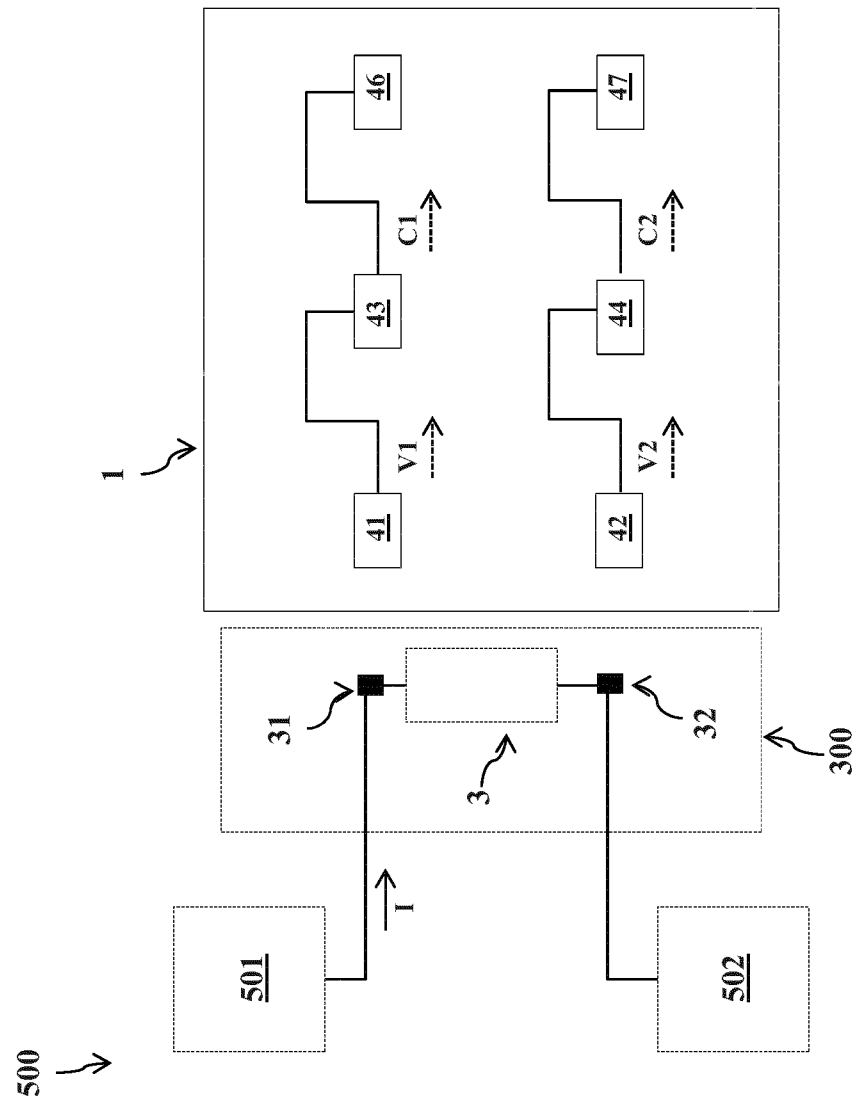


FIG. 1

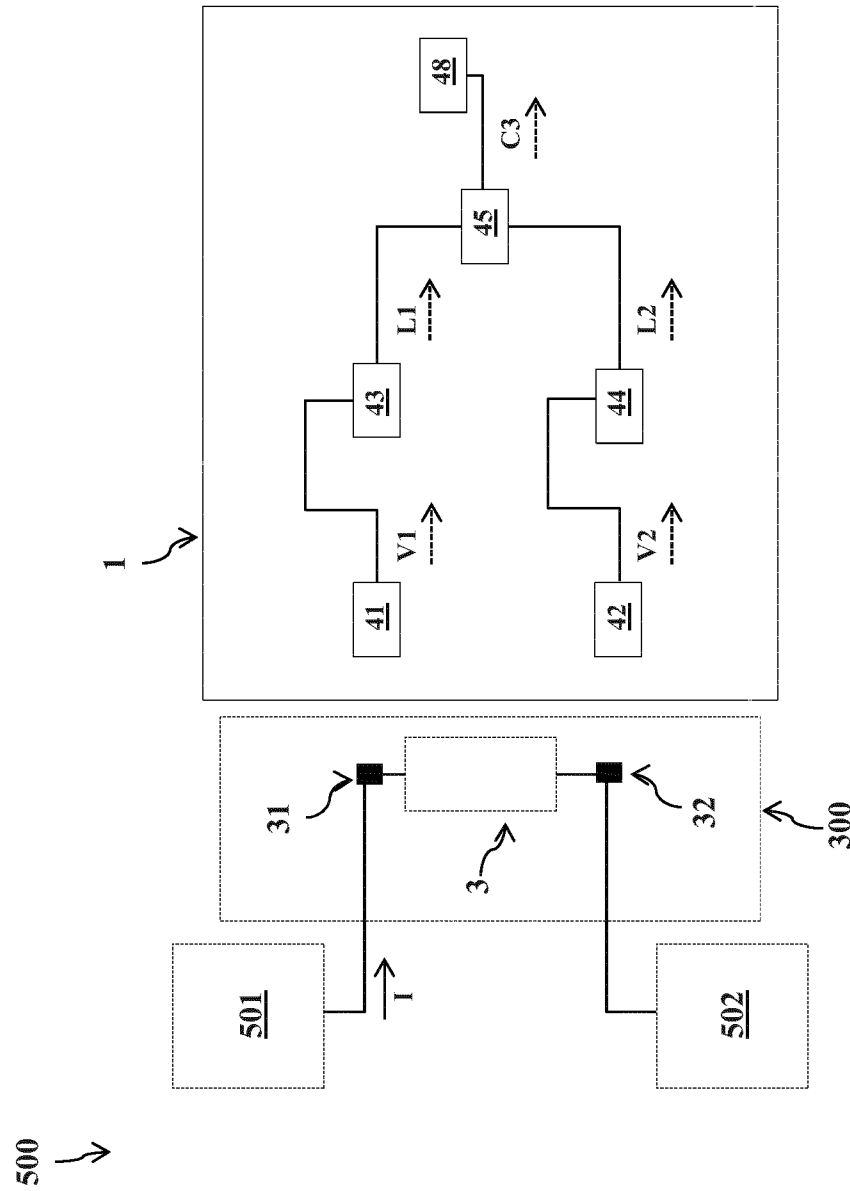


FIG. 2

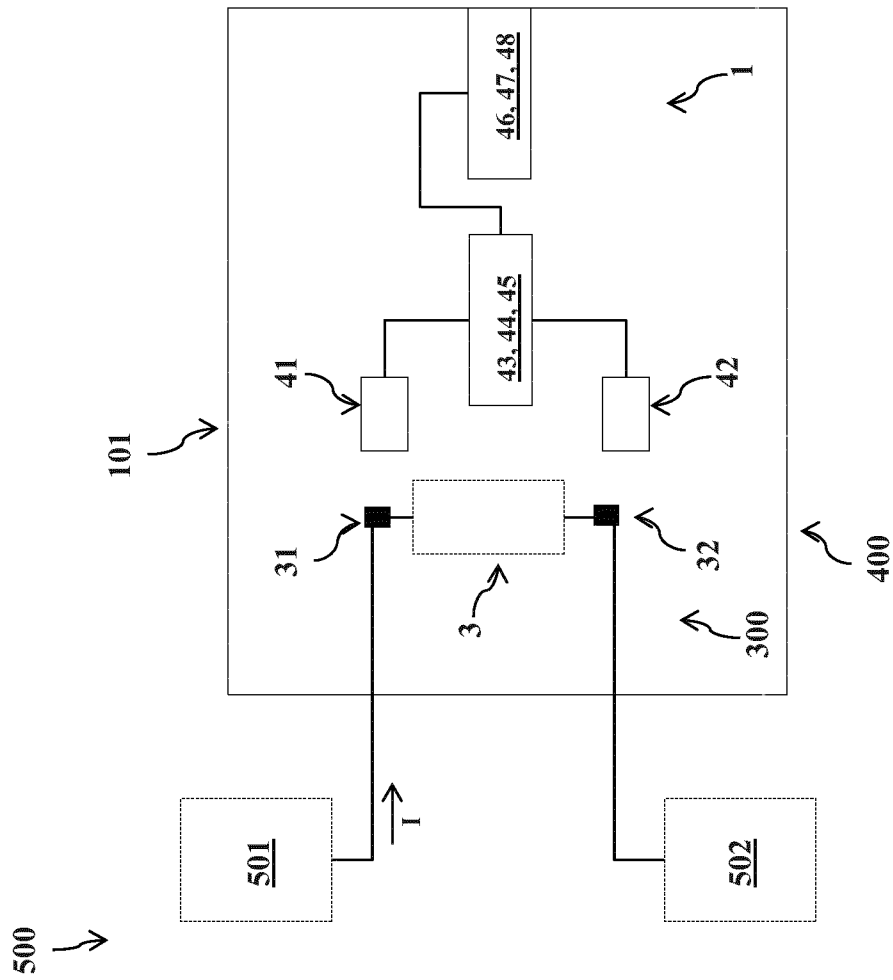


FIG. 3

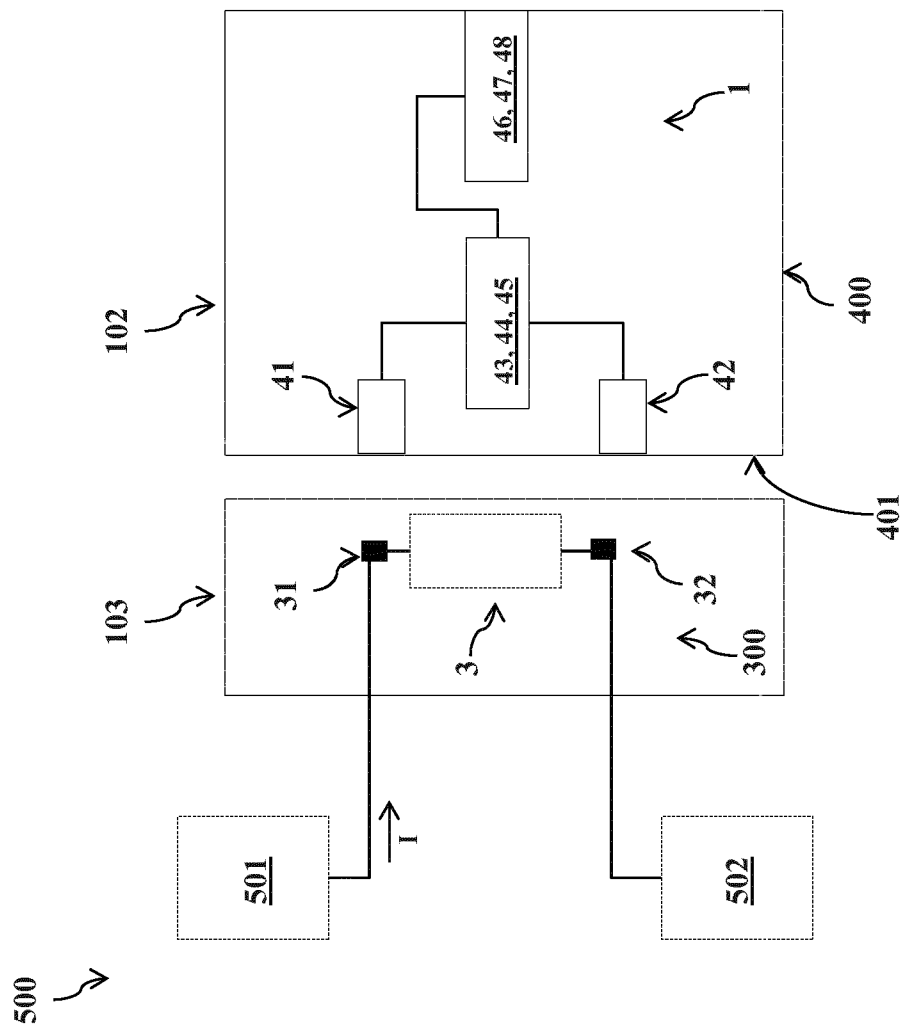


FIG. 4

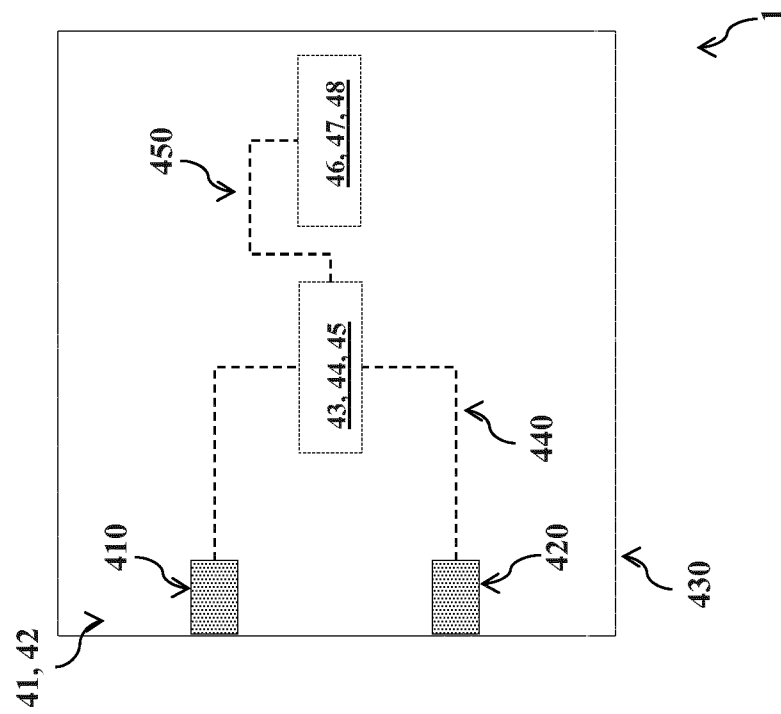


FIG. 5

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2014/071970A. CLASSIFICATION OF SUBJECT MATTER
INV. H01H85/32
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
H01H

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 02/46777 A2 (LEM HEME LTD [GB]; JONES LAWRENCE ANTHONY [GB]) 13 June 2002 (2002-06-13)	1,2,6-11
Y	page 16, line 18 - page 17, line 11;	3,4
A	figure 11	5
Y	----- US 5 093 657 A (BISHOP MARTIN T [US] ET AL) 3 March 1992 (1992-03-03) abstract; figure 5 -----	3,4



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents :

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Date of the actual completion of the international search

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/EP2014/071970

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 0246777	A2	13-06-2002	AT 349707 T 15-01-2007
		AU 2390402 A 18-06-2002	
		DE 60125586 T2 05-07-2007	
		EP 1340092 A2 03-09-2003	
		US 2004095125 A1 20-05-2004	
		WO 0246777 A2 13-06-2002	

US 5093657	A	03-03-1992	NONE
