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(54) Title: PROTECTION CIRCUIT FOR PREVENTING CONNECTION OF THE DC OUTPUT OF AN ELECTRONIC ELEMENT TO AN AC VOLTAGE BY MISTAKE AND AC/DC CONVERTER COMPRISING THE PROTECTION CIRCUIT

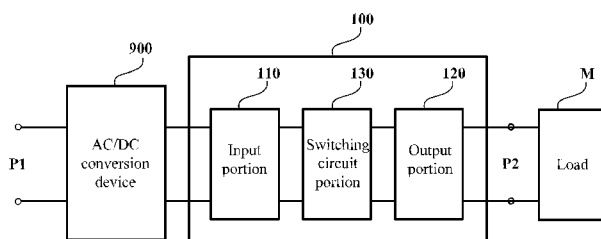


Fig. 1B

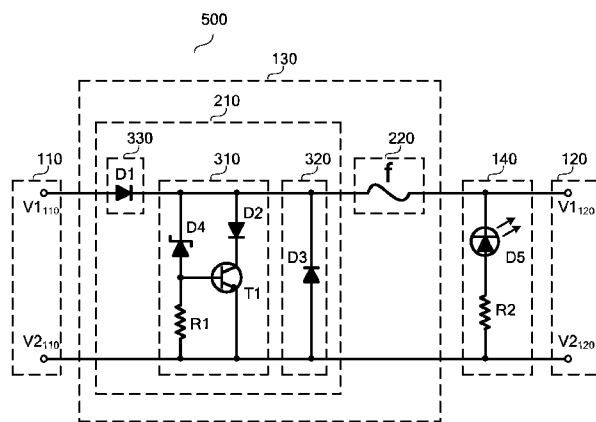


Fig. 5

(57) Abstract: The invention provides a protection circuit for preventing the DC output of an electronic device, such as an AC/DC conversion device, from being connected to an AC voltage by mistake. The protection circuit comprises an input portion to be connected to the DC output of the electronic device, an output portion and a switching circuit portion coupled between the input portion and the output portion. The switching circuit portion is configured provide a DC voltage from the input portion to the output portion. The switching circuit is further configured to prevent an AC voltage from being transmitted to the input portion when the output portion is connected to an AC voltage by mistake. An AC/DC converter according to the invention comprises an AC/DC conversion device and the above protection circuit. By applying the above techniques, damage to the elements can be prevented when connecting the output portion to an AC voltage by mistake and resultant fire can be avoided.



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Description

**PROTECTION CIRCUIT FOR PREVENTING CONNECTION OF THE DC OUTPUT
OF AN ELECTRONIC ELEMENT TO AN AC VOLTAGE BY MISTAKE AND
AC/DC CONVERTER COMPRISING THE PROTECTION CIRCUIT**

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Field of the Utility model

The present utility model generally relates to the circuit field, and in particular, to a protection circuit for preventing the output from connecting to the AC voltage by mistake and an AC/DC converter.

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Background of the Utility model

In the prior art, there are lots of electronic elements which are supposed to be driven by the DC voltage, such as LED. The AC voltage such as AC 220V needs to be converted into DC voltage before being used by these electronic elements. Generally, an AC/DC conversion element and the like can be used for realizing such conversion, and thereby the AC output of the AC/DC conversion element would be coupled with such an electronic element. However, the AC terminal and the DC terminal of such an electronic element appear similar to each other, so that a user usually has difficulty to discriminate the input and output, or often misrecognize them. For example, the DC output of the AC/DC conversion element is taken as the AC input by mistake, and thereby the AC voltage is applied to the DC output. In such a case, the AC voltage applied to the DC output by mistake would cause damage to the elements in the circuit, and even may result in a fire due to the magnitude of the AC voltage.

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Summary of the Utility Model

Hereinafter, a brief summary of the present utility model is given, so as to provide a basic understanding of some as-

pects of the present utility model. It should be understood that the summary is not an exhaustive summary of the utility model. The summary neither intends to determine the critical part or important part of the utility model, nor intends to
5 limit the scope of the utility model. The object of the summary is only presenting some concepts in a brief form, which is used as a preamble for the detailed description that will be presented later.

In view of the above defects in the prior art, it is one of
10 the objects for the present utility model to provide a protection circuit for preventing the output from connecting to the AC voltage by mistake and an AC/DC converter, to overcome at least the problem existing in the prior art that the AC voltage applied to the DC output of an element by mistake
15 would cause damage to the elements in the circuit.

In order to achieve the above object, according to the embodiments of the present utility model, there is provided a protection circuit for preventing output from connecting to the AC voltage by mistake, which comprises an input portion,
20 an output portion, and a switching circuit portion. The switching circuit portion is coupled between the input portion and the output portion, and is configured to work under the first state in the case where the input portion connects to an input DC voltage, so as to provide the input DC voltage to the output portion, and is configured to work under
25 the second state in the case where the output portion connects an input AC voltage, so as to prevent the input AC voltage from being transmitted to the input portion.

According to the embodiments of the present utility model,
30 there is further provided an AC/DC converter, which comprises an AC/DC conversion device and a protection circuit for preventing the output from connecting to the AC voltage by mistake as described above. The input portion of the pro-

tection circuit is coupled with the DC output of the AC/DC conversion device. The AC/DC converter is configured to output a DC voltage outwards by the output portion of the protection circuit in a case where the AC input of the AC/DC conversion device connects to an AC voltage, and prevent, in a case where the output portion of the protection circuit connects to an AC voltage, the AC voltage from being transmitted to the DC output of the AC/DC conversion device.

A protection circuit for preventing the output from connecting to the AC voltage by mistake and an AC/DC converter according to the embodiments of the present utility model can achieve at least one of the following advantages: it can avoid the damage to other elements in the circuit which contains the protection circuit caused by the AC voltage input from the output portion of the protection circuit; it can avoid the damage to the AC/DC converter and/or other elements in the circuit which contains the AC/DC converter caused by the AC voltage input from the DC output of the AC/DC conversion device; it can avoid the self ignition of the AC/DC converter caused by the above AC voltage; it can avoid the self ignition and other issues of the protection circuit or other elements in the circuit which contains the AC/DC converter caused by the above AC voltage; and it can reduce the possibility of fire; and so on.

The above and advantages of the present utility model will be more obvious in view of the following detailed description of the best embodiments of the present utility model in conjunction with the accompanying figures.

Brief Description of the Drawings

The present utility model may be better understood by referring to the description hereinafter in combination with the drawings, wherein in the drawings, the same or similar ref-

erence signs are used to indicate the same or similar components. All the drawings and the detailed description hereinafter are included in the specification and constitute a part of the specification, and are used to further present
5 examples to illustrate the preferred embodiments of the utility model and explain the principles and advantages of the utility model. In the drawings:

Fig.1A is a block diagram schematically showing a structure of the protection circuit for preventing the output from
10 connecting to the AC voltage by mistake according to the embodiments of the present utility model.

Fig.1B is a schematic diagram of a correct connecting method for the protection circuit as shown in Fig.1A and the AC/DC conversion device 900.

15 Fig.2 is a block diagram schematically showing a possible exemplary structure of the switching circuit portion 130 as shown in Fig.1A.

Fig.3 is a block diagram schematically showing an exemplary structure of the switching unit 210 as shown in Fig.2.

20 Fig.4 is a block diagram schematically showing another structure of the protection circuit for preventing the output from connecting to the AC voltage by mistake according to the embodiments of the present utility model.

Fig.5 is a circuit structure diagram schematically showing
25 an application example of the protection circuit for preventing the output from connecting to the AC voltage by mistake according to the embodiments of the present utility model.

Fig.6 is a block diagram schematically showing an exemplary
30 structure of the AC/DC converter according to the embodiments of the present utility model.

Detailed Description of the Embodiments

Hereinafter, the embodiments of the present utility model will be described in combination with the drawings. For clearness and conciseness, not all the features of the practical embodiments are described in the description. However, it should be understood that many decisions specific to the embodiments need to be made during the development of any such practical embodiments, so as to achieve the specific objects of the developer, for example, complying with the constraints correlated with the system and business, where the constraints may be changed with the variation of the embodiments. Further, it should be understood that although the developing work may be very complex and time-consuming, such developing work is merely a routine task for those skilled in the art benefiting from the disclosure of the utility model.

It should be further pointed out here that in the drawings, only device structures and/or process steps closely related to the solution of the present utility model are illustrated in the drawings, and other details having little relation with the present utility model are omitted, so as to prevent the present utility model from being obscured by unnecessary details.

In practical applications, since some electronic elements are supposed to be driven by the DC voltage, it is necessary to convert the AC voltage (for example, AC 220V) and use the converted DC voltage to drive the above electronic elements. However, in practice, a misoperation may occur during the process of connecting the electronic element and an element used for performing an AC/DC conversion. For example, when using this electronic element, a user should have coupled the DC output of the element used for performing an AC/DC conversion to the DC terminal of the electronic ele-

ment. However, in some situations, the user may carelessly couple the AC input of the element used for performing an AC/DC conversion with the DC terminal of the electronic element. Then, when the user tries to apply an AC voltage, the user may apply the AC voltage to the vacant DC output of the element used for performing an AC/DC conversion. In this case, the user intended to apply the AC voltage by the AC input of the element used for performing an AC/DC conversion, convert the AC voltage to obtain DC voltage, and then provide the converted DC voltage to this electronic element. But when the above misoperation occurs, for example, the element used for performing an AC/DC conversion is likely to be damaged by a large AC voltage. This might cause damage to this element and/or other elements in the circuit that contains this element, and might also cause serious consequences, such as self ignition of this element or other elements in the circuit containing this element or even disaster of fire because of overheat. Here, said "output connecting to the AC voltage by mistake" means that the AC voltage which was intended to be applied to the AC input of the element used for performing an AC/DC conversion is applied to the DC output of this element by mistake.

Fig.1A is a block diagram schematically showing a structure of the protection circuit for preventing the output from connecting to the AC voltage by mistake according to the embodiments of the present utility model. As shown in Fig.1A, the protection circuit 100 comprises an input portion 110, an output portion 120, and a switching circuit portion 130. The switching circuit portion 130 is coupled between the input portion 110 and the output portion 120, and is configured to work under the first state in a case where the input portion 110 connects to an input DC voltage, so as to provide the input DC voltage to the output portion 120, and

work under the second state in a case where the output portion 120 connects to an input AC voltage, so as to prevent the input AC voltage from being transmitted to the input portion 110.

5 Herein, there are a plurality of ways for "preventing the input AC voltage from being transmitted to the input portion 110". For example, it is possible to prevent the input AC voltage from being transmitted to the input portion 110 by switching off the switching circuit portion 130 using fusi-
10 ble elements such as fuses, or by bypassing the input AC voltage and using additional loads to bear this AC voltage, or by other ways that would not let the input AC voltage be transmitted to the input portion, etc.

With respect to the problem described above, the protection
15 circuit for preventing the output from connecting to the AC voltage by mistake according to the embodiments of the present utility model can be used to solve this problem. For example, as shown in Fig.1B, by coupling the input portion 110 of the protection circuit 100 as shown in Fig.1A to the
20 DC output of the AC/DC conversion device 900, damage to the elements in the circuit by "the output connecting to AC voltage by mistake" and even disaster of fire can be avoided.

Specifically, in the case where the input portion 110 of the
25 protection circuit 100 is coupled with the DC output of the AC/DC conversion device 900, as shown in Fig.1B, the correct operations next would be connecting the interface P2 corresponding to the output portion 120 of the protection circuit 100 to DC terminal of the load M and then applying an AC
30 voltage to the interface P1 corresponding to the AC input of the AC/DC conversion device 900. Thereupon the AC voltage is converted into a DC voltage after passing through the AC/DC conversion element, and the DC voltage is provided to the

above electronic element after passing through the input portion 110, the switching circuit portion 130 and the output portion 120 of the protection circuit 100. In this case, the switching circuit portion 130 works under the first state.

However, in practical use, the protection circuit 100 and the AC/DC conversion device 900 coupled together are packaged integrally in general, which makes the external interfaces thereof similar. The above external interfaces include the interface P1 corresponding to the AC input of the AC/DC conversion device 900 and the interface P2 corresponding to the output portion 120 of the protection circuit 100. As shown in Fig.1B, when a user tries to apply an AC voltage, correct operations would be coupling the interface P2 to the DC terminal of the load M and then applying an input voltage from the interface P1, while wrong operations may be coupling the interface P1 to the DC terminal of the load M and then applying an input AC voltage from the interface P2. In the case of the above wrong operations, the AC current produced by the input AC voltage flows through the output portion 120 and the switching circuit portion 130 and then returns back to the output portion 120, rather than flowing to the input portion 110, thus it would not flow to the AC/DC conversion device 900. Therefore, the AC/DC conversion device 900 would not be damaged even if the input AC voltage is input from the interface P2 by mistake, thereby no fire would be caused, resulting in a protection for the AC/DC conversion device 900.

In one specific implementation of the protection circuit for preventing the output from connecting to the AC voltage by mistake according to the embodiments of the present utility model, the switching circuit portion 130 can be configured in a way which will be described below, so as to realize the

above described functions of the switching circuit portion 130. Hereinafter, a specific configuration example of the switching circuit portion 130 will be described with reference to Fig.2.

5 Fig.2 is a block diagram schematically showing a possible exemplary structure of the switching circuit portion 130 as shown in Fig.1A according to the embodiments of the present utility model.

As shown in Fig.2, the switching circuit portion 130 may
10 comprise a switching unit 210 and an overcurrent breaker unit 220 which has a predetermined breaking current. The switching unit 210 can be coupled with the input portion 110 (not shown), and the overcurrent breaker unit 220 can be coupled between the switching unit 210 and the output portion 120 (not shown).
15

The switching unit 210 and the overcurrent breaker unit 220 can be configured to: in a case where the input portion 110 connects to an input DC voltage, cause the current to flow from the input portion 110 to the output portion 120 via the
20 switching unit 210 and the overcurrent breaker unit 220, so as to provide the above DC voltage to the output portion 120. In this case, the current flowing through the overcurrent breaker unit 220 (that is, the current flowing through the overcurrent breaker unit 220 when the switching circuit
25 portion works under the first state) is lower than the predetermined breaking current of the overcurrent breaker unit 220, and thereby the overcurrent breaker unit 220 would not break.

For example, the switching unit 210 can be configured to be
30 unidirectionally switched on in the direction of $V1_0$ - $V3_0$, that is, the switching unit 210 is a unidirectional switched on element in the direction of $V1_0$ - $V3_0$. In other words, the switching unit 210 is switched on in the direction of $V1_0$ - $V3_0$.

when the voltage between $V1_0$ and $V3_0$ is higher than a predetermined threshold, and is switched off in the direction of $V1_0$ - $V3_0$ when the voltage between $V1_0$ and $V3_0$ is lower than the predetermined threshold or negative. Herein, the voltage between $V1_0$ and $V3_0$ being negative means that the potential of $V1_0$ is lower than the potential of $V3_0$. Generally, the above predetermined threshold can be set relatively small, such that the current can readily flow to the output portion 120 via the switching unit 210 when the switching circuit portion 130 works under the first state.

Furthermore, in a preferred case, the switching unit 210 can be configured so that the current would not flow to the input portion 110 via the switching unit 210 when the switching circuit portion 130 works under the first state. For example, in the case where a first voltage between the two terminals $V1_0$ and $V2_0$ of the switching unit 210 when the switching circuit portion 130 works under the first state is known, a first turn-on voltage of the switching unit 210 in the direction of $V1_0$ - $V2_0$ can be set higher than the above first voltage. In this way, when the switching circuit portion 130 works under the first state, because the voltage distributed between the two terminals $V1_0$ and $V2_0$ of the switching unit 210 is lower than the above first turn-on voltage, the switching unit 210 is switched off in the direction of $V1_0$ - $V2_0$, and the current would not flow from the point $V1_0$ to the input portion 110 via the switching unit 210 and the point $V2_0$. In this way, when the switching circuit portion 130 works under the first state, the split-flow of the switching circuit portion 130 can be reduced, thereby reducing the loss of electrical energy. Herein, the above first voltage can be obtained through calculation, or through experiments, or obtained empirically.

Moreover, the switching unit 210 and the overcurrent breaker

unit 220 can be furthermore configured as follows: in a case where the output portion 120 connects to an input AC voltage, the switching unit 210 breaks the overcurrent breaker unit 220 when the current flowing through the overcurrent
5 breaker unit 220 is higher than the predetermined breaking current of the overcurrent breaker unit 220, thereby preventing the input AC voltage from being transmitted to the input portion 110, by causing the current flow from the output portion 120, and return to the output portion 120 via
10 the overcurrent breaker unit 220 and the switching unit 210. In this case, the current flowing through the overcurrent breaker unit 220 (that is, the current flowing through the overcurrent breaker unit 220 when the switching circuit portion works under the second state) is higher than the prede-
15 termined breaking current of the overcurrent breaker unit 220, and thereby causing overcurrent breaker unit 220 break. For example, in the case where a second voltage distributed between the two terminals $V3_0$ and $V4_0$ of the switching unit 210 when the output portion connects to AC voltage by mis-
20 take is known, the switching unit 210 can be configured in a similar way, such that a second turn-on voltage of the switching unit 210 in the direction of $V3_0$ - $V4_0$ is lower than the above second voltage. In this way, when the AC voltage input from the output portion 120 is in the positive half
25 cycle of the AC voltage, in the case where the voltage distributed between the two terminals $V3_0$ and $V4_0$ of the switching unit 210 is higher than the above second turn-on voltage, the current could flow back to the output portion 120 from the point $V3_0$ via the switching unit 210 and the point
30 $V4_0$. Meanwhile, during the positive half cycle of the above AC voltage, the voltage drop between the points $V1_0$ and $V3_0$ is negative while the switching unit 210 is unidirectionally switched on in the direction of $V1_0$ - $V3_0$, therefore, the cur-

rent can not flow back to the input portion 110 from the point $V3_0$ via the switching unit 210 and the point $V1_0$.

A specific implementation of the overcurrent breaker unit 220 may comprise a fuse. The rated current of the fuse is
5 higher than the current flowing through the fuse in a case where the input portion 110 connects to input DC voltage, and the fusing current of the fuse is lower than the current flowing through the fuse in a case where the output portion 120 connects to an input AC voltage. The fuse
10 is simple to use, small in size, and conveniently replaceable. The fuse would not consume too much electrical energy when the switching circuit portion works under the first status.

In one specific implementation of the protection circuit for
15 preventing the output from connecting to AC voltage by mistake according to the embodiments of the present utility model, the switching unit 210 can be configured in a way which will be described below, so as to perform the above described function. Hereinafter, a specific configuration
20 example of the switching unit 210 will be described with reference to Fig.3.

Fig.3 is a block diagram schematically showing an exemplary structure of the switching unit 210 as shown in Fig.2 according to the embodiments of the present utility model. As
25 shown in Fig.3, the switching unit 210 may comprise a first switching module 310, a second switching module 320 and a reverse cut-off module 330. The reverse cut-off module 330 is coupled with the input portion 110 (not shown), and the first switching module 310 and the second switching module
30 320 are respectively coupled between the reverse cut-off module 330 and the overcurrent breaker unit 220 (not shown). The first switching module 310, the second switching module 320 and the reverse cut-off module 330 can be configured as

follows: in a case where the input portion 110 connects to an input DC voltage, the reverse cut-off module 330 is switched on by the input DC voltage, the current flows to the output portion 120 from the input portion 110 via the reverse cut-off module 330 and the overcurrent breaker unit 220, and the first switching module 310 and the second switching module 320 are cut off.

The first switching module 310 may have a first switching-on voltage, the second switching module 320 may have a second switching-on voltage, and the reverse cut-off module 330 may have a third switching-on voltage. Furthermore, the first switching module 310 is unidirectionally conductive in the direction of $V7_0$ - $V8_0$, the second switching module 320 is unidirectionally switched on in the direction of $V10_0$ - $V9_0$, and the reverse cut-off module 330 is unidirectionally switched on in the direction of $V5_0$ - $V6_0$. Hereinafter, the descriptions will be conducted in combination with the above first, second and third switching-on voltages. Needless to say, the embodiments of the present utility model are not limited to these. Those skilled in the art can configure the circuit variously according to specific conditions, and design various corresponding property parameters with respect to various circuit components in cases of different circuit configuration, specific details omitted here.

As shown in Fig.3, the reverse cut-off module 330 can be configured so that the voltage drop between the points $V5_0$ and $V6_0$ is higher than the third threshold voltage of the reverse cut-off module 330 in a case where the input portion 110 connects to an input DC voltage, thereby the current could flow to the output portion 120 via the reverse cut-off module 330.

Furthermore, in a case where the input portion 110 connects an input DC voltage, the terminal voltage between $V7_0$ and $V8_0$

of the first switching module 310 can be set lower than the first switching-on voltage of the first switching module 310 such that the first switching module 310 is in a cut-off state, and the terminal voltage between V_{10_0} and V_{9_0} of the
5 second switching module 320 can be set negative such that the second switching module 320 is also in a cut-off state.

It can be seen from the above description that the current flowing through the switching unit 210 configured as above, in a case where the input portion 110 connects to an input
10 DC voltage, i.e., the switching circuit portion 130 works under the first status, only flows through the reverse cut-off module 330 of the switching unit 210 rather than the first switching module 310 and the second switching module 320 of the switching unit 210. Therefore, by configuring the
15 switching unit 210 in the way as above, the electrical energy consumed in a case where the switching circuit portion 130 works under the first state would be reduced.

Moreover, the first switching module 310, the second switching module 320 and the reverse cut-off module 330 can further
20 thermore be configured as follows: in a case where the output portion 120 connects to an input AC voltage, when the input AC voltage is in the positive half cycle of the AC voltage, the reverse cut-off module 330 is cut off, the first switching module 310 is switched on, the second switching
25 module 320 is cut off, and the current flows from the output portion 120, through the overcurrent breaker unit 220 and the first switching module 310, and back to the output portion 120, such that the overcurrent breaker unit 220 breaks.

30 For example, the reverse cut-off module 330 can be configured to have the above third switching-on voltage, such that the reverse cut-off module 330 would be in the cut-off state when the AC voltage input from the output portion 120 is in

the positive half cycle of the AC voltage. Because the reverse cut-off module 330 is unidirectionally switched on in the direction of $V5_0$ - $V6_0$, and the voltage drop between the points $V5_0$ and $V6_0$ is negative when the AC voltage input from the output portion 120 is in the positive half cycle of the AC voltage, the reverse cut-off module 330 is in the cut-off state and the current can not flow to the input portion 110 via the reverse cut-off module 330.

For another instance, the first switching module 310 can be configured to have the above first switching-on voltage, such that the voltage drop between the points $V7_0$ and $V8_0$ would be higher than the above first switching-on voltage when the AC voltage input from the output portion 120 is in the positive half cycle of the AC voltage, therefore the first switching module 310 is switched on. In this way, the current introduced from the output portion 120 can flow back to the output portion 120 via the point $V7_0$, the first switching module 310, and $V8_0$.

Furthermore, the second switching module 320 can be configured to have the above second switching-on voltage, such that the second switching module 320 would be in the cut-off state when the AC voltage input from the output portion 120 is in the positive half cycle of the AC voltage. Because the second switching module 320 is unidirectionally switched on in the direction of $V10_0$ - $V9_0$, and the voltage drop between the points $V10_0$ and $V9_0$ is negative when the AC voltage input from the output portion 120 is in the positive half cycle of the AC voltage, the second switching module 320 is in the cut-off state and there is no current flowing between $V10_0$ and $V9_0$.

Thus, referring to Figs.2 and 3, when the AC voltage input from the output portion 120 is in the positive half cycle of the AC voltage, the current introduced from the output por-

tion 120 can only flow back to the output portion 120 via the overcurrent breaker unit 220 and then along the first switching module 310 (namely along the branch of $V7_0$ - $V8_0$), but can not flow back to the output portion 120 via the second switching module 320 or flow to the input portion 110 via the reverse cut-off module 330. At this time, the AC voltage input from the output portion 120 is usually large, and the introduced current is also large, therefore, the current flowing through the overcurrent breaker unit 220 in this case is often well above the predetermined breaking current thereof, which causes a break of the overcurrent breaker unit 220. Therefore, the current flowing through the switching unit 210 is cut off, that is, the current flowing from the output portion 120 to the input portion 110 is stopped, which protects other devices that is connected with the input portion 110.

Moreover, the first switching module 310, the second switching module 320 and the reverse cut-off module 330 can furthermore be configured as follows: in a case where the output portion 120 connects to an input AC voltage, when the AC voltage input from the output portion 120 is in the negative half cycle of the AC voltage, the first switching module 310 is switched off, the second switching module 320 is switched on, and the current flows from the output portion 120, through the second switching module 320 and the overcurrent breaker unit 220, and back to the output portion 120, such that the overcurrent breaker unit 220 breaks. In this case, the voltage drop between the points $V7_0$ and $V8_0$ is negative and the first switching module 310 is unidirectionally switched on in the direction of $V7_0$ - $V8_0$, so the first switching module 310 is in a cut-off state. Moreover, because the voltage drop between the points $V10_0$ and $V9_0$ is higher than the above second switching-on voltage, the sec-

ond switching module 320 is in a switched-on state. Furthermore, when the input portion 110 is connected to a load device such as a electronic element by an AC/DC conversion device, for example, since the impedance of the branch where the load device and the reverse cut-off module 330 locates is obviously much larger than the impedance of the branch $V_{10_0} - V_{9_0}$, the current flowing through the reverse cut-off module 330 at this time can be considered to be 0. Similarly, since the AC voltage input from the output portion 120 at this time is usually large, and the introduced current is also large, therefore, the current flowing through the overcurrent breaker unit 220 in this case is often well above the predetermined breaking current thereof, which causes a break of the overcurrent breaker unit 220. Therefore, the current flowing through the switching unit 210 is cut off, that is, the current flowing from the output portion 120 to the input portion 110 is stopped, which protects other devices connected with the input portion 110.

It can be seen from the above that in a case where the output portion 120 connects to an input AC voltage, namely in the case where the switching circuit portion 130 works under the second state, no matter whether the above applied AC voltage is in the positive half cycle of the AC voltage or in the negative half cycle, the overcurrent breaker unit 220 breaks, which prevents the input AC voltage from being transmitted to the input portion 110.

Fig.4 is a block diagram schematically showing another structure of the protection circuit for preventing the output from connecting to the AC voltage by mistake according to the embodiments of the present utility model. As shown in Fig.4, the protection circuit 400 may further include an error indicating portion 140 in addition to the input portion 110, the output portion 120 and the switching circuit por-

tion 130. The error indicating portion 140 can be configured to emit an error indicating signal in a case where the output portion 120 connects to an input AC voltage. Herein, the input portion 110, the output portion 120 and the switching circuit portion 130 contained by the protection circuit 400 as shown in Fig.4 have the same structures and functions as the corresponding portions contained by the protection circuit 100 as shown in Fig.1A, with a similar operation principle, thus a description thereof are omitted herein.

As shown in Fig.4, in one specific implementation of the protection circuit for preventing the output from connecting to the AC voltage by mistake according to the embodiments of the present utility model, the error indicating portion 140 can be coupled between the switching circuit portion 130 and output portion 120. In this implementation, the error indicating portion 140 can be configured to realize the following functions: in the case where the switching circuit portion 130 works under the first state, namely in a case where a the input portion 110 connects an input DC voltage, the error indicating portion 140 is cut off and would not emit any error indicating signal; in the case where the switching circuit portion 130 works under the second state, namely in the case where the output portion 120 connects an input AC voltage, the error indicating portion 140 is driven by the AC voltage input from the output portion 120 to emit an error indicating signal. It is needless to say that the embodiments of the present utility model are not limited to these. Those skilled in the art can configure the circuit variously according to specific conditions, and design various corresponding property parameters with respect to various circuit components in cases of different circuit configuration, specific details being omitted herein.

In one example, the error indicating portion 140 can be con-

figured to have a fourth switching-on voltage. That is, as shown in Fig.4, the error indicating portion 140 would be switched on and emit an error indicating signal when the voltage drop between B1-A1 is higher than the fourth switching-on voltage, and would be switched off and would not emit any signal when the voltage drop between B1-A1 is lower than the fourth switching-on voltage or when the voltage drop between B1-A1 is negative (namely the potential of point A1 is higher than the potential of point B1). In this case, other components of the protection circuit 400 except the error indicating portion 140 operate in the same way as the corresponding portions contained by the protection circuit 100 as shown in Fig.1A, and the description thereof is omitted herein.

It can be seen from the above that in the case where the output portion 120 connects to an input AC voltage, no matter whether the switching circuit portion 130 breaks or not, the error indicating portion 140 can be triggered by the introduced AC voltage to emit an error indicating signal. Furthermore, while in a case where the input portion 110 connects to an input DC voltage, the error indicating portion 140 is switched off, which means that there is no current flowing inside the error indicating portion 140, it would not emit any error indicating signal. In this way, the user can determine whether the operations are correct by the presence and absence of the error indicating signal, and thereby perform some further operations to solve any present problem when the error indicating portion 140 emits an error indicating signal. Therefore, the damage to the elements in the circuit can be avoided, and the fire accident is less likely to occur. Meanwhile, the operations become more convenient and efficient, and also the user friendliness is raised.

Specifically, in one specific implementation of the protection circuit for preventing the output from connecting to the AC voltage by mistake according to the embodiments of the present utility model, the error indicating portion 140
5 may include an LED (Light Emitting Diode). One application example will be explained with reference to Figs.4 and 5 hereinafter.

As shown in Figs.4 and 5, the anode of the LED may be set close to B1, and the cathode thereof may be set close to A1.

10 Moreover, the error indicating portion 140 may further comprise a current limiting resistor (for example, the resistor R2 shown in Fig.5), wherein the current limiting resistor is connected in series with the LED. In this application example, as shown in Fig.4, it is assumed that in a case where
15 the switching circuit portion 130 works under the first status, $V1_{in}$ is the high-potential terminal of the input portion 110, $V2_{in}$ is the low-potential terminal of the input portion 110, $V1_{out}$ is the high-potential terminal of the output portion 120, and $V2_{out}$ is the low-potential terminal of
20 the output portion 120.

Referring to Figs.4 and 5, in a case where the input portion 110 connects to an input DC voltage, the voltage drop between the points B1 and A1 is negative (namely the voltage drop between the points A1 and B1 is positive), and the LED
25 is under reverse bias. At this time, to avoid a reverse breakdown of the LED, the resistance value of the current limiting resistor can be set to limit the current flowing the branch A1-B1. Those skilled in the art can determine the resistance value of the current limiting resistor empirically, or through experiments, and the specific details are
30 omitted herein. In this way, in a case where the LED is under reverse bias and not reverse breakdown, this LED would not emit any optical signal and the switching circuit por-

tion 130 works under the first state at this time. It indicates that in this case there occurs no wrong operation described above.

In a case where an the output portion 120 connects to an input AC voltage, the operational processes of the error indicating portion 140 are explained in two cases. When the AC voltage input from the output portion 120 is in the positive half cycle of the AC voltage, namely the voltage drop between the points $V1_{out}$ and $V2_{out}$ is positive, similarly to the above, since the voltage drop between the points A1 and B1 is positive, the LED is under reverse bias and not reverse breakdown (the resistance value of the current limiting resistor has been set such that the LED is not breakdown by the current limiting function). When the AC voltage input from the output portion 120 is in the negative half cycle of the AC voltage, namely the voltage drop between the points $V2_{out}$ and $V1_{out}$ is positive, since the switching-on voltage of the LED is usually small (ordinarily the voltage assigned to the LED by the voltage drop between the points $V1_{out}$ and $V2_{out}$ is sufficient to switch on the LED), in a case that in the above negative half cycle of the AC voltage the current limiting resistor has a suitable resistance value to switch on the LED, the LED emits an optical signal as an error indicating signal to warn the user that the power supply or the input voltage has been connected incorrectly.

One application example of the protection circuit for preventing the output from connecting to the AC voltage by mistake according to the embodiments of the present utility model will be explained with reference to Fig.5 hereinafter.

As shown in Fig.5, the protection circuit 500 includes an input portion 110, a switching circuit portion 130, an error indicating portion 140 and an output portion 120. The switching circuit portion 130 includes a switching unit 210

and an overcurrent breaker unit 220, and the switching unit 210 includes a first switching module 310, a second switching module 320 and a reverse cut-off module 330.

In the protection circuit 500, the reverse cut-off module
5 330 is implemented by a single first diode D1, wherein the first diode D1 may be an ordinary diode, such as an FR07 diode.

The first switching module 310 can be implemented by a first resistor R1 for limiting the current, a second diode D2, a
10 zener diode D4 and a triode T1 which are coupled with each other, as shown in Fig.5. The type of the second diode D2 may be 1N4007. The zener diode D4 may have a rated power of 0.5W and a switching-on voltage of 68V, for example. The triode T1, for example, may be an ordinary NPN triode. The
15 resistance value of the first resistor R1 may be between 10k Ω ~33 k Ω , and may preferably be 15k Ω . The first resistor R1 with a resistance value of 15k Ω has a large voltage distributed in the circuit, and can make the switching on of the branch it locates fast. The second switching module 320
20 can be implemented by a single third diode D3, wherein the type of the third diode D3 may be 1N4007, for example.

The overcurrent breaker unit 220 may be implemented by a fuse f. For example, if the current flowing the fuse f when the switching circuit portion 130 works under the first
25 state is 2A, a copper fuse with a rated current of 2.5A and a fusing current of 5A can be used as the overcurrent breaker unit 220.

Furthermore, the error indicating portion 140 may be implemented by a LED D5 and a second resistor R2 connected in series with each other, as shown in Fig.5. The LED D5 can be
30 an ordinary LED. The function of the second resistor R2 is limiting the current, i.e., limiting the current of the branch where the second resistor R2 locates, to prevent the

LED D5 from being damaged. In practical applications, a small current flowing through the LED D5 would enable the LED D5 to emit a weak optical signal, so the resistance value of the second resistor R2 can be set large. For example, the resistance value of the second resistor R2 may be 150 k Ω or other value between 50k Ω and 200k Ω .

As shown in Fig.5, the anode of the first diode D1 functions as the high-potential end of the input portion of the protection circuit 500. The cathode of the first diode D1 is connected with the cathode of the zener diode D4, the anode of the second diode D2, the cathode of the third diode D3 and one terminal of the fuse f. The other terminal of the fuse f functions as the high-potential end of the output portion of the protection circuit. The anode of the zener diode D4 is connected with the base of the triode T1 and one terminal of the first resistor R1. The cathode of the second diode D2 is connected with the collector of the triode T1. The other terminal of the first resistor, the emitter of the triode T1 and the anode of the third diode D3 are connected with each other and lead out two terminals therefrom as the low-potential end of the input portion and the low-potential end of the output portion of the protection circuit respectively.

In an optimal case, the protection circuit 500 may further include an error indicating portion 140. As shown in Fig.5, the error indicating portion 140 may include the LED D5 and the second resistor R2 connected in series with each other. The cathode of the LED D5 may be coupled with the other terminal of the fuse f. The anode of the LED D5 may be coupled with the one terminal of the second resistor R2. The other terminal of the second resistor R2 may be coupled with the anode of the third diode D3. Herein, LED D5 can be configured as follows: in a case where the output portion 120 con-

nects to an input AC voltage, when the input AC voltage is in the negative half cycle of the AC voltage, the LED D5 emits an optical signal as the error indicating signal.

In practical applications, the input portion 110 of the protection circuit 500 can be coupled with the DC output of the device or system having a DC output, so as to prevent the AC voltage from being applied to the DC output and to avoid the damage to the device or system and fires.

As shown in Fig.5, in the case where the switching circuit portion 130 works under the first state, the voltage applied between the two terminals $V1_{110}$ and $V2_{110}$ can be for example DC 12V, 24V or 48V, etc. In this situation, the first diode D1 is switched on, the zener diode D4 is in a cut-off state since the terminal voltage thereof is lower than its switching-on voltage, causing the triode T1 and the second diode D2 both to be cut off, and the third diode D3 is in a cut-off state because of being under reverse bias. Therefore, the current flows to the output portion 120 via the first diode D1 and the overcurrent breaker unit 220, i.e. the fuse.

Furthermore, in a case where the error indicating portion 140 (herein, the error indicating portion 140 include the LED D5 and the second diode D2) is preferably included, as shown in Fig.5, the LED D5 is also in a cut-off state because of being under reverse bias and thereby emit no light. At this time, the user finds that the LED D5 does not emit any optical signal, and therefore determine that the operations heretofore are correct and thereby determine that the device or system works stably and it's less likely to cause fire. It is to be noted that, the error indicating portion 140 is optional but not critical. It could be determined whether to provide the error indicating portion 140 according to requirements in practical use. Hereinafter, descrip-

tions will be made taking the optimal case where the error indicating portion 140 is included (namely including the LED D5 and the second diode D2) as an example. It will be easy for those skilled in the art to understand the case where
5 the error indicating portion 140 is not included, thus the description thereof is omitted herein.

When the user tries to apply an AC voltage from the output portion 120 of the protection circuit 500, the protection circuit 500 would cut off the current flowing from the out-
10 put portion 120 to the input portion 110. For example, the applied AC voltage may be 220V.

Specifically, when the AC voltage input from the output portion 120 is in positive half cycle of the AC voltage, that is, when the point $V1_{120}$ is the high-potential end and the
15 point $V2_{120}$ is the low-potential end, the LED D5 would be in a cut-off state and emit no light because of being under reverse bias, and the third diode D3 would also be in a cut-off state because of being under reverse bias. Furthermore, in this situation, since the assigned voltage of the zener
20 diode D4 is higher than its switching-on voltage of 60V and the second diode D2 is under forward bias, therefore, the zener diode D4, the second diode D2 and the triode T1 are all switched on. Meanwhile, the first diode D1 is in a cut-off state because of being under reverse bias. Therefore,
25 the current would instantly flow from the high-potential end $V1_{120}$ of the output portion 120, via the overcurrent breaker unit 220 (i.e. the fuse) and the first switching module 310 (that is, the zener diode D4, the second diode D2, the triode T1 and the first resistor R1), and back to the low-
30 potential end $V2_{120}$ of the output portion 120. At this time, since the current instantly flowing through the fuse is well above the its fusing current, so the fuse fuses, namely the overcurrent breaker unit 220 breaks. In this situation, when

the AC voltage input from the output portion 120 turns to be in the negative half cycle of the AC voltage, the LED D5 is under forward bias and switched on. However, since the fuse has fused already, the current output from the terminal V2₁₂₀ of the output portion 120 would flow back to the terminal V2₁₂₀ of the output portion 120 via the second resistor R2 and the LED D5 only, enabling the LED D5 to emit an optical signal. Hereafter, when the positive half and the negative half of AC voltage alternate, the LED D5 would emit or not emit the optical signal alternately. Therefore, according to the above situation of emitting light alternately by the LED D5, the user can determine that there has been a wrong operation, that is, an AC voltage has been applied to the output portion 120 of the protection circuit by mistake. Thus, the user can subsequently carry out some remedial measures, such as applying the AC voltage to the AC input portion of the device or system coupled with the input portion 110 of the protection circuit 500, and replacing the fuse in the protection circuit 500.

Similarly, when the AC voltage input from the output portion 120 is in the negative half cycle of the AC voltage and the fuse has not fused, the current will mainly flow through the second switching module 320, but hardly through the first switching module 310. This is because compared to the external branch coupled with the input portion 110, the branch where the second switching module 320 locates has a much smaller impedance, therefore the current flowing through the first switching module 310 and the above external branch can be omitted. When a large current instantly flows through the fuse, the fuse fuses. In a case where the AC voltage input from the output portion 120 is in the negative half cycle of the AC voltage, the LED D5 emits an optical signal, no matter whether the fuse fuses or not. The

subsequent situation of the positive half cycle and the negative half cycle of the AC voltage alternating is similar to that described above and is omitted herein.

It can be seen from the above that by applying the protection circuit for preventing the output from connecting to the AC voltage by mistake according to the embodiments of the present utility model, damage to other elements in the circuit containing the protection circuit by the AC voltage input from the output portion of the protection circuit can be avoided, and thereby the self ignition of other elements in the circuit containing the protection circuit caused by the above AC voltage being avoided and the possibility of fire reduced.

Furthermore, another embodiment of the present utility model further provides an AC/DC converter which comprises an AC/DC conversion device and a protection circuit for preventing the output from connecting to the AC voltage by mistake as described above in combination with Figs.1-5, wherein the input portion of the protection circuit is coupled with the DC output portion of the above AC/DC conversion device.

Fig.6 shows a block diagram of an exemplary structure of the AC/DC converter according to the embodiments of the present utility model. As shown in Fig.6, the AC/DC converter 600 comprises a protection circuit 601 for preventing the output from connecting to the AC voltage by mistake and an AC/DC conversion device 602.

Herein, the input portion (not shown) of the protection circuit 601 is coupled with the DC output of the AC/DC conversion device 602. The AC/DC converter 600 is configured as follows: in a case where an AC voltage is applied to the AC input of the AC/DC conversion device 602, a DC voltage would be output outwards from the output portion of the protection circuit 601; and in a case where an AC voltage is applied to

the output portion of the protection circuit 601, this AC voltage is prevented from being transmitted to the DC input of the AC/DC conversion device 602. The protection circuit 601 may have a structure of any protection circuit as described above in combination with Figs.1-5 and the same functions, and achieve the same effects, specific descriptions omitted here.

In one example of the AC/DC converter according to the embodiments of the present utility model, the output portion of the protection circuit 601 can be used for providing driving energy for a light emitter.

It can be seen from the above that by applying the AC/DC converter according to the embodiments of the present utility model, damage to the AC/DC converter or other elements in the circuit containing the AC/DC converter by the DC output of the AC/DC converter connecting to the AC voltage by mistake or even their self ignition can be avoided, reducing the possibility of fire.

In the above description of the embodiments of the present utility model, the features described and/or illustrated with respect to one implementation may be used, in the same or similar manner, in one or more other embodiments, in combination with the features in other embodiments, or to substitute for the features in other embodiments.

It should be emphasized that, the terms "including/containing" used herein mean presence of features, elements or assemblies, but do not exclude the presence or addition of one or more other features, elements or assemblies. The terms "first", "second" and the like which relate to order do not imply the implementation sequence or importance degree of the features, elements or assemblies defined by these terms, but only is for identifying among these features, elements or assemblies for purpose of clear descrip-

tion.

Although there has disclosed above the present utility model by way of the specific embodiments of the utility model, it should be understand that various modifications, improvements and equivalents can be devised by those skilled in the art without departing from the spirit and scope of the invention as defined in the appended claims. These modifications, improvements and equivalents should also be within the scope of protection of the present utility model.

Finally, it should be noted that, in the present disclosure, relational terms such as "left" and "right", "first" and "second" are used only to distinguish one entity or operation from the other entity or operation, but not necessarily demand or imply that there is actual relation or order among those entities and operations. Furthermore, the terms "including", "containing", or any other variations thereof means a non-exclusive inclusion, so that the process, method, article or device that includes a series of elements includes not only these elements but also other elements that are not explicitly listed, or further includes elements inherent in the process, method, article or device. Moreover, when there is no further limitation, the element defined by the wording "include(s) a ..." does not exclude the case that in the process, method, article or device that includes the element there are other same elements.

Patent claims

1. A protection circuit for preventing the output from connecting to the AC voltage by mistake, characterized by comprising:

an input portion;

an output portion; and

a switching circuit portion which is coupled between the input portion and the output portion, and is configured to:

work under a first state in a case where the input portion connects to an input DC voltage, so as to provide the input DC voltage to the output portion, and

work under a second state in a case where the output portion connects to an input AC voltage, so as to prevent the input AC voltage from being transmitted to the input portion.

2. The protection circuit for preventing the output from connecting to the AC voltage by mistake according to claim 1, characterized in that the switching circuit portion comprises a switching unit and an overcurrent breaker unit which has a predetermined breaking current, the switching unit is coupled with the input portion, and the overcurrent breaker unit is coupled between the switching unit and the output portion, wherein the switching unit and the overcurrent breaker unit are configured as follows:

in a case where the input portion connects to an input DC voltage, the current is made to flow from the input portion to the output portion via the switching unit and the overcurrent breaker unit, such that the DC voltage is provided to the output, and in a case where the output portion connects to an input AC voltage, the switching unit causes the current to flow from the output portion via the overcurrent

breaker unit and the switching unit back to the output portion, such that the overcurrent breaker unit breaks when the current flowing through the overcurrent breaker unit is higher than the predetermined breaking current of the overcurrent breaker unit, thereby the input AC voltage is prevented from being transmitted to the input portion, wherein the predetermined breaking current is higher than the current flowing through the overcurrent breaker unit when the switching circuit portion works under the first state and lower than the current flowing through the overcurrent breaker unit when the switching circuit portion works under the second state.

3. The protection circuit for preventing the output from connecting to the AC voltage by mistake according to claim 2, characterized in that the switching unit comprises a first switching module, a second switching module and a reverse cut-off module, the reverse cut-off module is coupled with the input portion, and the first switching module and the second switching module are respectively coupled between the reverse cut-off module and the overcurrent breaker unit, wherein the first switching module, the second switching module and the reverse cut-off module are configured as follows:

in a case where the input portion connects to an input DC voltage, the reverse cut-off module is switched on by the input DC voltage, the current flows to the output portion from the input portion via the reverse cut-off module and the overcurrent breaker unit, and the first switching module and the second switching module are cut off; and in a case where the output portion connects to an input AC voltage, when the input AC voltage is in the positive half cycle of the AC voltage, the reverse cut-off module is cut off, the

first switching module is switched on, the second switching module is switched off, and the current flows from the output portion, via the overcurrent breaker unit and the first switching module, and back to the output portion, such that
5 the overcurrent breaker unit breaks, and when the input AC voltage is in the negative half cycle of the AC voltage, the first switching module is switched off, the second switching module is switched on, and the current flows from the output portion, via the second switching module and the overcurrent
10 breaker unit, and back to the output portion, such that the overcurrent breaker unit breaks.

4. The protection circuit for preventing the output from connecting to the AC voltage by mistake according to any one
15 of claims 1-3, characterized in that the protection circuit further comprises:

an error indicating portion configured to emit an error indicating signal in a case where the output portion connects to an input AC voltage.

20

5. The protection circuit for preventing the output from connecting to the AC voltage by mistake according to claim 2 or 3, characterized in that the overcurrent breaker unit comprises a fuse, wherein a rated current of the fuse is
25 higher than the current flowing through the fuse in a case where the input portion connects to an input DC voltage, and a fusing current of the fuse is lower than the current flowing through the fuse in a case where the output portion connects to an input AC voltage.

30

6. The protection circuit for preventing the output from connecting to the AC voltage by mistake according to claim 3, characterized in that the reverse cut-off module com-

prises a first diode, the first switching module comprises a second diode, a zener diode, a triode and first resistor coupled with each other, the second switching module comprises a third diode, and the overcurrent breaker unit comprises a fuse; wherein an anode of the first diode functions as a high-potential end of the input portion of the protection circuit; a cathode of the first diode is coupled with a cathode of the zener diode, an anode of the second diode, a cathode of the third diode and one terminal of the fuse; the other terminal of the fuse functions as a high-potential end of the output portion of the protection circuit; a anode of the zener diode is coupled with a base of the triode and one terminal of the first resistor; a cathode of the second diode is coupled with a collector of the triode; the other terminal of the first resistor, a emitter of the triode and an anode of the third diode are connected with each other and lead out two terminals therefrom as a low-potential end of the input portion and a low-potential end of the output portion of the protection circuit respectively.

7. The protection circuit for preventing the output from connecting to the AC voltage by mistake according to claim 6, characterized in that the protection circuit further comprises an error indicating portion which comprises an LED and a second resistor connected in series with each other; wherein a cathode of the LED is coupled with the other terminal of the fuse, an anode of the LED is coupled with the one terminal of the second resistor, the other terminal of the second resistor is coupled with the anode of the third diode; and the LED is configured as follows:

in a case where the output portion connects to an input AC voltage, when the input AC voltage is in the nega-

tive half cycle of the AC voltage, the LED emits an optical signal as the error indicating signal.

8. An AC/DC converter, which comprises an AC/DC conversion device, characterized in that the AC/DC converter further comprises a protection circuit for preventing the output from connecting to the AC voltage by mistake according to any of claims 1-7, wherein the input portion of the protection circuit is coupled with the DC output of the AC/DC conversion device, and the AC/DC converter is configured

to output a DC voltage outwards by the output portion of the protection circuit in a case where the AC input of the AC/DC conversion device connects to an AC voltage, and prevent, in a case where the output portion of the protection circuit connects to an AC voltage, the AC voltage from being transmitted to the DC output of the AC/DC conversion device.

9. The AC/DC converter according to claim 8, characterized in that the output portion of the protection circuit is used for providing driving energy to a light emitter.

10. The AC/DC converter according to claim 9, characterized in that the AC/DC converter is an LED driver and the light emitter is an LED light emitting module.

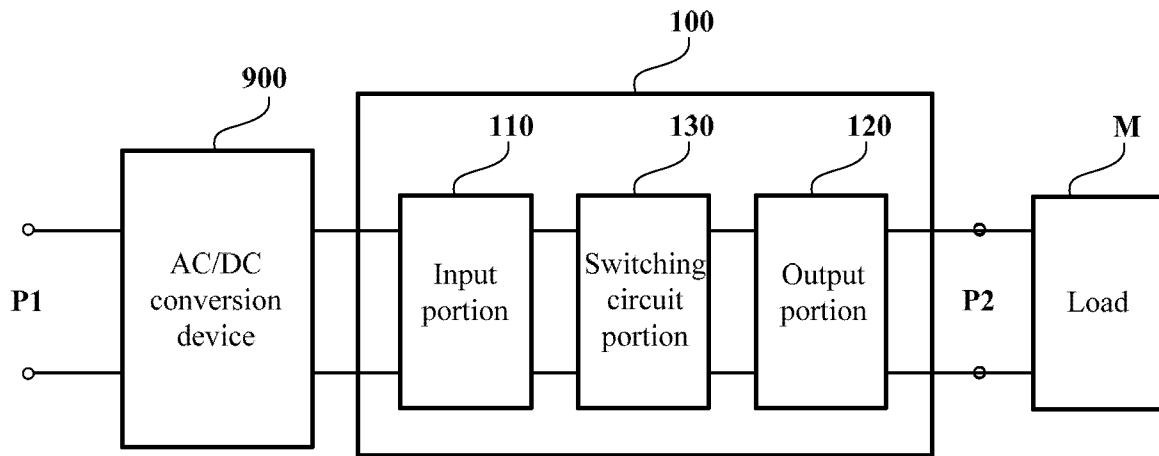


Fig. 1B

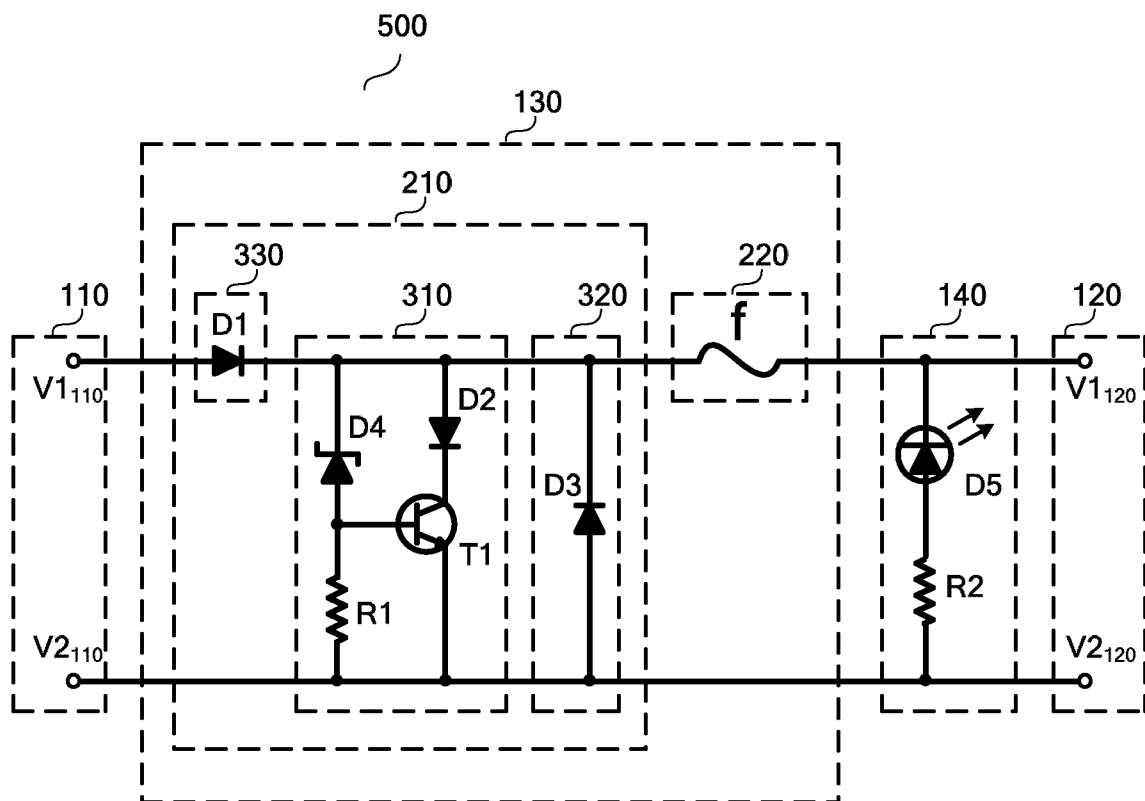


Fig.5

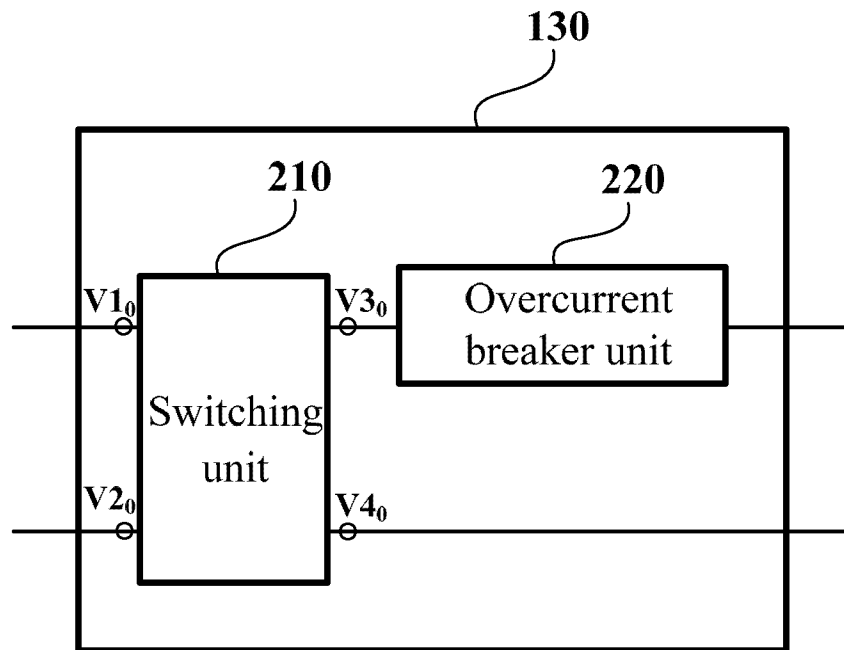


Fig. 2

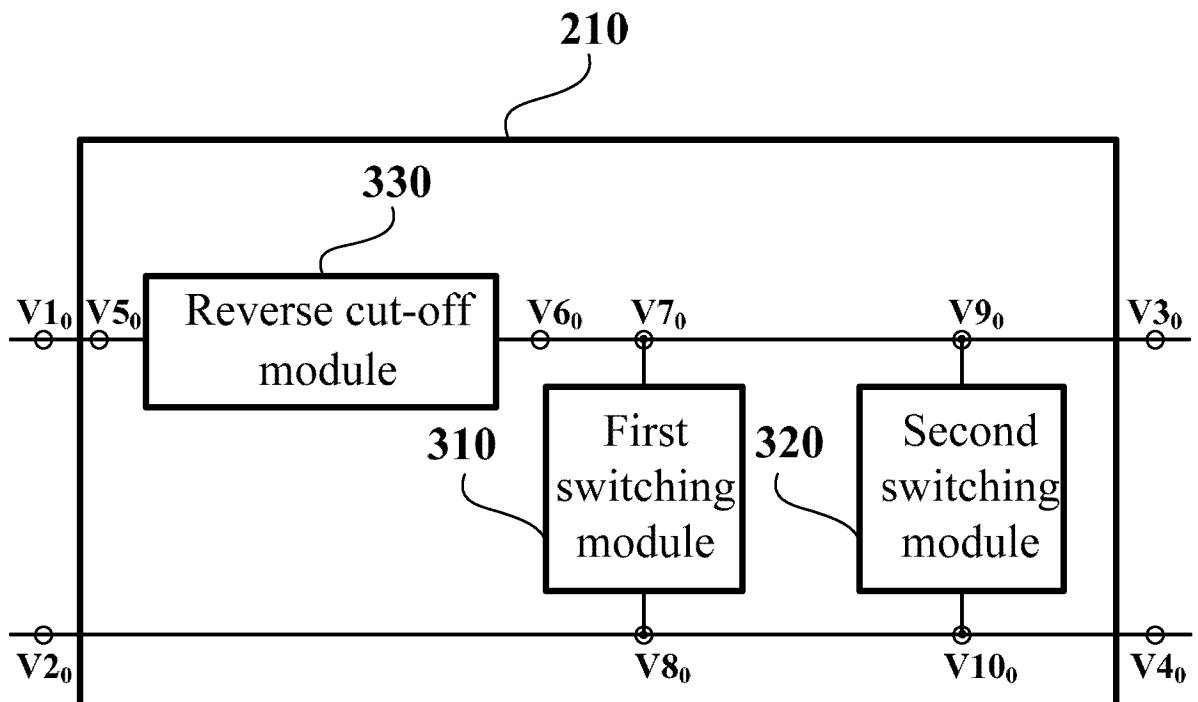


Fig. 3

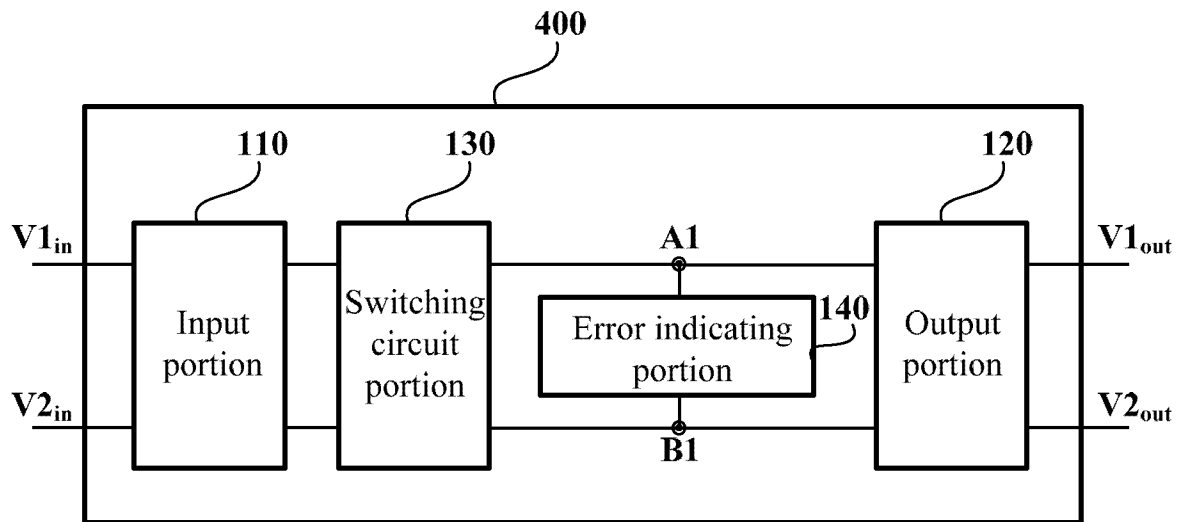


Fig. 4

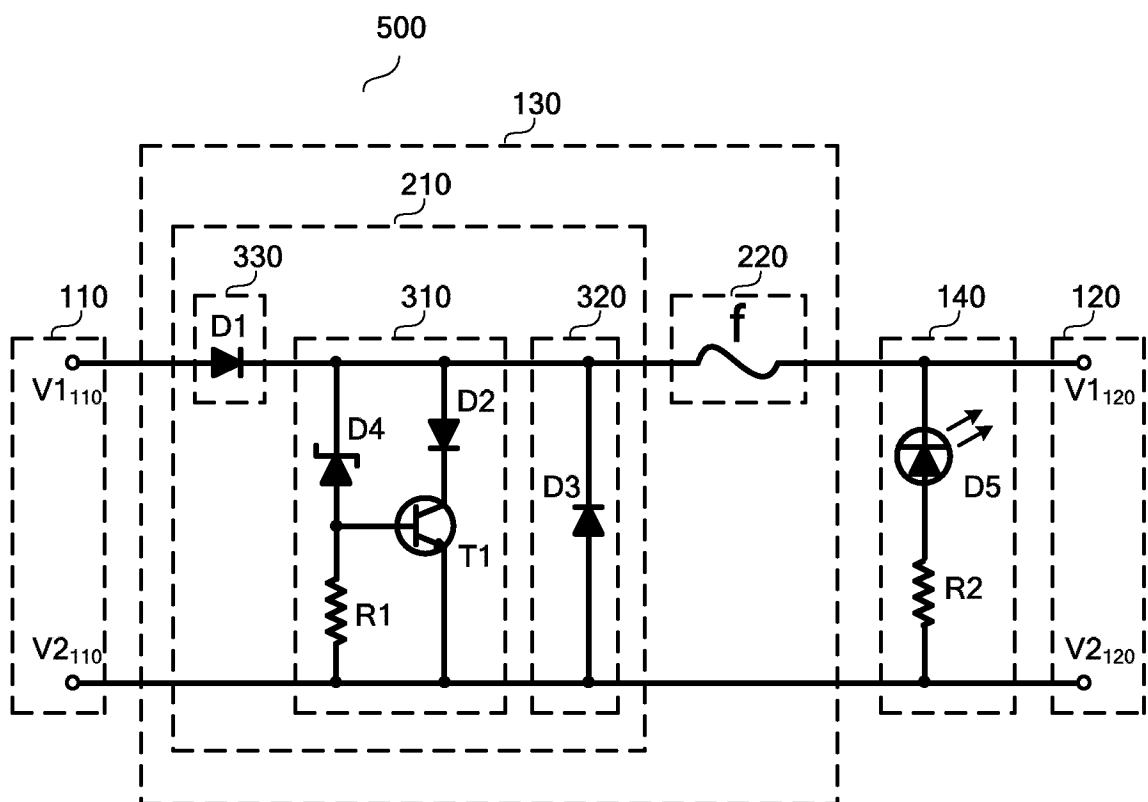
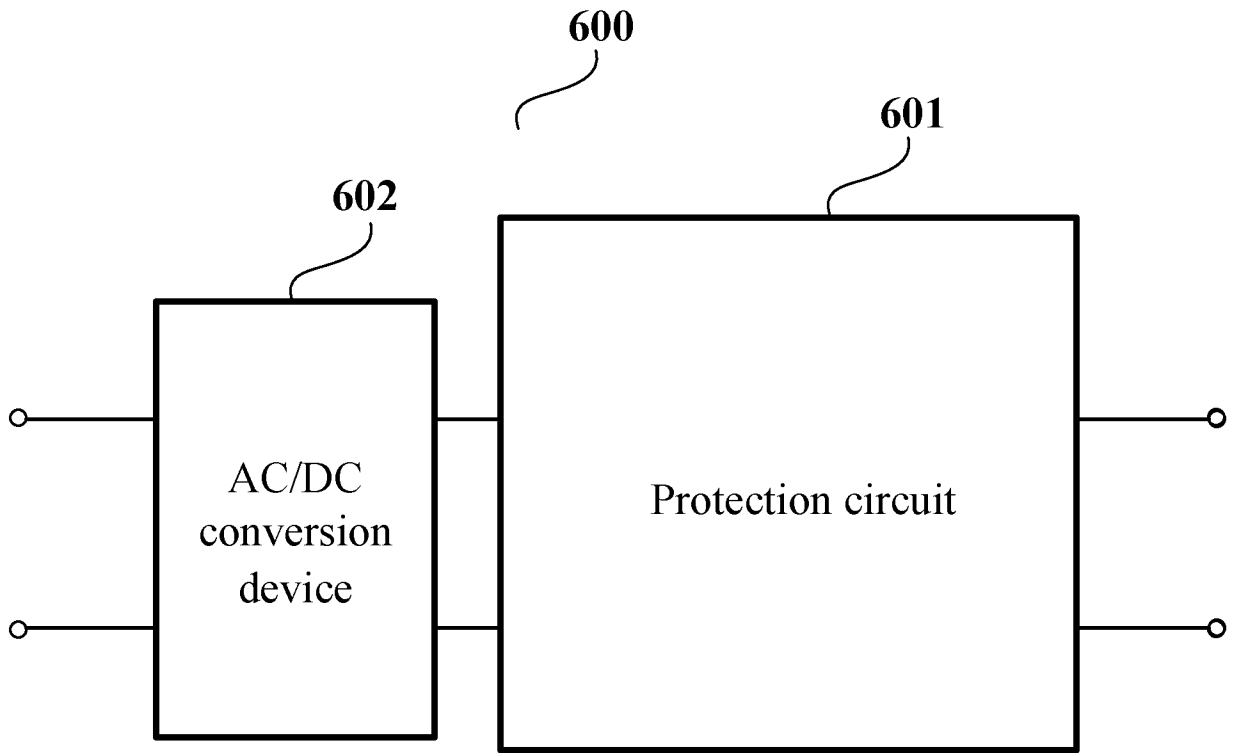


Fig.5

**Fig.6**

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2012/075745

A. CLASSIFICATION OF SUBJECT MATTER
INV. H02H11/00
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)
H02H

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, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 1 887 672 A1 (MITSUBISHI ELECTRIC CORP [JP]) 13 February 2008 (2008-02-13) paragraphs [0006] - [0008], [0019], [0024]; figures 1,3,4 -----	1,4,8-10



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents :

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"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

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"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

5 March 2013

Date of mailing of the international search report

21/03/2013

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Koegler, Lutz

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/EP2012/075745

Patent document cited in search report	Publication date	Patent family member(s)	Publication date	
EP 1887672	A1	13-02-2008	EP 1887672 A1	13-02-2008
			JP 4890247 B2	07-03-2012
			US 2008304298 A1	11-12-2008
			WO 2007110913 A1	04-10-2007
