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(54) **Resistive circuit for an electronic dimmer device**

(57) Resistive circuit for an electronic dimmer device (2) equipped with a power semiconductor, which circuit (1) contains a resistive load (3) connected to the dimmer device (2) as an auxiliary load or built in in the dimmer device, characterized in that it contains detection means (6) to detect the moment when the power

semiconductor of the dimmer device (2) is connected and switching means (4 and 5) to switch on the resistive load (3) for a restricted length of time (T) when said detection means (6) detect that the power semiconductor is connected.

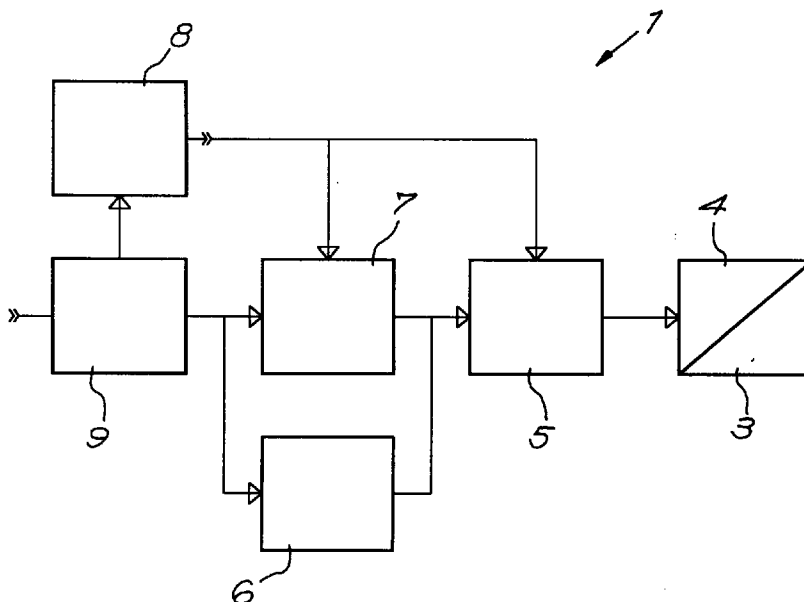


Fig. 1

EP 0 914 026 A1

Description

[0001] The present invention concerns a resistive circuit for an electronic dimmer device equipped with a power semiconductor, which circuit contains a resistive load connected to the dimmer device as an auxiliary load or built in in the dimmer device.

[0002] Such circuits are used in electronic dimmer devices with a power semiconductor to avoid functional problems which might occur in some cases.

[0003] One of the problems with dimmer devices equipped with a power semiconductor is among others an insufficient holding current in the case of certain load types such as inductive loads, for example motors or wound transformers, loads which are lower than the prescribed load or also electronic chokes with an inductive character such as fluorescent ballasts.

[0004] The known resistive circuits for resolving the above-mentioned problems contain an either or not external resistance, continuously connected in series with the dimmer.

[0005] Since, however, a resistance causes a loss of energy and particularly a heating up, it is clear that said resistance which is continuously connected as a load in front of the dimmer device results in a relatively large loss of energy and a relatively large heating up.

[0006] Due to the heating up, the use of said resistance may entail a fire risk. Moreover, said resistance is applied loosely in some cases, which is not always safe.

[0007] The present invention aims a resistive circuit for an electronic dimmer device which does not have the above-mentioned and other disadvantages and which avoids problems with an insufficient holding current, whereas the loss of energy and the heat production remain restricted, so that the whole is safe.

[0008] This aim is reached according to the invention in that the circuit contains detection means to detect the moment when the power semiconductor of the dimmer device is connected and switching means to switch on the resistive load for a restricted length of time, for example for 1.5 ms, when said detection means detect that the power semiconductor is connected.

[0009] With such a resistive circuit replacing the above-mentioned continuously connected resistance, the resistive load will not be continuously connected, but only when this is required to maintain the holding current at a sufficiently high level.

[0010] The circuit may also contain a voltage detector to detect when the input voltage over the circuit is situated beneath a certain threshold value, for example a threshold value between 80 and 120 V, or reaches this threshold value, and switching means to switch on the resistive load when the input voltage of the circuit is situated beneath the above-mentioned threshold value and to keep it switched on at least until the input voltage reaches this threshold value, preferably for a certain length of time, for example 1.5 ms, after said threshold value has been reached, even though the above-men-

tioned length of time has already elapsed after the detection means have detected that the power semiconductor has been connected.

[0011] The present embodiment also prevents the undesired starting of the oscillator of an electronic transformer by the leakage current, caused by the anti-interference capacitor of the dimmer device, which problem was normally also solved by the above-mentioned known and thus continuously operating resistance with said disadvantages.

[0012] The switching means onto which the detection means and the voltage detector are connected can be common switching means.

[0013] The switching means preferably contain a circuit element, for example a transistor, which is connected in series to the resistive load, and a control consisting for example of a monostable multivibrator, onto which the circuit element is connected.

[0014] In order to better explain the characteristics of the invention, the following preferred embodiment of a resistive circuit for an electronic dimmer device according to the invention is described as an example only without being limitative in any way, with reference to the accompanying drawings, in which:

figure 1 represents a block diagram of a resistive circuit according to the invention;

figure 2 represents an electrical circuit diagram of the circuit of figure 1 into more detail;

figure 3 schematically represents how the resistive circuit of the preceding figures is connected to a dimmer device onto which a load is applied.

[0015] The resistive circuit 1 represented in figure 1 is designed to be connected in parallel with a load, as is represented for example in figure 3, to an electronic dimmer device 2 which may be of a known design, with a power semiconductor which may for example be a transistor or a thyristor, in particular a triac.

[0016] This resistive circuit 1 mainly consists of a resistive load 3 which can be switched on and off by a circuit element 4, of a control of said circuit element 4 consisting of a monostable multivibrator 5 and which is connected to detection means consisting of a differentiator 6 on the one hand, and to a voltage detector 7 on the other hand, and of a direct-current power supply 8 which is connected to a rectifier 9.

[0017] The rectifier 9 is connected to an alternating-current power supply and is required since the circuit element 4 and thus also the monostable multivibrator 5 operate on direct current. The direct-current power supply 8 provides for the power supply of the monostable multivibrator 5 and the voltage detector 7.

[0018] The differentiator 6 forms detection means to detect the switching moment of the power semiconductor of the dimmer device 2 and emits a signal on the monostable multivibrator 5 as soon as this is detected.

[0019] The voltage detector 7 will react when the input

voltage of the resistive circuit 1 is situated beneath a certain threshold value P situated between 90 and 110 V and which preferably amounts to 100 V until said threshold value P is reached.

[0020] The monostable multivibrator 5 forms common switching means to put the circuit element 4 in its switch position, i.e. the position in which the resistive load 3 is switched on, either after the connection of the power semiconductor of the dimmer device 2 has been detected by the differentiator 6, or when the voltage detector 7 detects an input voltage which is situated beneath the above-mentioned threshold value P, and in order to bring the circuit element 4 out of said switch position again, a certain length of time T which in the given example amounts to 1.5 ms, after the connection of the power semiconductor has been detected, unless the voltage detector 7 detects an input voltage situated underneath the above-mentioned threshold value P, or after the voltage detector 7 has detected that the input voltage has reached the threshold value P respectively.

[0021] The direct-current power supply 8 is connected to the rectifier 9 and feeds the voltage detector 7 and the monostable multivibrator 5.

[0022] The working of the above-described resistive circuit 1 is as follows:

[0023] When the dimmer device 2 is switched on, also the resistive circuit 1 connected onto it will be switched on.

[0024] As soon as the differentiator 6 detects that the power semiconductor of the dimmer device 2 is connected, it will transmit a signal to the monostable multivibrator 5 which is connected as a result thereof and changes the position of the circuit element 4, such that the resistive load 3 will be connected in parallel with the load onto which the dimmer device 2 is connected for a length of time T, and will also keep it in the switch position during said length of time T to prevent the power semiconductor to be reversed due to a retardation of current or an induced current.

[0025] The voltage detector 7 detects when the input voltage over the resistive circuit 1 has reached the threshold value P and connects the monostable multivibrator 5 when said input voltage is situated under the threshold value P, as a result of which the latter puts the circuit element 4 in its switch position and the resistive load 3 is connected.

[0026] The voltage detector 7 will not keep the monostable multivibrator 5 connected any longer when the input voltage has reached the threshold value P, but the monostable multivibrator 5 will retain the circuit element 4 in its switch position for the above-mentioned length of time T.

[0027] As a result, the leakage current in electronic transformers or electronic chokes will be reduced.

[0028] The differentiator 6 and the voltage detector 7 operate simultaneously, which has for a result that, in the case when the length of time T has elapsed after the differentiator 6 has detected that the power semicon-

ductor has started, and the voltage detector 7 detects that the input voltage is still situated beneath the threshold value P, the monostable multivibrator 5 will not bring the circuit element 4 out of its switch position, but it will wait to do so until the length of time T has elapsed after the threshold value P has been reached.

[0029] Thus, the resistive load 3 is only switched on when necessary and it is switched out as soon as it is no longer required, so that the loss over this load 3 is restricted to a minimum.

[0030] Also the heating up is restricted to a minimum; and the resistive circuit can even be provided in one and the same housing together with the dimmer device or it can be cast as a whole.

[0031] Figure 2 represents an electrical circuit diagram of a practical embodiment of the resistive circuit 1.

[0032] The resistive load 3 is a resistance and the circuit element 4 is a transistor, for example a MOSFET.

[0033] The rectifier 9 is a conventional rectifier with diodes whose input is connected to an alternating-current source of 230 V and of which one output pole is connected to the mass, whereas the other is connected to a positive direct current of 230 V.

[0034] The differentiator 6 which is connected between the outputs of the rectifier 9 consists of a series connection with a capacity 10 and two resistances 11 and 12.

[0035] The voltage detector 7 contains a transistor 13 whose base is connected to a positive pole of the rectifier 9 via a resistance 14, whose emitter is connected to the direct-current power supply 8 and whose collector is connected to the output of the differentiator 6 via a resistance 15 and a diode 16. Further, the voltage detector 7 contains another resistance 17 and a diode 18 between the mass and the direct-current power supply 8.

[0036] The above-mentioned output of the differentiator 6 is also connected to the base of the transistor 19 which is part of the monostable multivibrator 5. Between this base and the mass is connected a zener diode 20. The emitter of the transistor 19 is connected to the transistor forming the circuit element 4 and it is connected to the mass over a condenser 21 and over a resistance 22. The collector of the transistor 19 is connected to the direct-current power supply 8 via a resistance 23.

[0037] When the monostable multivibrator 5 is switched on, said condenser 21 will be charged, and when the differentiator 6 and the voltage detector 7 do no longer keep said monostable multivibrator 5 switched on, the condenser 21 will be discharged and it will keep the circuit element 4 further closed for the above-mentioned length of time T.

[0038] The direct-current power supply 8 contains two condensers 24 and 25, a resistance 26 which limits the current, a diode 27 which only lets the voltage through in the direction of the monostable multivibrator 5 and the voltage detector 7, and a zener diode 28 which brings the voltage to for example 10 V.

[0039] Figure 3 shows how the above-described resistive circuit 1 can be used in practice.

[0040] This figure represents a circuit with a low-voltage halogen lamp 29 which is fed over a transformer 30 which is connected to a dimmer device 2.

[0041] The resistive circuit 1 is connected in parallel to the transformer 30 on its primary side.

[0042] The present invention is by no means restricted to the above-described embodiments represented in the accompanying drawings; on the contrary, such a resistive circuit or dimmer device can be made in all sorts of embodiments while still remaining within the scope of the invention.

Claims

1. Resistive circuit for an electronic dimmer device (2) equipped with a power semiconductor, which circuit (1) contains a resistive load (3) connected to the dimmer device (2) as an auxiliary load or built in in the dimmer device, characterized in that it contains detection means (6) to detect the moment when the power semiconductor of the dimmer device (2) is connected and switching means (4 and 5) to switch on the resistive load (3) for a restricted length of time (T) when said detection means (6) detect that the power semiconductor is connected.
2. Resistive circuit according to claim 1, characterized in that the restricted length of time (T) during which switching means (4 and 5) switch on the resistive load (3) amounts to 1.5 ms.
3. Resistive circuit according to any of the preceding claims, characterized in that the detection means to detect the moment when the power semiconductor of the dimmer device (2) is connected consist of a differentiator (6).
4. Resistive circuit according to any of the preceding claims, characterized in that it also contains a voltage detector (7) to detect when the input voltage over the circuit (1) is situated beneath a certain threshold value (P) or reaches this threshold value (P), and switching means (4 and 5) to switch on the resistive load (3) when the input voltage of the circuit is situated beneath the above-mentioned threshold value (P) and to keep it switched on at least until the input voltage has reached this threshold value (P), even though the above-mentioned length of time (T) has already elapsed after the detection means (6) have detected that the power semiconductor has been connected.
5. Resistive circuit according to claim 4, characterized in that the switching means (4 and 5) are means to switch on the resistive load (3) when the input voltage is situated beneath a certain threshold value (P) and to keep it switched on for a certain length of time (T), for example 1.5 ms, after the input voltage has reached this threshold value (P).
6. Resistive circuit according to claim 5, characterized in that the threshold value (P) is situated between 80 and 120 volt and preferably amounts to 100 volt.
7. Resistive circuit according to any of claims 4 to 6, characterized in that the switching means (4 and 5) onto which the detection means and the voltage detector (7) are connected are common.
8. Resistive circuit according to any of the preceding claims, characterized in that the switching means (4 and 5) for switching the resistive load (3) on and off contain a circuit element (4) which is connected in series to the resistive load (3) and a control onto which the circuit element (4) is connected.
9. Resistive circuit according to claim 8, characterized in that the control of the circuit element (4) consists of a monostable multivibrator (5).
10. Resistive circuit according to claims 7 and 9, characterized in that the detection means (6) and the voltage detector (7) are connected to one and the same monostable vibrator (5) which controls a circuit element (4) in series with the resistive load (3).
11. Resistive circuit according to claims 8 to 10, characterized in that the circuit element (4) is a transistor and in that the resistive circuit (1) contains a rectifier (9).

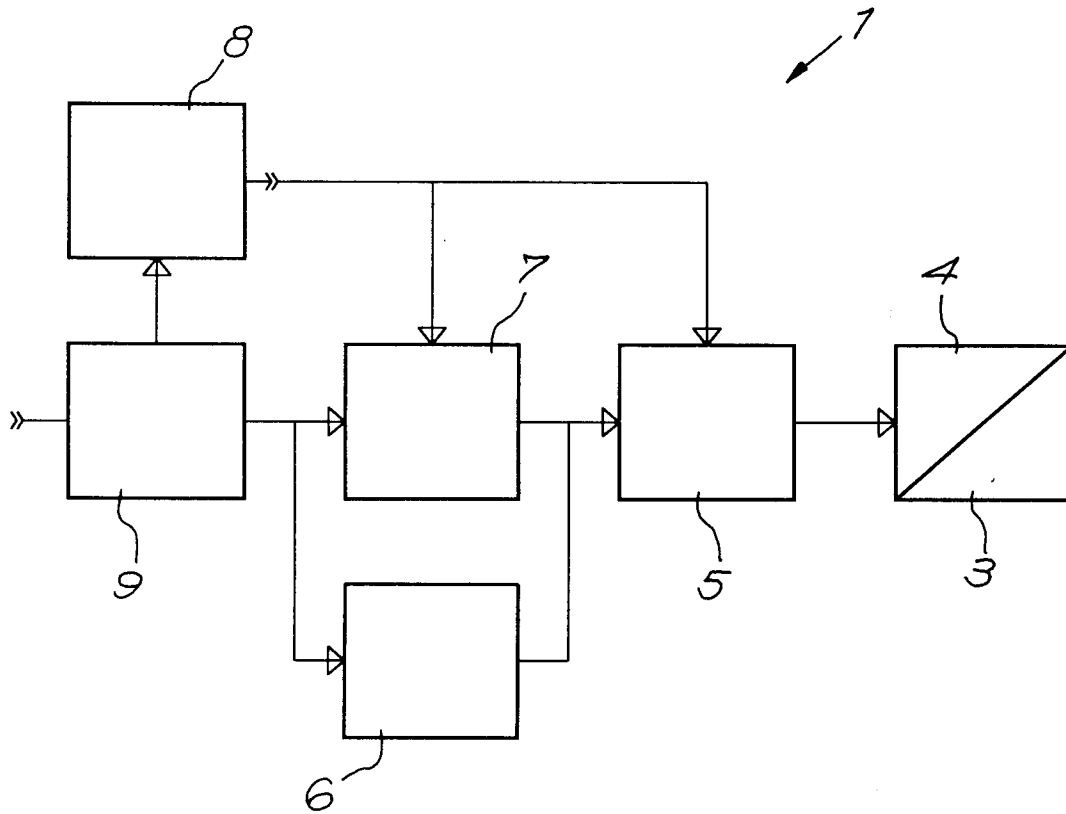


Fig. 1

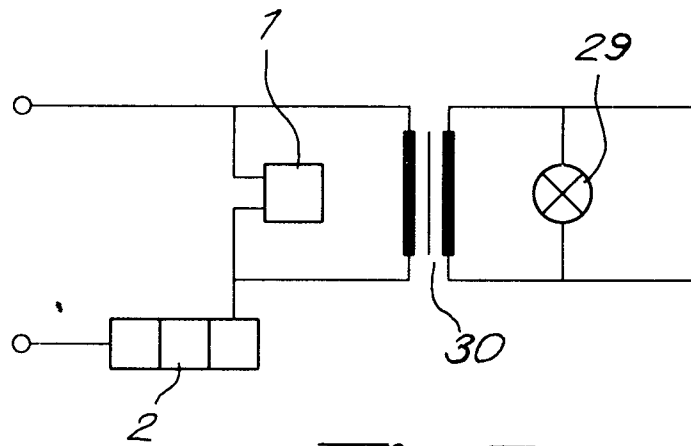


Fig. 3

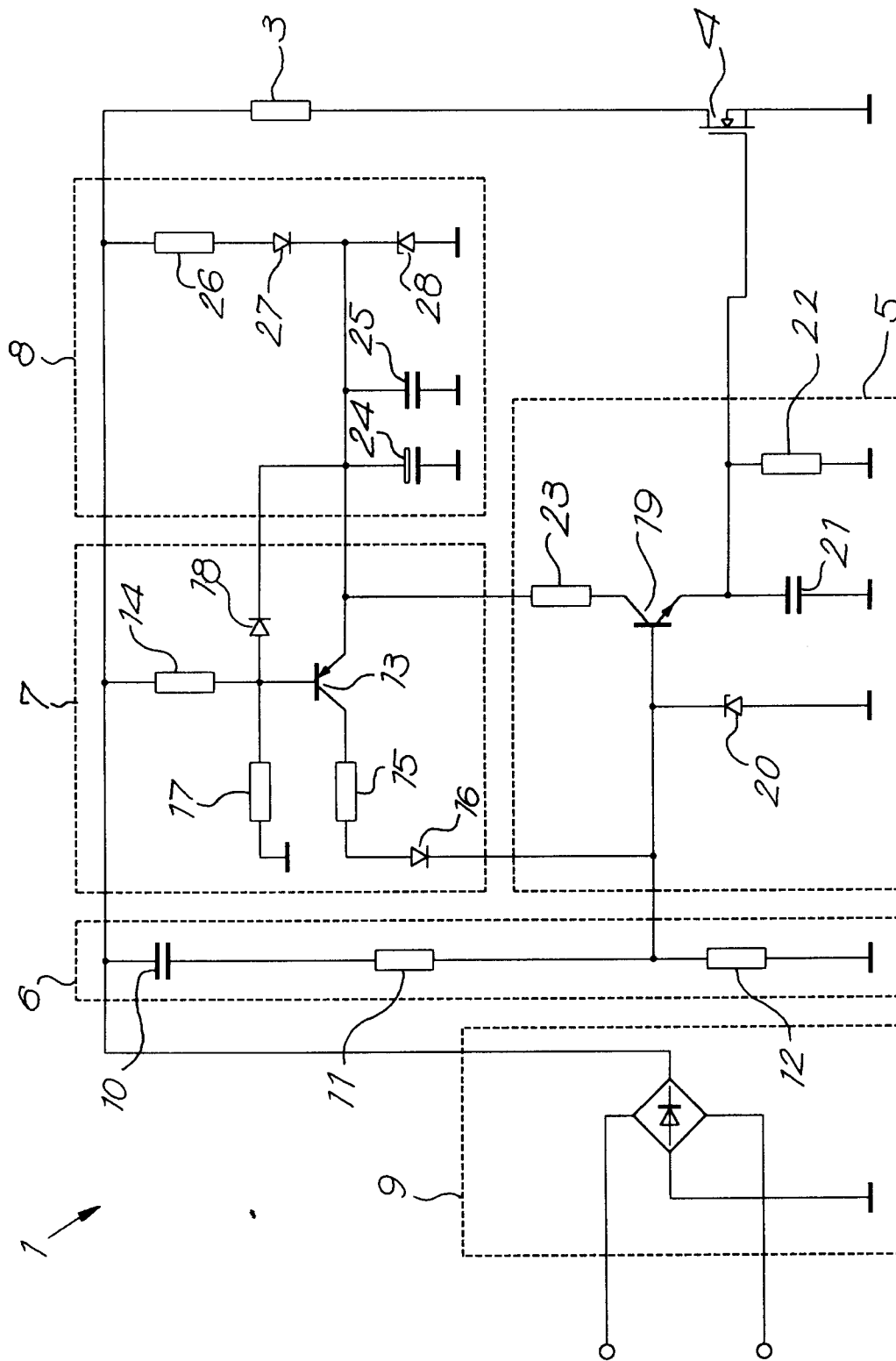


Fig. 2



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EUROPEAN SEARCH REPORT

Application Number
EP 98 20 3277

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
A	EP 0 140 851 A (KRAFTELEKTRONIK AB) 8 May 1985 * page 2, line 24 - page 3, line 34; figures 1,2 *	1	H05B39/08 H02M5/257
A	GB 2 228 151 A (LUTRON ELECTRONICS CO) 15 August 1990 * page 7, line 9 - page 11, line 22; figures 2,4 *	1	
A	DE 40 26 350 A (ROBO MECHANIK R BORISS GMBH EL) 27 February 1992 * column 2, line 36 - column 2, line 62; figure 1 *	1	
A	"HALOGEN LIGHT DIMMER" ELEKTOR ELECTRONICS, vol. 20, no. 221, 1 April 1994, pages 5-7, XP000440260 * page 6, left-hand column, line 1 - page 6, right-hand column, line 9; figure 1 *	1	
			TECHNICAL FIELDS SEARCHED (Int.Cl.6)
			H05B H02M
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 13 January 1999	Examiner Speiser, P
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EP 98 20 3277

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