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(54) STRAIGHT TUBE LIGHT EMITTING DIODE LAMP

(57) This application relates to a straight tube light emitting diode (LED) lamp compatible with an inductance ballast. The straight tube LED lamp includes a lamp tube, a power module, an LED module, and a safety circuit. The lamp tube includes two lamp holders configured to be connected to a lamp base, and two pins are disposed on each lamp holder. The power module is electrically connected to the two pins of the first lamp holder to receive an external power signal and perform power conversion to generate a driving signal for lightening the LED module. The safety circuit is disposed between the two pins on the second lamp holder and is configured to be cut off when a voltage across the safety circuit is greater than or equal to 3.6 V.

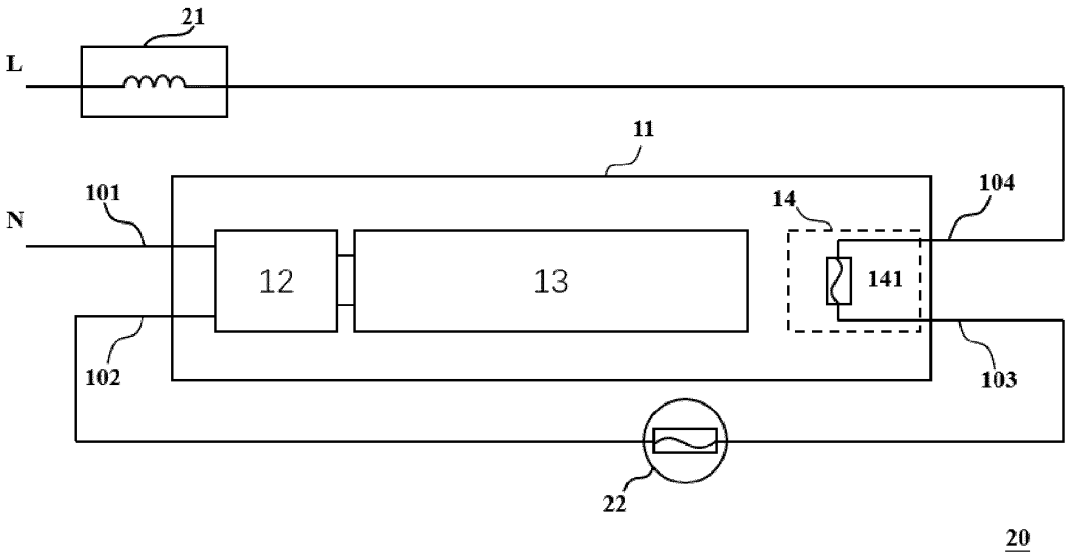

FIG. 2A

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Description

TECHNICAL FIELD

[0001] This application relates to the field of light emitting diode (LED) lighting, and in particular, to a straight tube LED lamp.

BACKGROUND

[0002] Fluorescent lamps in people's daily life are gradually replaced with much cleaner and much more efficient LED lamps.

[0003] The conventional fluorescent lamp is powered by a ballast. The ballast is generally disposed on a lamp base. During replacement with LED lamps, the LED lamps are required to be compatible with the original ballast, especially an inductance ballast, to minimize circuit changes.

[0004] EP3028541B1 describes a safety circuit for LED lamps. The safety circuit is disposed on one end of the LED lamp for fusing when a current of a power supply loop is excessively large, to prevent the inductance ballast from overheating and causing danger. The safety circuit is configured to limit the current of the power supply loop and is set to a resistance of 7.06 ohm or more. According to Ohm's law, heat is generated when a current passes through a resistor. The heat is an unnecessary loss in non-heating electrical appliances, which reduces system efficiency and increase power consumption, especially in LED lighting appliances. The heat accelerates the attenuation of LED lamp beads and reduces the service life. Therefore, the heat loss is minimized during circuit designing. For example, the current of the power supply loop is 200 milliamperes (mA). If the resistance of the safety circuit is set to 7.06 ohms, a heat loss of the safety circuit is 0.28 W.

[0005] EP3005834B1 discloses an LED lamp, the LED lamp includes a safety module. The safety module is composed of a first module (F1) and a second module (F2) to prevent overcurrent. When the LED lamp is powered by an electromagnetic ballast and at least one diode in an input rectifier fails, the second module (F2) is disconnected before the first module (F1). After the second module (F2) is disconnected, the LED lamp can still be used as a single-ended lamp tube, and is directly connected to the power supply for use. When the circuit failure in the system is not eliminated, the lamp tube may be burnt, or even other electrical appliances in the circuit system may be ruined in such a usage manner.

SUMMARY

[0006] This application is intended to provide a straight tube LED lamp to resolve the above problems.

[0007] This application provides a straight tube LED lamp. The straight tube LED lamp includes: a lamp tube, having a first lamp holder and a second lamp holder respectively located on two ends of the lamp tube, where a first pin and a second pin are disposed on the first lamp holder, and a third pin and a fourth pin are disposed on the second lamp holder; a power module, electrically connected to the first pin and the second pin to receive an external power signal by using the first pin and the second pin and perform power conversion to generate a driving signal; and an LED module, including at least one LED, disposed in the lamp tube, and electrically connected to the power module to receive the driving signal for lightening; and a first safety circuit, disposed between the third pin and the fourth pin to limit a current, where the safety circuit is configured to be cut off when a voltage across the safety circuit is greater than or equal to 3.6 V. The safety circuit is configured to be connected in series with the power module.

[0008] In an embodiment of this application, a resistance value of the first safety circuit is configured to be less than 7.06 ohms.

[0009] In an embodiment of this application, the first safety circuit includes: a first current limiting assembly, electrically connected to the third pin and the fourth pin.

[0010] In an embodiment of this application, the first current limiting assembly includes a first current fuse. A first contact of the first current fuse is electrically connected to the first pin, and a second contact of the first current fuse is electrically connected to the fourth pin.

[0011] In an embodiment of this application, a fusing current of the first current fuse is 250 mA or more.

[0012] In an embodiment of this application, a fusing current of the first current fuse is 510 mA or more.

[0013] In an embodiment of this application, a fusing current of the first current fuse is 2 A or more.

[0014] In an embodiment of this application, the power module includes a second safety circuit and a rectifier circuit. The second safety circuit is coupled between the first pin and the second pin and the rectifier circuit to limit a current. A current threshold of the second safety circuit is less than a current threshold of the first safety circuit.

[0015] In an embodiment of this application, the second safety circuit includes a second current limiting assembly electrically connected between the first pin and the rectifier circuit.

[0016] In an embodiment of this application, the second safety circuit further includes a third current limiting assembly electrically connected between the second pin and the rectifier circuit.

[0017] In an embodiment of this application, the second current limiting assembly and the third current limiting assembly have a same current threshold.

[0018] In an embodiment of this application, the second current limiting assembly and the third current limiting assembly each have a different current threshold.

[0019] In an embodiment of this application, the second current limiting assembly includes a first resistance fuse, and the third current limiting assembly includes a second resistance fuse.

[0020] This application provides a straight tube LED

lamp. The straight tube LED lamp includes: a lamp tube, having a first lamp holder and a second lamp holder respectively located on two ends of the lamp tube, where a first pin and a second pin are disposed on the first lamp holder, and a third pin and a fourth pin are disposed on the second lamp holder; a first safety circuit, disposed between the third pin and the fourth pin to limit a current; a power module, electrically connected to the first pin and the second pin to receive an external power signal by using the first pin and the second pin and perform power conversion to generate a driving signal, where the power module includes a second safety circuit and a rectifier circuit; and an LED module, including at least one LED, disposed in the lamp tube, and electrically connected to the power module to receive the driving signal for lightening. The first safety circuit includes a first current limiting assembly, and the second safety circuit includes a second current limiting assembly. The first current limiting assembly and the second current limiting assembly are of different types. The first safety circuit is configured to be connected in series with the second safety circuit when powered by using an inductance ballast.

[0021] In an embodiment of this application, the first current limiting assembly is one of a current fuse and a resistance fuse.

[0022] In an embodiment of this application, the second current limiting assembly is one of a current fuse and a resistance fuse.

[0023] In an embodiment of this application, the first current limiting assembly includes a first current fuse, and the second current limiting assembly includes a first resistance fuse. A current threshold of the first current fuse is greater than a current threshold of the first resistance fuse.

[0024] In an embodiment of this application, a resistance of the first current fuse is less than 7.06 ohms.

[0025] In an embodiment of this application, the first current fuse is configured to blow when a voltage across the first current fuse is greater than or equal to 3.6 V.

[0026] In an embodiment of this application, the current threshold of the first current fuse is 2 A.

[0027] In an embodiment of this application, the rectifier circuit includes at least two diodes, and the second safety circuit is configured to be cut off when the diodes of the rectifier circuit are short-circuited.

[0028] By means of the technical solutions disclosed in the above embodiments, the unnecessary power consumption of the straight tube LED lamp can be greatly reduced, and the efficiency of the LED lamp can be improved.

BRIEF DESCRIPTION OF THE DRAWINGS

[0029]

FIG. 1A is a schematic structural circuit diagram of a straight tube LED lamp according to an embodiment of this application.

FIG. 1B is a schematic structural circuit diagram of a straight tube LED lamp according to another embodiment of this application.

FIG. 1C is a schematic structural circuit diagram of a power module according to an embodiment of this application.

FIG. ID is a schematic structural circuit diagram of a power module according to another embodiment of this application.

FIG. 2A is a schematic structural circuit diagram of an LED lamp lighting system according to an embodiment of this application.

FIG. 2B is a schematic structural circuit diagram of an LED lamp lighting system according to another embodiment of this application.

FIG. 3 is a schematic structural circuit diagram of an LED lamp lighting system according to still another embodiment of this application.

DETAILED DESCRIPTION

[0030] To make the foregoing objectives, features, and advantages of the technical solutions more comprehensible, specific embodiments of the technical solutions are described in detail below with reference to the accompanying drawings. The following descriptions of various embodiments of the technical solutions of this application are merely for illustration but are not examples, and do not indicate all embodiments of this application or indicate that this application is limited to specific embodiments. All other embodiments obtained by a person of ordinary skill in the art based on the embodiments of this application without creative efforts fall within the protection scope of the present disclosure.

[0031] It should be noted that, when a component is referred to as "being disposed on" another component, the component may be directly on the another component, or there may be an intermediate component. When a component is considered to be "connected to" another component, the component may be directly connected to the another component, or there may be an intermediate component. The terms "vertical", "horizontal", "left", "right" and similar expressions used in this specification are merely for purposes of illustration but not indicate a unique implementation.

[0032] Unless otherwise defined, meanings of all technical and scientific terms used in this specification are the same as those commonly understood by a person skilled in the art to which this application belongs. In this specification, terms used in the specification of this application are merely intended to describe objectives of the specific embodiments, but are not intended to limit this application. The term "and/or" used in this specification includes any or all combinations of one or more related listed items.

[0033] A single resistor in the circuit diagram may be equivalently replaced with a plurality of resistors connected in series or in parallel in an actual circuit. This appli-

cation is not limited thereto. A capacitor may also be equivalently replaced with a plurality of capacitors connected in series or in parallel.

[0034] FIG. 1A is a schematic structural circuit diagram of a straight tube LED lamp according to an embodiment of this application. The straight tube LED lamp 10 includes a lamp tube 11, lamp holders 11a and 11b disposed on two ends of the lamp tube 11, a power module 12, an LED module 13, and a safety circuit 14. A first pin 101 and a second pin 102 are disposed on the lamp holder 11a, and a third pin 103 and a fourth pin 104 are disposed on the lamp holder 11b. The first pin 101, the second pin 102, the third pin 103, and the fourth pin 104 are metallic pins, and are connected to a lamp base to fix the lamp tube, and are electrically connected to electrical pins of the lamp base to receive an external power signal. The first pin 101 and the second pin 103 are further electrically connected to the power module 12, and the third pin 103 and the fourth pin 104 are further electrically connected to the safety circuit 14. The LED module 13 is electrically connected to the power module 12. It should be noted that the safety circuit 14 is not electrically connected to the power module 12 or the LED module 13.

[0035] In this embodiment, the straight tube LED lamp 10 has a lamp tube powered at a single end. When directly powered by a mains supply, the straight tube LED lamp can be normally lightened by receiving an external power signal merely by using the first pin 101 and the second pin 102. The third pin 103 and the fourth pin 104 may be idle. The power module 12 receives the external power signal by using the first pin 101 and the second pin 102 and performs power conversion. The power module converts the external power signal to a driving signal for the LED module 13, so as to lighten the LED module. The external power signal is a mains supply signal or power supply signals of other types. This application is not limited thereto. The external power supply is configured to provide the external power signal.

[0036] In some embodiments, when the straight tube LED lamp 10 is misused, for example, the lamp holder 11b of the straight tube LED lamp 10 receives the external power signal, the safety circuit 14 is cut off to disconnect the power supply, so as to prevent the system from overheating and causing danger. In this embodiment, the safety circuit 14 is configured to be cut off when voltages on the third pin 103 and the fourth pin 104 are equal to or greater than 3.6 V.

[0037] In order to ensure the circuit safety of conventional fluorescent lamps, a filament is tested by using a voltage of 3.6 V in accordance with the standard of the International Electrotechnical Commission (IEC), to ensure that a current of the filament is less than 0.51 A. According to Ohm's law, setting a resistance value of safety circuit 14 to be greater than or equal to 7.06 Ω can satisfy the safety standard of the IEC. However, a higher resistance of the safety circuit 14 leads to more unnecessary power consumption, resulting in a waste of energy.

[0038] In this embodiment, when a test voltage of 3.6 V is applied to the third pin 103 and the fourth pin 104, that is, when the voltage applied to the safety circuit 14 is 3.6 V, the safety circuit 14 is cut off. In this case, a current between the third pin 103 and the fourth pin 104 is zero, that is, less than 0.51 A. Therefore, the safety requirements of the IEC can be satisfied.

[0039] In this embodiment, the safety circuit 14 includes a current fuse. The current fuse includes two contacts. A first contact is electrically connected to the third pin 103, and a second contact is electrically connected to the fourth pin 104.

[0040] A current of a common LED lamp is about 200 mA. In some embodiments, in order to protect the LED lamp more effectively, a threshold of the safety circuit 14 is set to 250 mA. When a current flowing through the safety circuit 14 is greater than or equal to 250 mA, the safety circuit 14 is cut off.

[0041] In some embodiments, in order to satisfy the safety standard of the IEC, the safety circuit 14 is configured to be cut off when the current flowing through the safety circuit is equal to or greater than 510 mA. In some embodiments, the resistance of the safety circuit 14 is configured to be less than 7.06 ohms.

[0042] FIG. 1B is a schematic structural circuit diagram of a straight tube LED lamp according to another embodiment of this application. In this embodiment, the configuration of the straight tube LED lamp 10 is the same as that described in the embodiment of FIG. 1A. Further, the power module 12 includes a safety circuit 121 and a rectifier circuit 122. The safety circuit 121 is a current limiting assembly, and is coupled between the power supply pins (the first pin 101 and the second pin 102) and the rectifier circuit, to limit a supply current from the external power signal to the rectifier circuit 122. When the current flowing through the safety circuit 121 is greater than the set threshold, the safety circuit 121 is cut off, so that LED lamp 10 stops receiving the external power signal to ensure the circuit safety.

[0043] In this embodiment, the safety circuit 121 includes a resistance fuse. When a current flowing through the resistance fuse is greater than a set threshold, the resistance fuse blows. Different types of current limiting assemblies are used for the safety circuit 121 and the safety circuit 14.

[0044] The rectifier circuit 122 is a half-bridge or full-bridge rectifier circuit. The rectifier circuit 122 includes at least two diodes. When the power module 12 fails, for example, when the diodes in the rectifier circuit 122 are short-circuited or disconnected, causing the current flowing through the safety circuit 121 to be greater than the set threshold, the safety circuit 121 is cut off to ensure the circuit safety.

[0045] FIG. 1C is a schematic structural circuit diagram of a power module 12 according to an embodiment of this application. In this embodiment, the power module 12 includes a safety circuit 121 and a rectifier circuit 122. The safety circuit 121 includes a resistance fuse F1. The

resistance fuse F1 is coupled between the first pin 101 and the rectifier circuit. The second pin 102 is electrically connected to the rectifier circuit. The external power signal is transmitted to the LED lamp through the first pin 101 and the second pin 102. A current flowing through the resistance fuse F1 is the current of the external power signal. When the current is greater than a threshold set for the resistance fuse F1, the resistance fuse F1 blows, so that the LED lamp 10 stops receiving the external power signal (supply of the external power signal to the LED lamp 10 is stopped).

[0046] In other embodiments, the resistance fuse F1 may be replaced with a current fuse or other current limiting assemblies. This application is not limited thereto.

[0047] FIG. ID is a schematic structural circuit diagram of a power module 12 according to another embodiment of this application. In this embodiment, the power module 12 includes a safety circuit 121 and a rectifier circuit 122. The safety circuit 121 includes resistance fuses F1 and F2. The resistance fuse F1 is coupled between the first pin 101 and the rectifier circuit, and the resistance fuse F2 is coupled between the second pin 102 and the rectifier circuit. The external power signal is supplied to the LED lamp 10 through the first pin 101 and the second pin 102. A current flowing through the resistance fuse F1 is equal to a current flowing through the resistance fuse F2. When the current flowing through the resistance fuse F1 is greater than a set threshold, the resistance fuse F1 blows. When the current flowing through the resistance fuse F2 is greater than the set threshold, the resistance fuse F2 blows. In this embodiment, the threshold of the resistance fuse F1 is the same as the threshold of the resistance fuse F2. By disposing two resistance fuses in a power supply loop of the LED lamp 10, the circuit can be more reliable. When one of the resistance fuses fail to blow, the other resistance fuse can still protect the circuit.

[0048] The threshold of the resistance fuse F1 is the same as the threshold of the resistance fuse F2. Alternatively, the resistance fuses F1 and F2 may be replaced with current fuses or other current limiting assemblies. This application is not limited thereto.

[0049] FIG. 2A is a schematic structural circuit diagram of an LED lamp lighting system according to an embodiment of this application. In this embodiment, an LED lamp lighting system 20 further includes an inductance ballast 21 and a safety circuit 22, in addition to the straight tube LED lamp 10. The inductance ballast 21 is electrically connected to an external power signal input terminal L and the fourth pin 104, and the second pin 102 is electrically connected to the third pin 103 by using the safety circuit 22. The first pin 101 is electrically connected to an external power signal input terminal N.

[0050] During replacement of the conventional fluorescent lamp, power is directly supplied to the straight tube LED lamp 10 according to the connection method described in FIG. 2A, so as to minimize circuit changes. In this way, not only circuit changes are reduced, but also the straight tube LED lamp 10 can be normally powered either when the straight tube LED lamp is either positively or negatively connected to the lamp base.

[0051] In this embodiment, power is supplied from the external power signal to the straight tube LED lamp 10 through a power supply loop formed by the power signal input terminal L, the inductance ballast 21, the safety circuit 14, the safety circuit 22, the power module 12, and the power signal input terminal N. The inductance ballast 21, the safety circuit 14, the current limiting assembly 21, and the power module 12 are connected in series.

[0052] In this embodiment, the safety circuit 22 includes a fuse for replacing an original starter. The fuse can not only connect the circuits, but also prevent the circuit of the power supply loop from exceeding a threshold current. A threshold current of the fuse is set to 300 Ma.

[0053] In this embodiment, the safety circuit 14 includes a current limiting assembly 141. The current limiting assembly 141 may be a fuse or other electronic elements capable of current limitation. A fuse is used as an example for description in this application. The threshold of the fuse is set to 300 mA. When a current flowing through the fuse is greater than 300 mA, the fuse blows, that is, the safety circuit 14 is cut off, and the power supply loop is cut off, so as to prevent the current of the straight tube LED lamp 10 from exceeding the safety threshold and causing circuit damage or even fire.

[0054] It should be particularly noted that, since the current limiting assembly 141 in the safety circuit 14 is connected in series with the power supply loop, the current flowing through the straight tube LED lamp 10 is the same as the current flowing through the current limiting assembly 141. For example, when the straight tube LED lamp 10 is normally lightened, the current in the power supply loop is 200 mA. If a resistance of the current limiting assembly 141 is relatively large, for example, is 10 ohms, according to Ohm's law, a power consumed for the current limiting assembly 141 is 0.4 W. The power is completely converted to heat. The current limiting assembly 141 consumes energy of 3.5 kW·h over a year. In addition, the heat generated by the current limiting assembly 141 increases an operating temperature of the straight tube LED lamp 10, reducing the service life of the straight tube LED lamp 10. If the resistance of the current limiting assembly 141 is set to 3 ohms or less, the power consumed for the current limiting assembly is greatly reduced. Therefore, the unnecessary power consumption is greatly reduced, and the straight tube LED lamp is more environmentally friendly and energy saving and has a longer service life.

[0055] In some embodiments, the current limiting assembly 141 is a fuse with a resistance value of 1 ohm or less.

[0056] FIG. 2B is a schematic structural circuit diagram of an LED lamp lighting system according to another embodiment of this application A circuit structure of the LED lamp lighting system in this embodiment is the same as

the LED lamp lighting system shown in FIG. 2A. Further, the power module 12 in this embodiment includes a safety circuit 121 and a rectifier circuit 122. The safety circuit 121 is a current limiting assembly, and is coupled between the power supply pins (the first pin 101 and the second pin 102) and the rectifier circuit, to limit a supply current of the external power signal. When a current flowing through the safety circuit 121 is greater than a set threshold, the safety circuit 121 is cut off, so that the external power signal cannot be supplied to the rectifier circuit 122, that is, the supply to the power module is stopped. The current limiting assembly included in the safety circuit 121 may be a current fuse or a resistance fuse. This application is not limited thereto.

[0057] In this embodiment, the safety circuit 121 includes a resistance fuse. When a current flowing through the resistance fuse is greater than a set threshold, the resistance fuse blows. Different types of current limiting assemblies are used for the safety circuit 121 and the safety circuit 14.

[0058] The rectifier circuit 122 is a half-bridge or full-bridge rectifier circuit. The rectifier circuit 122 includes at least two diodes. When the power module 12 fails, for example, when the diodes in the rectifier circuit 122 are short-circuited or disconnected, causing the current flowing through the safety circuit 121 to be greater than the set threshold, the safety circuit 121 is cut off to ensure the circuit safety.

[0059] When the straight tube LED lamp fails, for example, the power module 12 fails or the rectifier circuit 122 in the power module 12 fails, the current in the power supply loop surges. If the power supply loop is not cut off in time, circuit devices may generate heat and be damaged, or even lead to a fire, resulting in an accident.

[0060] In some embodiments, in order to prevent the current increase of the power supply loop caused by an LED lamp failure or the like, an operation threshold of the safety circuit 2 is set to be less than those of the safety circuit 121 and the safety circuit 14. That is, when the circuit fails, the third safety circuit is first cut off. In this way, when the circuit failure originates from the outside of the straight tube LED lamp 10, the operation of the third current limiting assembly can prevent an abnormal current of the loop from damaging the straight tube LED lamp 10. After the circuit failure is eliminated, the third safety circuit is replaced, so that the straight tube LED lamp 10 can still be normally used.

[0061] In some usage scenarios, the safety circuit 22 is bypassed. In this case, the first safety circuit or the second safety circuit operates when the circuit fails. When the second safety circuit operates first, if the circuit failure originates from the outside of the straight tube LED lamp, a user may modify the circuit to directly connect the first pin 101 and the second pin 102 to the mains supply, so that the straight tube LED lamp 10 can still be normally used. If the circuit failure originates from the straight tube LED lamp 10, for example, the rectifier circuit in the power module 12 fails, if the user still modifies the circuit (directly connecting the first pin 101 and the second pin 102 to the mains supply) to use the straight tube LED lamp, the circuit failure in the straight tube LED lamp causes the first current limiting assembly 15 to operate or the mains line to be abnormal.

[0062] In this embodiment, the threshold of the safety circuit 121 is set to be less than that of the safety circuit 14. Therefore, when the current of the power supply loop surges as a result of a circuit failure, the safety circuit 121 operates before the safety circuit 14 to cut off the power supply loop of the power module. In this case, even if the user modifies the circuit to directly connect the first pin 101 and the second pin 102 to the mains supply (referring to FIG. 3), the LED lamp still cannot be lightened normally. In this case, the safety circuit 121 is cut. By means of the configuration, the circuit safety and the user safety can be guaranteed more effectively.

[0063] Similar to the above embodiment, in order to satisfy the safety standard of the IEC, the current limiting assembly included in the safety circuit 14 is a current fuse, and the current limiting assembly used in the safety circuit 121 is a resistance fuse. The costs of the current fuse are higher than that of the resistance fuse. In order to reduce the maintenance costs, the threshold of the safety circuit 121 is set to be lower than that of the safety circuit 14. That is, when the power module 12 fails and the current of the power supply loop exceeds a rated current, the safety circuit 121 is cut off before the safety circuit 14. In this way, only the resistance fuse in the safety circuit 121 needs to be replaced during repair. In this embodiment, the current threshold of the safety circuit 14 is set to 2 A. When a current flowing through the safety circuit 14 is greater than or equal to 2 A, the safety circuit 14 is cut off.

[0064] The fuse in the above embodiment may be a current fuse or a resistance fuse. This application is not limited thereto.

[0065] The current fuse in this embodiment of this application is a fusible fuse. When the current flowing through the current fuse is greater than or equal to the current threshold (a fusing threshold), the current fuse blows. Similarly, the resistance fuse is a fusible fuse. When the current flowing through the resistance fuse is greater than or equal to the current threshold (a fusing threshold), the resistance fuse blows.

Claims

1. A straight tube light emitting diode (LED) lamp, comprising:

   a lamp tube, having a first lamp holder and a second lamp holder respectively located on two ends of the lamp tube, wherein a first pin and a second pin are disposed on the first lamp holder, and a third pin and a fourth pin are disposed on the second lamp holder;

a power module, electrically connected to the first pin and the second pin to receive an external power signal by using the first pin and the second pin and perform power conversion to generate a driving signal; and

an LED module, comprising at least one LED, disposed in the lamp tube, and electrically connected to the power module to receive the driving signal for lightening; and

a first safety circuit, disposed between the third pin and the fourth pin to limit a current, wherein the safety circuit is configured to be cut off when a voltage across the safety circuit is greater than or equal to 3.6 V, wherein

the safety circuit is configured to be connected in series with the power module.

2. The straight tube LED lamp according to claim 1, wherein a resistance value of the first safety circuit is configured to be less than 7.06 ohms.

3. The straight tube LED lamp according to claim 1, wherein the first safety circuit comprises:
a first current limiting assembly, electrically connected to the third pin and the fourth pin.

4. The straight tube LED lamp according to claim 3, wherein the first current limiting assembly comprises a first current fuse, a first contact of the first current fuse is electrically connected to the first pin, and a second contact of the first current fuse is electrically connected to the fourth pin.

5. The straight tube LED lamp according to claim 4, wherein a fusing current of the first current fuse is 250 milliamperes (mA) or more.

6. The straight tube LED lamp according to claim 4, wherein a fusing current of the first current fuse is 510 milliamperes (mA) or more.

7. The straight tube LED lamp according to claim 4, wherein a fusing current of the first current fuse is 2 A or more.

8. The straight tube LED lamp according to claim 4, wherein the power module comprises a second safety circuit and a rectifier circuit, the second safety circuit is coupled between the first pin and the second pin and the rectifier circuit to limit a current, and a current threshold of the second safety circuit is less than a current threshold of the first safety circuit.

9. The straight tube LED lamp according to claim 8, wherein the second safety circuit comprises a second current limiting assembly electrically connected between the first pin and the rectifier circuit.

10. The straight tube LED lamp according to claim 9, wherein the second safety circuit further comprises a third current limiting assembly electrically connected between the second pin and the rectifier circuit.

11. The straight tube LED lamp according to claim 9, wherein the second current limiting assembly and the third current limiting assembly have a same current threshold.

12. The straight tube LED lamp according to claim 9, wherein the second current limiting assembly and the third current limiting assembly each have a different current threshold.

13. The straight tube LED lamp according to claim 9, wherein the second current limiting assembly comprises a first resistance fuse, and the third current limiting assembly comprises a second resistance fuse.

14. A straight tube LED lamp, comprising:

a lamp tube, having a first lamp holder and a second lamp holder respectively located on two ends of the lamp tube, wherein a first pin and a second pin are disposed on the first lamp holder, and a third pin and a fourth pin are disposed on the second lamp holder;

a first safety circuit, disposed between the third pin and the fourth pin to limit a current;

a power module, electrically connected to the first pin and the second pin to receive an external power signal by using the first pin and the second pin and perform power conversion to generate a driving signal, wherein the power module comprises a second safety circuit and a rectifier circuit; and

an LED module, comprising at least one LED, disposed in the lamp tube, and electrically connected to the power module to receive the driving signal for lightening, wherein

the first safety circuit comprises a first current limiting assembly, the second safety circuit comprises a second current limiting assembly, the first current limiting assembly and the second current limiting assembly are of different types, and the first safety circuit is configured to be connected in series with the second safety circuit when powered by using an inductance ballast.

15. The straight tube LED lamp according to claim 14, wherein the first current limiting assembly is one of a current fuse and a resistance fuse.

16. The straight tube LED lamp according to claim 14, wherein the second current limiting assembly is one of a current fuse and a resistance fuse.

17. The straight tube LED lamp according to claim 14, wherein the first current limiting assembly comprises a first current fuse, the second current limiting assembly comprises a first resistance fuse, and a current threshold of the first current fuse is greater than a current threshold of the first resistance fuse.

18. The straight tube LED lamp according to claim 17, wherein a resistance of the first current fuse is less than 7.06 ohms.

19. The straight tube LED lamp according to claim 17, wherein the first current fuse is configured to blow when a voltage across the first current fuse is greater than or equal to 3.6 V.

20. The straight tube LED lamp according to claim 17, wherein the current threshold of the first current fuse is 2 A.

21. The straight tube LED lamp according to claim 14, wherein the rectifier circuit comprises at least two diodes, and the second safety circuit is configured to be cut off when the diodes of the rectifier circuit are short-circuited.

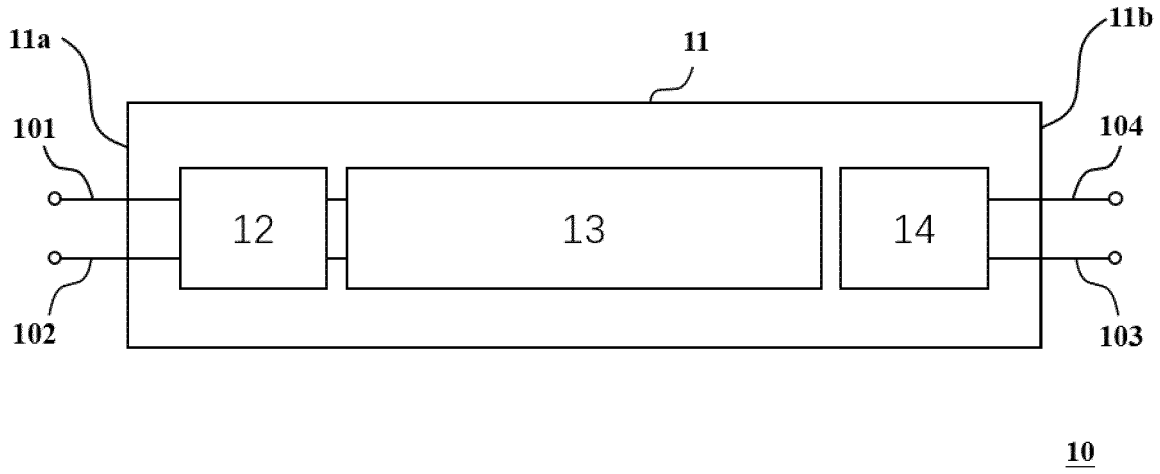
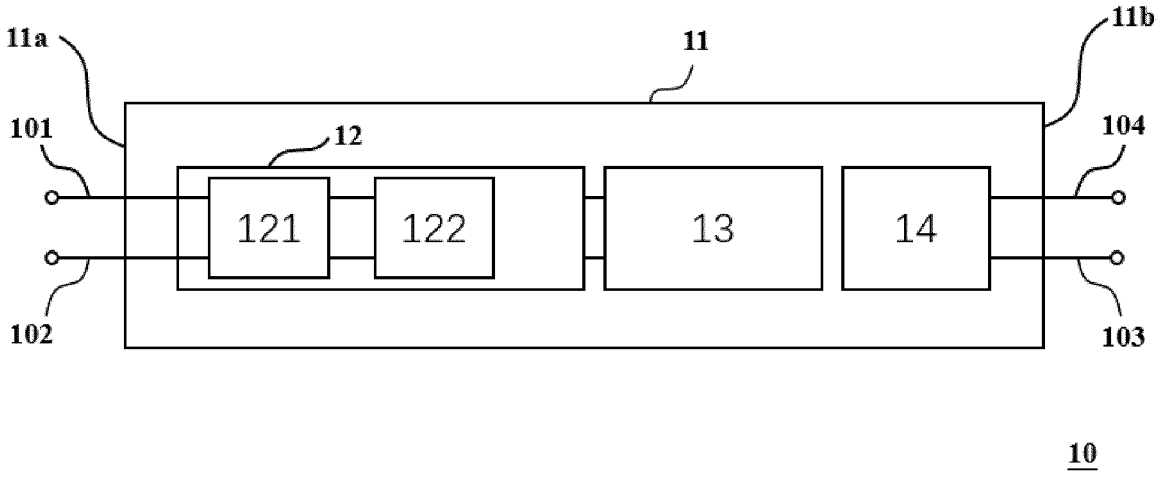

11a
11
11b
101
104
12
13
14
102
103
10

FIG. 1A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11b
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103
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FIG. 1B

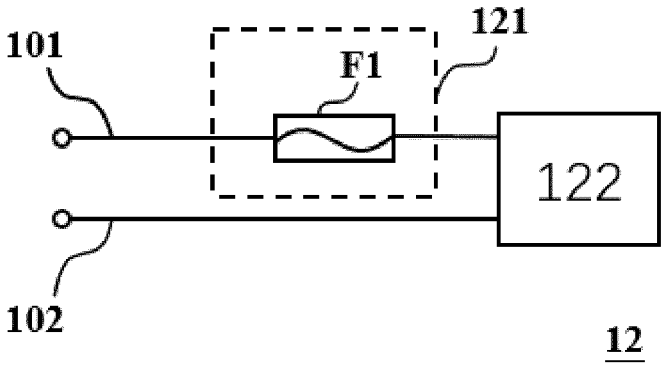


FIG. 1C

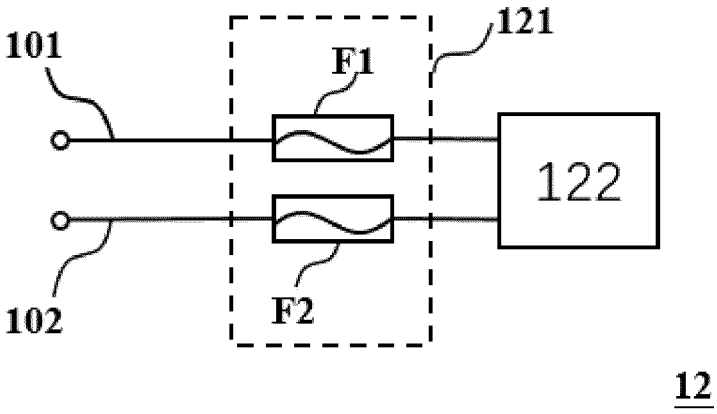
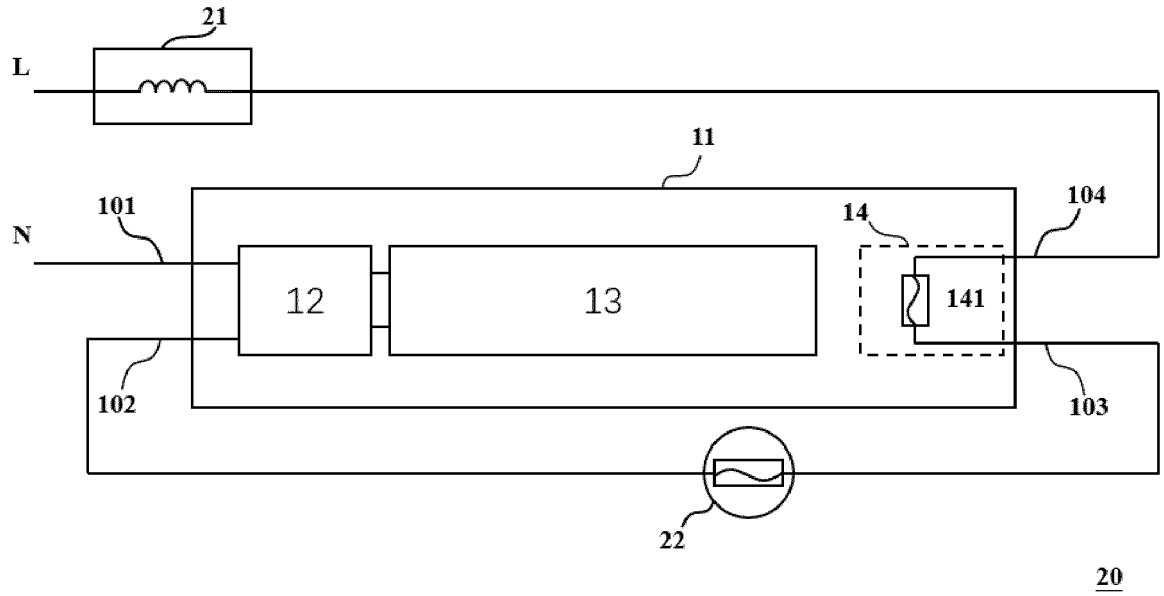


FIG. 1D


21
L
11
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104
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141
102
103
22
20

FIG. 2A

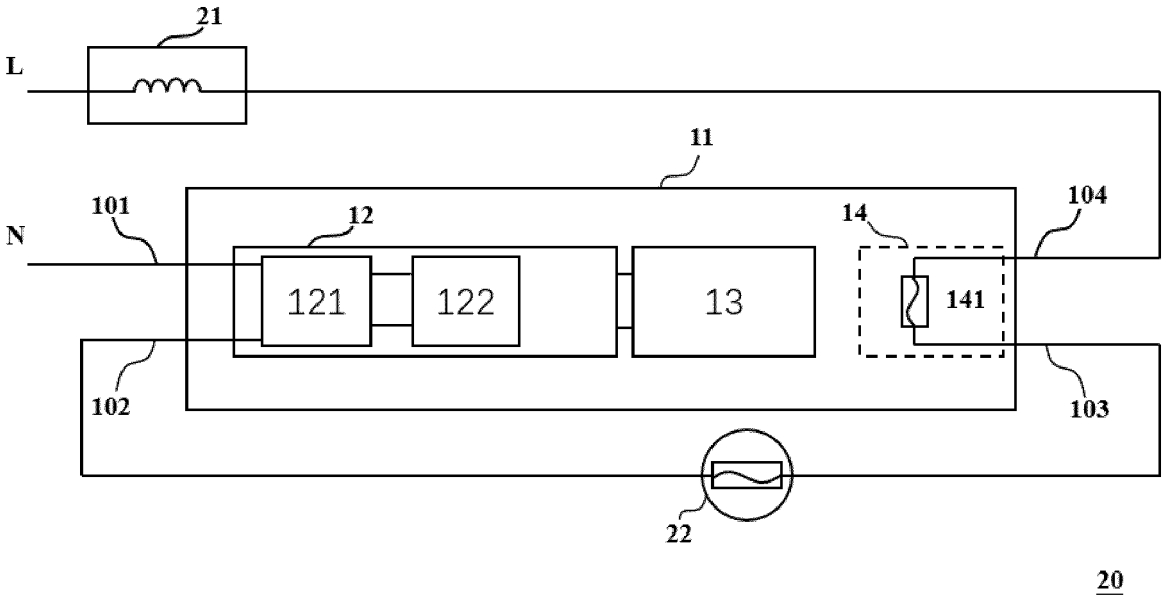
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FIG. 2B

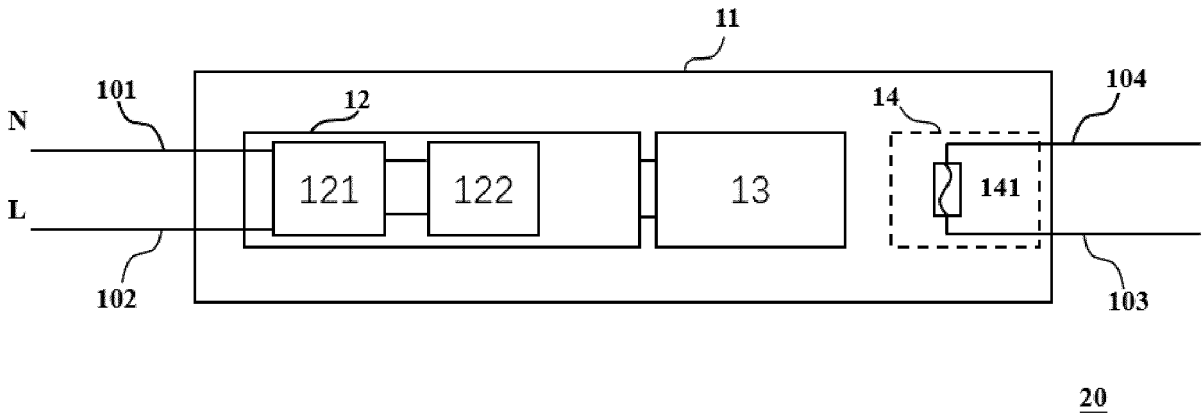

FIG. 3

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EUROPEAN SEARCH REPORT

Application Number
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Place of search	Date of completion of the search	Examiner
Munich	7 March 2022	Brosa, Anna-Maria

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