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(54) Control circuit for fluorescent lamp

(57) A control circuit for a fluorescent lamp comprises a ballast control unit (1) and an oscillator unit (2), the control circuit further comprising a signal detection unit (3), a switch unit (4) and a frequency converter (5); wherein the signal detection unit (3) outputs a signal to the switch unit (4) after receiving a light up signal from the ballast control unit (1), the switch unit (4) outputs a signal to the frequency converter (5) and the frequency converter (5) outputs a signal to the oscillator unit (2) and converts an oscillation frequency of the oscillator unit (2). According to the control circuit of the invention, the signal detection unit (3) receives a light up signal to trigger the switching of the switch unit (4) so as to enable the frequency converter (5) to convert an oscillation frequency of the oscillator unit (2) of the fluorescent lamp, such that a filament current of the fluorescent lamp could be increased to boost the light flux rate of the fluorescent lamp. Thus, a normal brightness of the fluorescent lamp could be rapidly reached in a relatively short time.

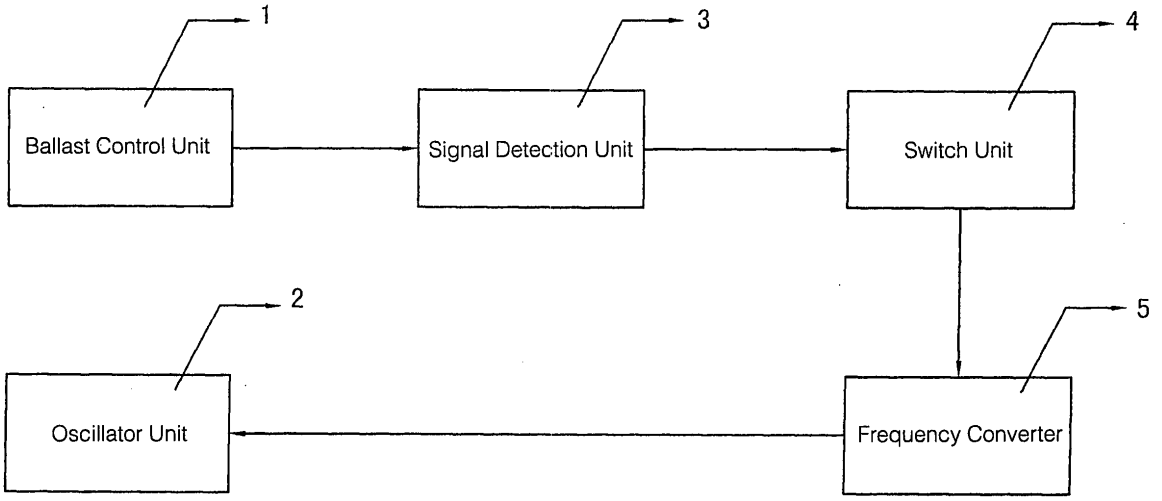

Fig. 1

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Description

[0001] The present invention relates to a control circuit for a fluorescent lamp, and more particularly to a control circuit capable of increasing a current of the fluorescent lamp within a specific time period, allowing to reach a normal brightness of the fluorescent lamp rapidly in a relatively short time.

[0002] Fluorescent lamps currently available in the market utilize mercury to emit ultraviolet light. Generally, mercury exists in a liquid form or in an amalgam form (bead-shaped mercury alloy). Amalgam is significantly advantageous over liquid mercury, but amalgam is able to excite for the emission of ultraviolet light only when it is heated. As a result, an amalgam fluorescent lamp needs a period of time to reach a rated output light flux, and after the fluorescent lamp is lit, it is the heat energy in the vicinity of the amalgam that determines how much the bead-shaped amalgam evaporates. It is common that the fluorescent lamp is relatively dim at the beginning of the ignition of the fluorescent lamp, and reaches to a normal brightness after the elapse of a period of time. This inevitably causes an inconvenience when people use fluorescent lamps.

[0003] A fluorescent lamp usually controls its ignition and lightening by a control circuit which comprises a ballast control unit and an oscillator unit. Generally, the control circuit could ignite the fluorescent lamp with a specific preheating time or without a preheating time. In these cases, the control circuit starts with a relatively high initial oscillation frequency, and thereafter, the oscillation frequency will be decreased at a relatively fast speed during which the fluorescent lamp is ignited. Thus, the fluorescent lamp needs to take a period of time to reach a normal brightness after it is ignited, such that the fluorescent lamp is always "darkish" at the beginning of the ignition of the lamp. Therefore, there exists a need for a control circuit for adjusting the oscillation frequency of the oscillator unit to allow a fluorescent lamp to reach rapidly a normal brightness when the lamp is switched on.

[0004] An aim of the present invention is to provide a control circuit for a fluorescent lamp, which is able to increase promptly a current of the fluorescent lamp within a very short time period to boost heat energy generated by amalgam and thus an evaporation rate of amalgam, such that a normal brightness of the fluorescent lamp could be rapidly reached in a relatively short time.

[0005] Accordingly, the present invention provides a control circuit for a fluorescent lamp comprising a ballast control unit and an oscillator unit, the control circuit further comprises a signal detection unit, a switch unit and a frequency converter; the signal detection unit outputs a signal to the switch unit after receiving a light up signal from the ballast control unit, the switch unit outputs a signal to the frequency converter, and the frequency converter outputs a signal to the oscillator unit and converts an oscillation frequency of the oscillator unit.

[0006] Preferably, the signal detection unit comprises a diode, a resistor and a first capacitor; the resistor and the first capacitor are connected in parallel together, and then connected with a negative terminal of the diode having a positive terminal connected with the ballast control unit; the switch unit is a NMOS transistor having its gate terminal connected with the negative terminal of the diode and having its source terminal earthed; the frequency converter comprises a second capacitor and a third capacitor which are connected in series together, and in parallel between drain and source terminals of the NMOS transistor, and the oscillator unit is connected with a point where the second capacitor and the third capacitor are connected.

[0007] Preferably, the oscillator unit further comprises a current comparator, and the signal detection unit comprises a diode and a first capacitor; the diode has a positive terminal connected with the ballast control unit, and a negative terminal connected with the first capacitor which has another terminal earthed; the switch unit is a NMOS transistor having its gate terminal connected with the negative terminal of the diode and having its source terminal earthed, while a drain terminal of the NMOS transistor is connected with a negative terminal of the current comparator via a resistor; the frequency converter comprises a second capacitor having its one terminal earthed and another terminal connected with the oscillator unit.

[0008] According to the control circuit of the invention, the signal detection unit receives a light up signal to trigger the switching of the switch unit so as to enable the frequency converter to convert an oscillation frequency of the oscillator unit of the fluorescent lamp, such that a filament current of the fluorescent lamp could be increased to boost the light flux rate of the fluorescent lamp. Thus, a normal brightness of the fluorescent lamp could be rapidly reached in a relatively short time.

[0009] The present invention will be described in more detail, by way of example, with reference to the drawings, in which:

Figure 1 is a block diagram of a control circuit for a fluorescent lamp of the present invention;
Figure 2 is a first schematic diagram of a control circuit for a fluorescent lamp of the present invention; and
Figure 3 is a second schematic diagram of control circuit for a fluorescent lamp of the present invention.

[0010] Referring to Fig. 1, a control circuit for a fluorescent lamp of the present invention is illustrated, which comprises a ballast control unit 1, an oscillator unit 2, a signal detection unit 3, a switch unit 4, and a frequency converter 5. The signal detection unit 3 outputs a signal to the switch unit 4 after receiving a light up signal from the ballast control unit 1, the switch unit 4 outputs a signal to the frequency converter 5, and the frequency converter 5 outputs a signal to the oscillator unit 2 and converts an oscillation frequency of the oscillator unit 2.

[0011] Preferably, as shown in Fig. 2, the signal de-

tection unit comprises a diode D1, a resistor R1 and a first capacitor Ctimer. The resistor R1 and the first capacitor Ctimer are connected in parallel, and then connected to a negative terminal of the diode D1 which has a positive terminal connected with the ballast control unit. The switch unit is a NMOS transistor having its gate terminal connected with the negative terminal of the diode D1 and having its source terminal earthed. The frequency converter comprises a second capacitor Cf and a third capacitor Cqst connected in series together, and in parallel between drain and source terminals of the NMOS transistor. The oscillator unit is connected to a point where the second capacitor Cf and the third capacitor Cqst are connected.

[0012] The control circuit shown in Fig. 2 can be actuated by a digital signal or a preheating time signal from the ballast control unit. When a high level signal is detected by the diode D1, the diode D1 is turned on and the timer capacitor Ctimer is charged up with a voltage for driving the turning-on of the NMOS transistor which serves as a switch in the circuit. When the NMOS transistor is turned on, the second capacitor Cf parallels with the third capacitor Cqst to determine a frequency at which the fluorescent lamp can reach rapidly the normal brightness, and the third capacitor Cqst determines a frequency at which the fluorescent lamp ignites normally. After the elapse of the period of time for reaching the normal brightness (time signal is zero), the NMOS transistor is turned off and the oscillator unit is connected only with the second capacitor Cf where the circuit operates at a normal working frequency.

[0013] Preferably, as shown in Fig. 3, the oscillator unit further comprises a current comparator, and the signal detection unit comprises a diode D2 and a capacitor C1. The diode D2 has a positive terminal connected with the ballast control unit, and a negative terminal connected with the capacitor C1 which has another terminal earthed. The switch unit is a NMOS transistor having its gate terminal connected with the negative terminal of the diode D2 and having its source terminal earthed. The NMOS transistor further has its drain terminal connected with a negative terminal of the current comparator via a resistor R3. The frequency converter comprises a capacitor Cquickstart having one terminal earthed and another terminal connected with the oscillator unit.

[0014] The control circuit shown in Fig. 3 can be actuated by a digital signal or a preheating time signal from the ballast control unit. When a high level signal is detected by the diode D2, the diode D2 is turned on and the timing capacitor C1 is charged up with a voltage for driving the turning-on of the NMOS transistor which serves as a switch in the circuit. When the NMOS transistor is turned on, the negative input terminal of the current comparator becomes a short-circuit , and a biased current is generated at the positive terminal of the current comparator because this positive terminal is subject to the action of a voltage Vset1 or a dimming circuit voltage signal Vdim. When the current level at the negative input terminal of the current comparator is zero, the circuit would work at its minimum working frequency where the frequency of the circuit is determined by the capacitor Cquickstart. When the period of time for rapidly reaching the normal brightness comes to end (time signal is zero), the NMOS transistor is turned off, and the voltage at the negative input terminal of the current comparator (corresponding to the voltage across the terminals of the Rlamp) would be adjusted to the voltage level at the positive input terminal of the current comparator, such that the circuit operates at its normal working frequency (at a normal current level) or at the frequency corresponding to the dimming level of the dimming fluorescent lamp.

[0015] While the invention has been described with reference to above preferred embodiments, it will be understood by those skilled in the art that various changes, additions or deletions may be made and equivalents may be substituted for elements thereof without departing from the scope of the invention and its claims, and all such alteration and/or modification shall fall into the scope of the present invention.

Claims

1. A control circuit for a fluorescent lamp comprising a ballast control unit (1) and an oscillator unit (2), **characterized in that**: the control circuit further comprises a signal detection unit (3), a switch unit (4) and a frequency converter (5); the signal detection unit (3) being arranged to output a signal to the switch unit (4) after receiving a light up signal from the ballast control unit (1), the switch unit (4) outputting a signal to the frequency converter (5) and the frequency converter (5) outputting a signal to the oscillator unit (2) and converting an oscillation frequency of the oscillator unit (2).

2. A control circuit for a fluorescent lamp according to claim 1, wherein the signal detection unit (3) comprises a diode (D1), a resistor (R1) and a first capacitor (Ctimer); the resistor (R1) and the first capacitor (Ctimer) are connected in parallel together and then connected with a negative terminal of the diode (D1), the diode (D1) having a positive terminal connected with the ballast control unit (1); the switch unit (4) is a NMOS transistor having its gate terminal connected with the negative terminal of the diode (D1) and having its source terminal earthed; the frequency converter (5) comprises a second capacitor (Cf) and a third capacitor (Cqst) which are connected in series together and in parallel between drain and source terminals of the NMOS transistor, and the oscillator unit (2) is connected with a point where the second capacitor (Cf) and the third capacitor (Cqst) are connected.

3. A control circuit for a fluorescent lamp according to

claim 1, wherein the oscillator unit (2) further comprises a current comparator, and the signal detection unit (3) comprises a diode (D2) and a first capacitor (C1); the diode (D2) has a positive terminal connected with the ballast control unit (1), and a negative terminal connected with the first capacitor (C1) which has another terminal earthed; the switch unit (4) is a NMOS transistor having its gate terminal connected with the negative terminal of the diode (D2) and having its source terminal earthed, while a drain terminal of the NMOS transistor is connected with a negative terminal of the current comparator via a resistor (R3); the frequency converter comprises a second capacitor (Cquickstart) having one terminal earthed and another terminal connected with the oscillator unit (2).

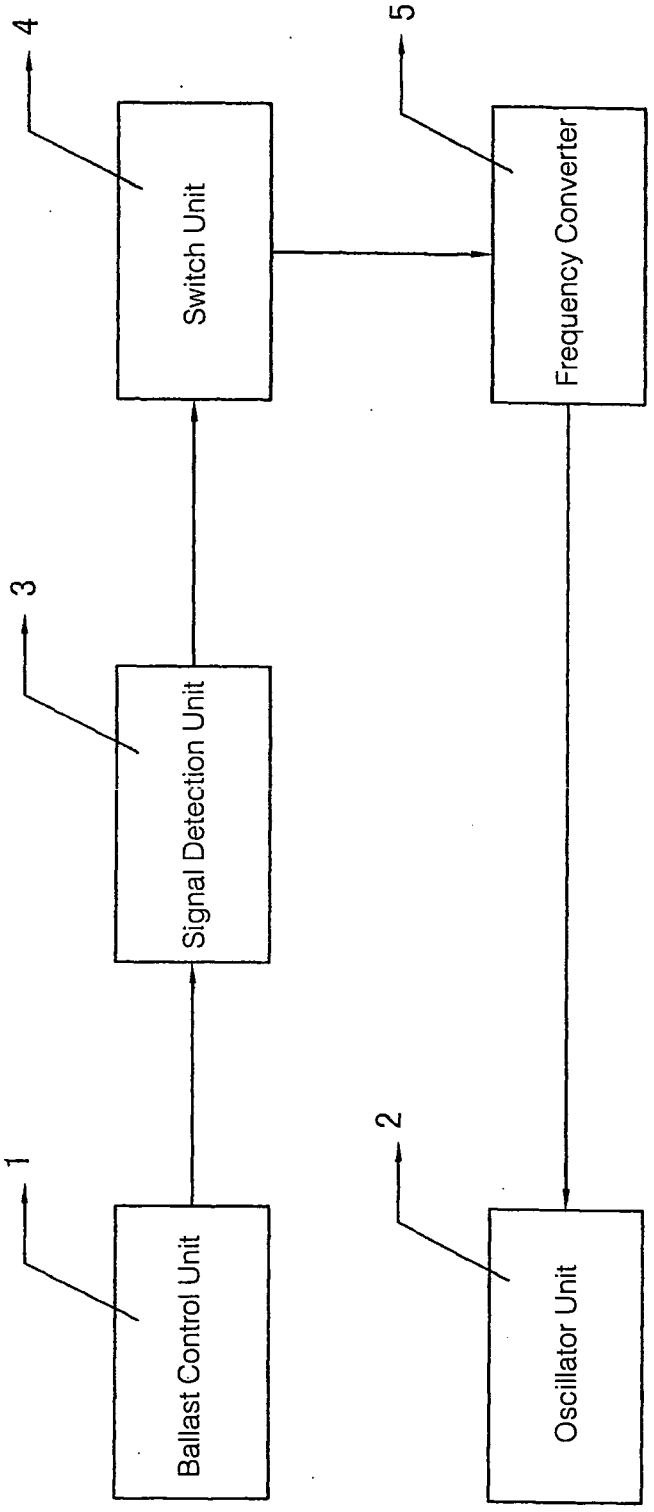
4
Switch Unit
5
Frequency Converter
3
Signal Detection Unit
1
Ballast Control Unit
2
Oscillator Unit

Fig. 1

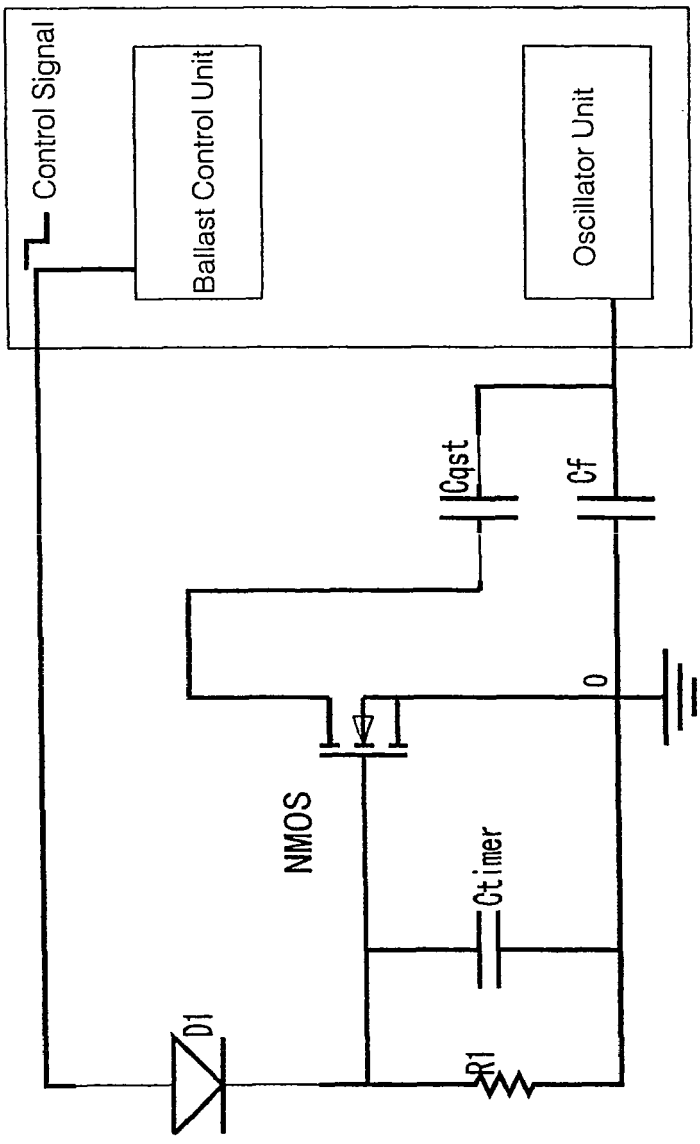
Control Signal
Ballast Control Unit
Oscillator Unit
Cgst
Cf
0
NMOS
Ctimer
D1
R1

Fig. 2

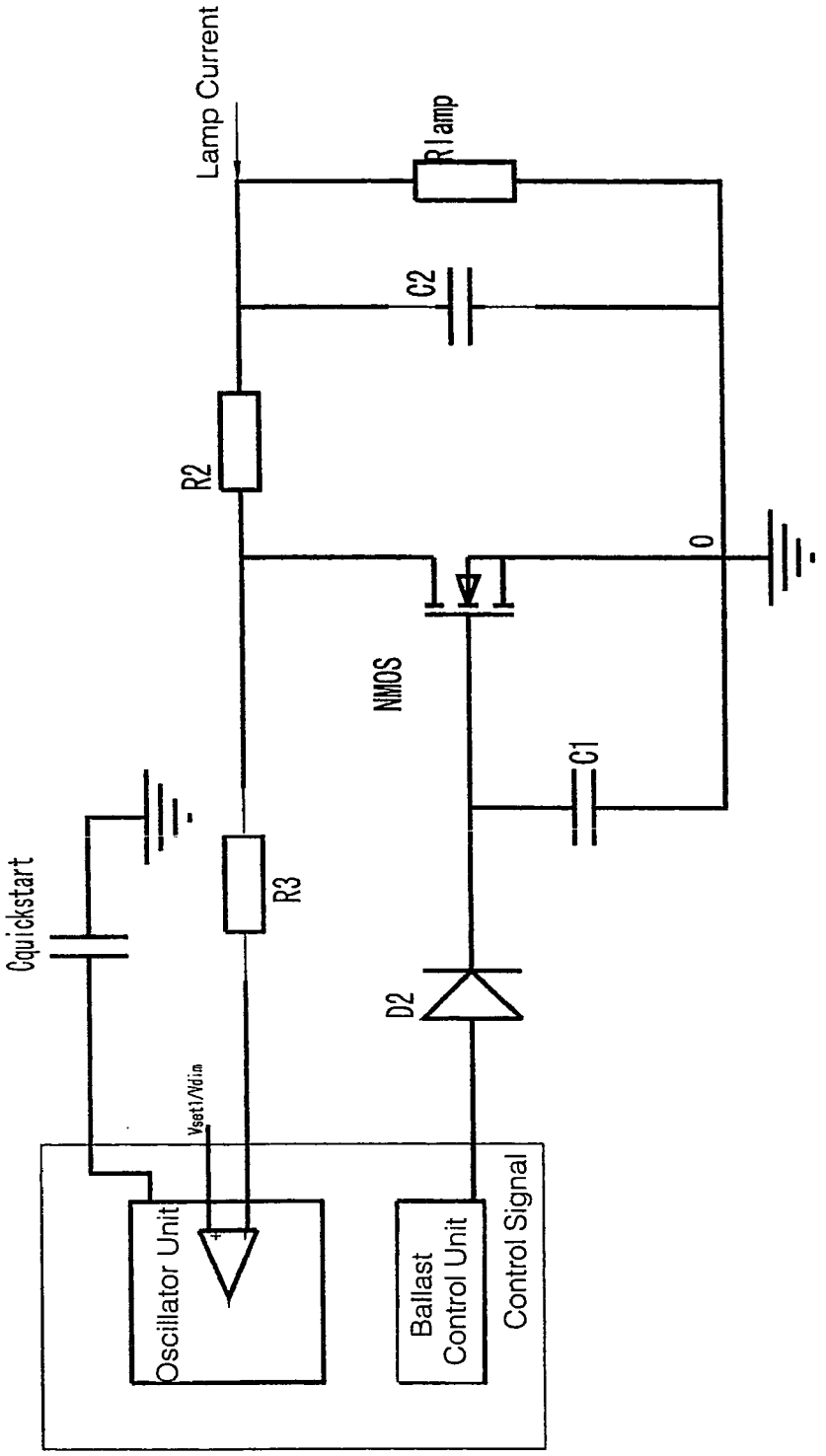
Lamp Current
Rlamp
C2
R2
0
NMOS
C1
R3
Cquickstart
D2
Vset1/Vdim
Oscillator Unit
Ballast Control Unit
Control Signal

Fig. 3