CLAIMS

1. An electronic lighting apparatus comprising:

a light emitting diode(LED);

an Alternating Current (AC) power dete.ction circuit connected to an AC power source; and

a power source selection circuit coupled to the AC power detection circuit, a battery and the LED,

wherein the AC power detection circuit is to generate a control signal to indicate whether an AC power source is present; and if an AC power source is present, the AC power detection circuit is to detect a voltage level of the AC power source, and determine a path of gain based on the detected voltage level to produce a constant AC output voltage level and

wherein the power source selection circuit is to receive the control signal from the AC power detection circuit, electrically connect the battery and the LED if the control signal indicates that no AC power source is present, or electrically connect the AC power source and the LED if the control signal indicates that an AC power source is present.,

~~2. The apparatus of claim 1,~~ wherein the AC power detection circuit comprises a voltage detection unit, a gain selection unit, and a control signal generation unit,

wherein the voltage detection unit is to detect a voltage level of the AC power source, generate signals to indicate the voltage level of the AC power source and output the signals to the gain selection unit;

wherein the gain selection unit is to select a path of gain based on the signals output from the voltage detection unit to produce a constant AC output voltage level, and generate an AC output signal; and

wherein the control signal generation unit is to generate a control signal to indicate that an AC power source is present based on the AC output signal from the gain selection unit, and generate a control signal to indicate an AC power source is not present if there is no AC output signal from the gain selection unit,

wherein the control signal generation unit comprises:

a capacitor connected in series to the gain selection unit to block a DC level,
a diode connected in series to the capacitor to convert an output signal of the gain selection unit into a half-wave rectifier;
a transistor, having a base, an emitter and a collector, wherein the base is connected in series to the diode and connected in parallel to a high potential end of a parallel circuit with a capacitor and a resistor, the emitter is connected to the ground end of the parallel circuit;

an inverter having an input end and an output end, the input end connected in series to the collector of the transistor and connected in series to a battery through a resistor;

an XOR gate having two input ends, one input end connected to the output end of the inverter, the other input end connected to a Ground end;

wherein if there is an AC power source, the AC signal from the gain selection unit is to pass through the capacitor and be converted by the diode into a half-wave rectifier, which is to be input to the base of the transistor, when input voltage of the transistor is greater than a voltage between the base and the emitter of the transistor, the transistor is to conduct; if there is no AC power source, there is no AC output signal from the gain selection unit, the transistor is not to conduct; an output signal is to be generated based on the conduction of the transistor and output to the inverter;

wherein the signal output to the inverter is to be inverted and output to the XOR gate, wherein the XOR gate is to generate a control signal to indicate whether an AC power source is present according to the inverted signal received from the inverter .~~.~~

~~3~~2. The apparatus of claim ~~2~~1, wherein the voltage detection unit comprises a potential dividing circuit, and a comparing circuit ~~and a logical circuit~~, wherein

the potential dividing circuit includes at least a series connection having a diode, a first resistor, and a second resistor, to block negative cycle of the AC power source, step down the voltage, and provide a voltage input to the comparing circuit;

the comparing circuit includes a voltage division sub-circuit formed by at least two resistors in series connection, at least two comparators and at least two XOR gates,

wherein each comparator connects to a same position on the potential dividing circuit to receive a first voltage input, and connects to different position of the voltage division sub-circuit to receive a second voltage input, is to compare the first and second voltage input and generate a comparison signal output to at least one of the XOR gates,

wherein each XOR gate has two input signals, at least one of the two input signals of each XOR gate is received from one of the comparators, one input signal of one of the at least two XOR gates is received from a Ground end, each XOR gate is to generate a signal to indicate whether a predetermined AC power source is present based on the two input signals.

43. The apparatus of claim 32, wherein the gain selection unit comprises

a ~~first~~ parallel circuit with an input end and an output end, which has at least three branches, one of the branches having an operation amplifier, the other branches each having a switch and a resistor connected to each other in series, wherein the switch is connected to the input end and the resistor is connected to the output end, wherein the resistor is selected based on a predetermined gain for a predetermined AC power source;

wherein each switch is connected to one of the XOR gates to receive the signal indicating whether a predetermined AC power source is present;

wherein the operation amplifier has two input ends and one output end, one of the input ends connects to the input end of the ~~first~~ parallel circuit, the other input end connects to a voltage division circuit with two resistors connected between a battery and a Ground end, the two resistors are configured such that the voltage drop across the operation amplifier is a predetermined value regardless of an input voltage of the AC power source.

~~5. The apparatus of claim 4, wherein the control signal generation unit comprises~~

~~a capacitor connected in series to the output end of the first parallel circuit to block a DC level,~~

~~a diode connected in series to the capacitor to convert an output signal of the first parallel circuit into a half-wave rectifier;~~

~~a transistor, having a base, an emitter and a collector, wherein the base is connected in series to the diode and connected in parallel to a high potential end of a second parallel circuit with a capacitor and a resistor, the emitter is connected to the ground end of the second parallel circuit;~~

~~an inverter having an input end and an output end, the input end connected in series to the collector of the transistor and connected in series to a battery through a resistor;~~

~~an XOR gate having two input ends, one input end connected to the output end of the inverter, the other input end connected to a Ground end;~~

~~wherein if there is an AC power source, the AC signal output from the first parallel circuit is to pass through the capacitor and be converted by the diode into a half-wave rectifier, which is to be input to the base of the transistor, when input voltage of the transistor is greater than a voltage between the base and the emitter of the transistor, the transistor is to conduct; if there is no AC power source, there is no AC signal output from the first parallel circuit, the transistor is not to conduct; an output signal is to be generated based on the conduction of the transistor and output to the inverter;~~

~~wherein the signal output to the inverter is to be inverted and output to the XOR gate, wherein the XOR gate is to generate a control signal to indicate whether an AC power source is present according to the inverted signal received from the inverter.~~

64. The apparatus of claim 1, wherein the power source selection circuit comprises

an inverter which is to invert the signal to indicate whether an AC power source is present from the AC power detection circuit;

a relay connected to the inverter which is to be energized by the signal output from the inverter which indicates an AC power source is present such that the AC power source is electrically connected to the LED.

~~7~~5. The apparatus of claim 64, wherein the power source selection circuit further comprises:

a transformer which is configured to accept at least two types of AC power sources and step down the received AC power source to a predetermined level, and

a bridge connected to the relay to convert a received AC voltage to a DC voltage.

~~8~~-6. The apparatus of claim 1, further comprises a AC soft start circuit connected between the AC power source and the AC power detection circuit, wherein the AC soft circuit includes

a first series connection comprising a first resistor and a capacitor, wherein ~~the first resistor is connected to the AC power source,~~ the capacitor is connected to a Ground end;

a second series connection comprising a diode for blocking negative cycle of the AC power source and a resistor for limiting current, wherein the first resistor is connected to the resistor for limiting current;

a first Zener diode connected to a position between the first resistor and the capacitor, and

a second Zener diode connected to the second series connection in series and connected to the first series in parallel, wherein the voltage drop across the second Zener diode is to be a charging source of the first resistor and the capacitor; and

a FET having two input ends, one input end connected to the first Zener diode, the other input end connected to the AC power source, and one output end connected to the AC power detection circuit;

wherein the FET is to turn on only when a reverse break down voltage of the first Zener diode is reached.

~~9. The apparatus of claim 8, wherein the AC soft start circuit further comprises~~

~~a second series connection comprising a diode for blocking negative cycle of the AC power source and a resistor for limiting the current, and~~

~~a second Zener diode connected to the second series connection in series and connected to the first series in parallel,~~

~~wherein the voltage drop across the second Zener diode is to be a charging source of the first resistor and the capacitor.~~

~~10~~7. The apparatus of claim 1, further comprises at least one DC soft start circuit arranged between an output end of the power source selection circuit and the LED to get rid of the current spike, wherein the DC soft start circuit includes:

a first series connection comprising a first resistor and a capacitor, wherein the first resistor is connected to the output end of the power source selection circuit, and the capacitor is connected to a Ground end;

a first Zener diode connected to a position between the first resistor and the capacitor, and

a FET having two input ends, one input end connected to the first Zener diode, the other input end connected to the output end of the power source selection circuit, and one output end connected to the LED;

wherein the FET is to turn on only when a reverse break down voltage of the first Zener diode is reached.

~~11~~8. The apparatus of claim 1, further comprises a battery charger coupled to the battery and the power source selection circuit to charge the battery when an AC power source is available, wherein the battery charger includes:

a voltage detection circuit connected to the battery, which is designed to detect ~~the~~ a voltage range of the battery;

a charger control circuit which connects to the voltage detection circuit and is to control charging of the battery by the charger based on the voltage ~~scope~~ range of the battery detected by the voltage detection circuit.

~~12~~9. The apparatus of claim ~~11~~8, wherein the voltage detection circuit comprises

a first voltage comparison circuit and a second voltage comparison circuit,

wherein the first voltage comparison circuit includes a first series connection having a Zener diode and a first resistor, the first series connection is arranged between the battery and a DC ground end, and a second series connection having a second resistor and a first FET, the second series connection is arranged between a battery and a DC Ground end, wherein the first FET has three ends respectively connected to a position between the Zener diode and the first resistor, a DC ground end and the second resistor;

wherein the second voltage comparison circuit includes a third series connection having a Zener diode and a third resistor, the third series connection is arranged between the battery and a DC ground end, and a fourth series connection with a fourth resistor and a second FET, the fourth series connection is arranged between a battery and a DC Ground end, wherein the second FET have three ends, respectively connected to a position between the Zener diode and the third resistor, a DC ground end and the fourth resistor,

wherein conducting state of each FET is controlled by preset resistance values of the resistors and the voltage ~~scope~~ range of the battery.

~~13~~10. The apparatus of claim ~~12~~9, wherein the charger control circuit includes a first logical gate, a second logical gate and a third logical gate, a comparator and a Zener diode, wherein

the first logical gate has two input ends which respectively connect to a first position and a second position respectively located on two sides of the second resistor, wherein the first position is near to the first FET, and one output end connected to a first input end of the third logical gate;

the second logical gate has two input ends, one connected to the first position, the other connected to a position between the fourth resistor and the

second FET, and is to generate an output signal based on signals from the two input ends;

the third logical gate has two input ends, one of the two input ends connects to the first logical gate, and is to generate an output signal based on signals from the two input ends of the third logical gate;

wherein the comparator compares the output signal from the third logical gate to a signal from a DC ground end, when the output signal from the third logical gate is greater than the signal from the DC ground end, the Zener diode is to be turned on, the charger is to charge the battery; or the Zener diode is to be turned off, the charger is not to charge the battery.

~~14~~11. The apparatus of claim ~~13~~10, wherein the battery charging circuit further comprises a clock signal generator connected to the charging control part to control the battery charging in a non-continuous state,

wherein the charger control circuit of the battery charging circuit further comprises a fourth logical gate having two inputs end and one output end wherein one of the two input ends connects to the clock signal generator, the other of the two input ends connects to the output end of the second logical gate, the output end of the fourth logical gate connects to one input end of the third logical gate, wherein the fourth logical gate is to compare the clock signal from the clock signal generator with the output signal from the second logical gate to generate an output signal which is to be output to one input end of the third logical gate such that charging state of the charger is changed based on the clock signal.

~~15~~12. The apparatus of claim ~~14~~11, wherein the first logical gate is a NAND gate, the second logical gate is an XNOR gate, the third logical gate is an OR gate, the fourth logical gate is an AND gate.

~~16~~13. The apparatus of any one of claims ~~15~~8-12, wherein the battery charger further comprises an indicator circuit for indicating charging state of the battery charger, wherein the indicator circuit includes:

a LED and an inverter connected to each other in series wherein the LED is powered by a battery and the inverter is to receive and invert the output signal from the third logical gate such that the LED is to be turned on when the charger is charging the battery.