

ELECTRICAL LOAD SWITCHING DEVICE MADE SECURE AGAINST SHORT
CIRCUITS

The invention generally relates to the field of electrical breaking and protection against short circuits.

More precisely, the invention relates to an electrical load switching device comprising at least one active power
5 supply terminal and a neutral power supply terminal connected to active and neutral electrical power supply lines respectively, a controlled terminal, a switch inserted between the active terminal and the controlled terminal, an active conductor connecting the active
10 terminal to the switch, a controlled conductor connecting the switch to the controlled terminal, and a support to which the terminals, the switch and conductors are fixed, the load being connected between the neutral terminal and the controlled terminal during operation.

15 This type of device has been universally known and used for more than a century.

However, when this type of device is made in large production series, the problem arises of reducing their size and production cost, while optimising their safety.

In particular, desirable changes to safety standards
5 to make them increasingly strict imposes that these devices should be redesigned to resist short circuits without endangering their environment, and particularly without any emission of flames or burning particles, and without allowing the appearance of live metallic parts, or
10 sustaining their presence.

At the present time, these results are achieved either by the use of a fuse, which has the disadvantage that it increases the cost and size of the device, or by using a fuse track, which introduces serious difficulties in
15 development and calibration and a large dispersion of performances of the device.

Moreover, neither of these two known solutions is capable of guaranteeing that reliability requirements will be respected if the electrical load to be controlled is
20 composed of a light source such as a halogen or dichroic lamp at the end of its life.

In this context, the purpose of the invention is to propose an electrical load switching device which does not have the defects mentioned above, and can eliminate the
25 risk of deterioration for its environment if there is a short circuit.

To achieve this, the device according to the invention, which is otherwise conform with the generic definition given in the preamble above, is characterised
30 essentially in that the support comprises a stack formed of

at least two superposed insulating layers and with an upper outer face and a lower outer face, and in that the active conductor and the controlled conductor are each separated from each outer face of the support by at least one
5 insulating layer of the stack.

In the preferred embodiment of the invention, the stack is in the form of a multilayer printed circuit and each conductor is formed by a conducting track deposited on one of the insulating layers of this printed circuit.

10 For example, the support comprises a stack of at least three insulating layers, in which case the active conductor and the controlled conductor may be separated from each other by at least one of these insulating layers.

In one advanced embodiment of the invention, at least
15 a first of the outer faces of the stack may be provided with additional conducting tracks, and this device may comprise electronic components connected to these additional conducting tracks and fixed to the first outer face of the stack.

20 In practice, the switch may in particular be composed of an electromechanical component such as a relay, or by an electronic component such as a thyristor, a triac, an IGBT transistor, a MOS transistor or generically a semiconductor power component.

25 Other characteristics and advantages of the invention will become clearer after reading the description given below for guidance that is in no way limitative, with reference to the attached drawings, in which:

- Figure 1 is a general diagram illustrating the
30 electric functions of a device conform with a first or

second embodiment of the invention and shown in its functional environment;

- Figure 2 is a top view of the upper insulating layer in the device illustrated in Figure 1;

5 - Figure 3 is a top view of the intermediate insulating layer in the device illustrated in Figure 1 and assumed to be conforming with the second embodiment, this figure representing the location of some elements of the device visible in figures 1 and 2, in the form of dashed
10 lines,

- Figure 4 is a top view of the lower insulating layer in the device illustrated in Figure 1 and assumed to be conforming with the second embodiment, this figure representing the location of some elements of the device
15 visible in figures 1 and 2, in the form of dashed lines,

- Figure 5 is a bottom view of the lower insulating layer in the device illustrated in Figure 1 and assumed to be conforming with the second embodiment, this figure representing the location of some elements of the device
20 visible in figures 1 and 2, in the form of dashed lines,

- Figure 6 is a sectional view along a vertical plane of the device illustrated in figure 1, assumed to be conforming with the first embodiment; and

- Figure 7 is a sectional view on a vertical plane
25 of the device illustrated in Figure 1 and assumed to be conforming with the second embodiment.

As mentioned above, the invention relates to an electrical load switching device comprising particularly a neutral power supply terminal 10, an active power supply
30 terminal 11 and a controlled terminal 12.

The active power supply terminal 11 and the neutral power supply terminal 10 are connected to an active electrical power supply line LA called the "phase" by those skilled in the art, and to a neutral electrical power supply line LN, respectively, during operation (figure 1).

Moreover, the device comprises a switch 2 inserted between the active terminal 11 and the controlled terminal 12, an active conductor 31 connecting the active terminal 11 to the switch 2, and a controlled conductor 32 connecting the switch 2 to the controlled terminal 12.

The invention is particularly applicable to the case in which the switch 2 is composed of an electromechanical component such as a relay, or by an electronic component such as a thyristor, a triac, an IGBT transistor, a MOS transistor, or more generically a semiconductor power component.

During operation, the electrical load K shown in figure 1 in the form of a light bulb is connected between the neutral terminal 10 and the controlled terminal 12, such that it may or may not carry an electrical current depending on the state of the switch 2.

The elements represented by the terminals 10 and 12, the switch 2 and the conductors 31 and 32 are fixed to a support 4 on which the main characteristics of the invention are shown more specifically.

According to the invention, the support 4 comprises a stack of superposed insulating layers such as 41 to 43, and each of the conductors represented by the active conductor 31 and the controlled conductor 32 is separated firstly from the upper outer face 4s and the lower outer face 4i of

the support 4 by one or several insulating layers, such as 41 to 43, in the stack that forms this support.

In its most industrial embodiment, the support 4 is composed essentially of a multilayer printed circuit, and
5 the active conductor 31 and the controlled conductor 32 are formed by a conducting track deposited on one of the insulating layers 41 to 43 of this printed circuit.

As shown in Figure 6, the support 4 may comprise only two insulating layers, the active conductor 31 and the
10 controlled conductor 32 then being arranged between the upper face of the lower insulating layer 42 and the lower face of the upper insulating layer 41, in other words separated from the lower outer face 4i of the support 4 by the lower layer 42 and separated from the upper outer face
15 4s of the support 4 by the upper layer 41.

In one embodiment designed to resist more severe operating conditions, the support 4 may for example comprise a stack with at least three insulating layers 41 to 43 (Figure 7), the active conductor 31 and the
20 controlled conductor 32 then being separated from each other by at least the insulating layer 42.

In addition to the elements already mentioned, and particularly in the case in which the switch 2 is composed of an electronic component, the device according to the
25 invention may comprise auxiliary electronic components 6, capable of cooperating with switch 2, according to schemes well known to those skilled in the art.

In this case, the outer faces 4s and 4i of the stack, or at least one of them, has additional conducting tracks
30 such as 51 to 54 to which the electronic components 6 are

connected and through which they are fixed to the support, in addition to other possible attachment means.

For example, all components 6 are fixed to the upper outer face 4s of the support 4 as shown in figure 2, these components being connected to each other, to the switch 2, and to the neutral terminal 10 by conducting tracks, some of which (51 and 52) are deposited on the upper outer face 4s and others (53 and 54) are deposited on the lower outer face 4i.

10 With this arrangement, the device according to the invention reacts to a short circuit of the load K without creating any blast or damage to its environment.

CLAIMS

1. Electrical load switching device comprising at least one active power supply terminal (11) and a neutral power supply terminal (10) connected to active (LA) and neutral (LN) electrical power supply lines respectively during
5 operation, a controlled terminal (12), a switch (2) inserted between the active terminal (11) and the controlled terminal (12), an active conductor (31) connecting the active terminal (11) to the switch (2), a controlled conductor (32) connecting the switch (2) to the
10 controlled terminal (12), and a support (4) to which the terminals (10 to 12), the switch (2) and conductors (31, 32) are fixed, the load (K) being connected between the neutral terminal (10) and the controlled terminal (12) during operation, characterised in that the support (4)
15 comprises a stack formed of at least two superposed insulating layers (41 to 43) and with an upper outer face (4s) and a lower outer face (4i), and in that the active conductor (31) and the controlled conductor (32) are each separated from each outer face (4s, 4i) of the support (4)
20 by at least one insulating layer (41 to 43) of the stack.

2. Device according to claim 1, characterised in that the stack is in the form of a multilayer printed circuit and in that each conductor (31, 32) is formed by a conducting
25 track deposited on one of the insulating layers (41 to 43) of this printed circuit.

3. Device according to any one of claims 1 and 2, characterised in that the support (4) comprises a stack of at least three insulating layers (41 to 43), and in that the active conductor (31) and the controlled conductor (32)
5 are separated from each other by at least one of these insulating layers (42).

4. Device according to any one of the previous claims, characterised in that at least a first (4s) of the outer
10 faces (4s, 4i) of the stack is provided with additional conducting tracks (51 to 54), and in that this device comprises electronic components (6) connected to these additional conducting tracks (51 to 54) and fixed to the first outer face (4s) of the stack.

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5. Device according to any one of the previous claims, characterised in that the switch (2) is composed of an electromechanical component such as a relay.

20 6. Device according to any one of the previous claims, characterised in that the switch (2) is composed of an electronic component such as a thyristor, a triac, an IGBT transistor, a MOS transistor or any other semiconductor power component.