(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 1 133 215 A2

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
12.09.2001 Bulletin 2001/37

(51) Int Cl.[7]: **H05B 41/04**

(21) Application number: **01660040.5**

(22) Date of filing: **02.03.2001**

(84) Designated Contracting States:
AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU MC NL PT SE TR
Designated Extension States:
AL LT LV MK RO SI

(30) Priority: **06.03.2000 FI 20000505**

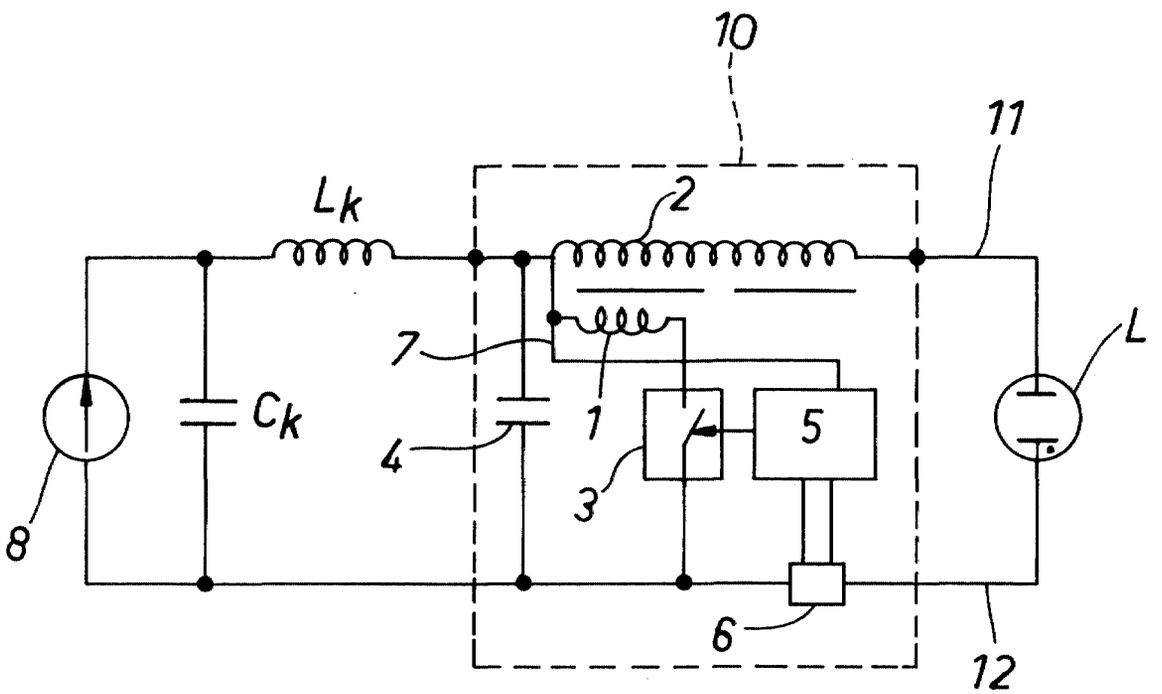
(71) Applicant: **Helvar Oy Ab**
00380 Helsinki (FI)

(72) Inventors:
- **Viljanen, Teijo**
  02700 Kauniainen (FI)
- **Luomala, Jukka**
  01260 Vantaa (FI)

(74) Representative: **LEITZINGER OY**
Ruoholahdenkatu 8
00180 Helsinki (FI)

(54) Method and ignition circuit for switching a high pressure lamp on and off

(57) The invention relates to a method and an ignition circuit for switching a high pressure lamp on and off. A load circuit is capable of being short-circuited by means of a switch (3), which is connected in series with a primary winding (1) of a pulse transformer (1, 2) and whose on-off control is also used for generating ignition voltage pulses through a secondary winding (2) to a lamp (L). Upon a controlled closing of the switch (3) conductively for an extended period of time, a current ballast (Lk) will be subjected to a through-going short-circuit current for the load circuit and the lamp voltage falls to such a low level that the lamp is turned off. This lamp turn-off function can be used both for switching off a normally burning lamp and for terminating an abnormal status of gas discharge of a lamp not ignited between ignition attempts, in order to give the lamp a chance to cool down prior to another ignition attempt.



EP 1 133 215 A2

Description

[0001] The invention relates to a method for switching a high pressure lamp on and off with an ignition circuit, comprising

- a pulse transformer, which has its secondary winding subjected to a through-going lamp current and which is connected in series with a current ballast,
- a switch in series with the pulse transformer's primary winding,
- a pulse capacitor, which is connected in parallel with a series connection established by the switch and the primary winding, and
- an intelligent control device for a controlled opening and closing of the switch, the controlled closing of the switch developing ignition voltage pulses in the secondary winding as the capacitor's charge is able to oscillate in an oscillating circuit established by the capacitor and the primary winding.

[0002] The invention relates also to an ignition circuit for carrying out the method.

[0003] High pressure lamps, such as high-pressure sodium and metal halide lamps, must be switched on with voltage pulses substantially higher than mains voltage, typically within the voltage range of 1,0 kV - 5 kV. High pressure lamps are most commonly used in street lighting and indoors in industrial buildings.

[0004] A problem in switching on some high pressure lamps is that the extinguished hot lamp does not ignite sufficiently fast but remains in an abnormal status of gas discharge, in which the lamp cannot be switched on with normal ignition pulses unless it is allowed to cool in the meantime. This is a common occurrence, e.g. when re-ignition of a lamp still excessively hot is attempted with normal ignition pulses. The problem can be avoided by spacing ignition attempts in an effort to reduce the amount of heat generated by ignition attempts. For example, it is possible to use a timer for controlling ignition attempts to repeat the same e.g. for 5 seconds only, followed by a pause of e.g. 1 minute for the lamp to cool down. This type of timer-controlled ignition has been described e.g. in published applications WO 97/08920 and WO 97/08921. These prior known ignition circuits do not function as an active extinguisher for a lamp or its status of gas discharge.

[0005] It is an object of the invention to provide an improved ignition circuit, capable of effecting not only the effective and quick-action ignition of a lamp but also the extinction of the same or its status of gas discharge.

[0006] This object of the invention is achieved by means of a method set forth in the appended claim 1 and an ignition circuit set forth in claim 7. The non-independent method claims disclose preferred embodiments of the invention.

[0007] The invention will now be described in more detail with reference made to the accompanying drawing, which shows an ignition circuit for a discharge lamp in one embodiment.

[0008] A power source 8 comprises a mains-frequency alternating current, which is connected over load circuit lines 11, 12 to a lamp L. The lamp current is restricted by means of a ballast Lk. The ballast Lk has its inductive load compensated for by a capacitor Ck.

[0009] An ignition circuit 10 comprises a pulse transformer, the lamp current passing through its secondary winding 2. Thus, the secondary winding 2 is connected in series with the ballast Lk. A switch 3 is connected in series with a primary winding 1 of the pulse transformer, and a pulse capacitor 4 is connected in parallel with the series connection established by the switch 3 and the primary winding 1. The controlled opening and closing of the switch 3 is effected by means of a control device 5, e.g. a microprocessor.

[0010] A controlled closing of the switch 3 develops ignition voltage pulses in the secondary winding 2 as the charge of the capacitor 4 oscillates in an oscillating circuit established by the capacitor 4 and the primary winding 1. The controlled closing cycles of the switch 3 for ignition pulses are short compared e.g. to the half-cycle of mains power. The duration of a single ignition pulse can be e.g. two micro-seconds, and a multitude of ignition pulses develop during a single half-cycle. The pulse transformer 1, 2 may have a ratio of revolutions which is e.g. 5/80.

[0011] The secondary winding 2 and the primary winding 1 of a pulse transformer associated with the load current line 11 have confluent ends thereof connected to the second load current line 12 by way of the capacitor 4. The primary winding 1 has its free end also connected to the second load current line 12 by way of the switch 3. The microprocessor 5 is coupled to receive a control message from a lamp current measuring element 6 and/or a load circuit voltage measurement 7. The cited measuring sites 6 and 7 are but examples, and the location thereof may vary relative to the lamp L and the pulse transformer 2. The current measuring element 6 may be e.g. a shunt resistance (a strip of foil), a current transformer or a Hall element.

[0012] This circuitry makes it possible that, with a controlled closing of the switch 3 conductively for an extended period of time (1-2 seconds), the ballast Lk will be subjected to a through-going short-circuit current for the load circuit, whereby the lamp voltage falls to such a low level that the lamp L is turned off. This turn-off function can happen both to a normally burning lamp and to a lamp left in an abnormal state of gas discharge at a failed ignition attempt, whereby the lamp does not remain in the state of gas discharge but goes out, and ignition attempts can be repeated more quickly.

[0013] It is known that a failed lamp often results in a partial rectifying effect. The inventive ignition circuit is used for monitoring the DC component of a lamp current by means of the lamp-current measuring device 6 and/or the lamp voltage measurement 7. The DC component

is visible across the capacitor 4 as the voltage measurement is performed in front of the pulse transformer winding 2. The level of the DC component is discovered by simultaneously sensing the current passing in the winding 2. As an option to the current measurement 6, it is also possible to arrange a current measurement in connection with the pulse transformer winding 2. If the current's DC component grows to an excessive level, the lamp is extinguished by short-circuiting the ballast Lk with the switch 3 and ignition of the lamp L is halted until the circuit 10 is reset (after replacement of a faulty lamp).

[0014] When extinguishing a lamp by means of the current measurement 6 and/or the voltage measurement 7, the control device 5 effects a controlled opening of the switch 3 during a zero current after the load circuit has been short circuited for 1-2 seconds for turning off the lamp L or for extinguishing its abnormal status of gas discharge for the lamp to cool down.

[0015] The extinguishing status is terminated by opening the switch during a zero circuit in order to avoid extra voltage peaks in the circuitry.

[0016] An intelligent control device constituted by the microprocessor 5 can also be exploited in a manner which is novel in this type of igniters. The intelligent control device 5 can be programmed to collect in its memory status data for a lamp (history log) and to transmit its status data to a receiver as requested. Transmission can be effected e.g. over a twin wire or by an infrared or radio signal.

Claims

1. A method for switching a high pressure lamp on and off with an ignition circuit (10), comprising

   - a pulse transformer, which has its secondary winding (2) subjected to a through-going lamp current and which is connected in series with a current ballast (Lk),
   - a switch (3) in series with the pulse transformer's primary winding (1),
   - a pulse capacitor (4), which is connected in parallel with a series connection established by the switch (3) and the primary winding (1), and
   - a control device (5) for a controlled opening and closing of the switch (3), the reversal in a status of the switch (3) developing ignition voltage pulses in the secondary winding (2) as the capacitor's (4) charge is able to oscillate in an oscillating circuit established by the capacitor (4) and the primary winding (1), **characterized in that** a controlled closing of the switch (3) conductively is effected whenever necessary for an extended period of time in such a way that the ballast (Lk) is subjected to a through-going short-circuit current for the load circuit and the lamp voltage falls to such a low level that the lamp (L) is turned off.

2. A method as set forth in claim 1, **characterized in that** the delivery of ignition pulses is continued for a predetermined time by using the active control of the intelligent control device (5) for a controlled alternating closing and opening of the switch (3), that the ignition of a lamp is sensed by the intelligent control device (5) for the switch (3), and that the abnormal status of gas discharge of a lamp not ignited after said predetermined time is terminated by means of said controlled extended closure of the switch (3).

3. A method as set forth in claim 1 or 2, **characterized in that**, in the process of turning off the lamp, a controlled closing of the switch (3) is effected at such a lamp current phase angle at which the peak current of a transient caused in the lamp current by the controlled closing is as low as possible.

4. A method as set forth in any of claims 1-3, **characterized in that**, in the process of turning off the lamp, the switch (3) is opened at such a lamp current phase angle at which the opening of the switch (3) causes a voltage peak as low as possible in the lamp (L) through the secondary winding (2) of a pulse transformer.

5. A method as set forth in any of claims 1-4, **characterized in that** the switch (3) is controlled by way of such a control circuit (5, 6, 7) which identifies a rectifying effect in the discharge lamp (L) by means of a lamp current and/or a lamp voltage.

6. A method as set forth in any of claims 1-5, **characterized in that** the discharge lamp (L) capable of being switched on and off under control of the switch (3) comprises a metal halide lamp.

7. An ignition circuit for switching a high pressure lamp on and off with an ignition circuit, said ignition circuit comprising

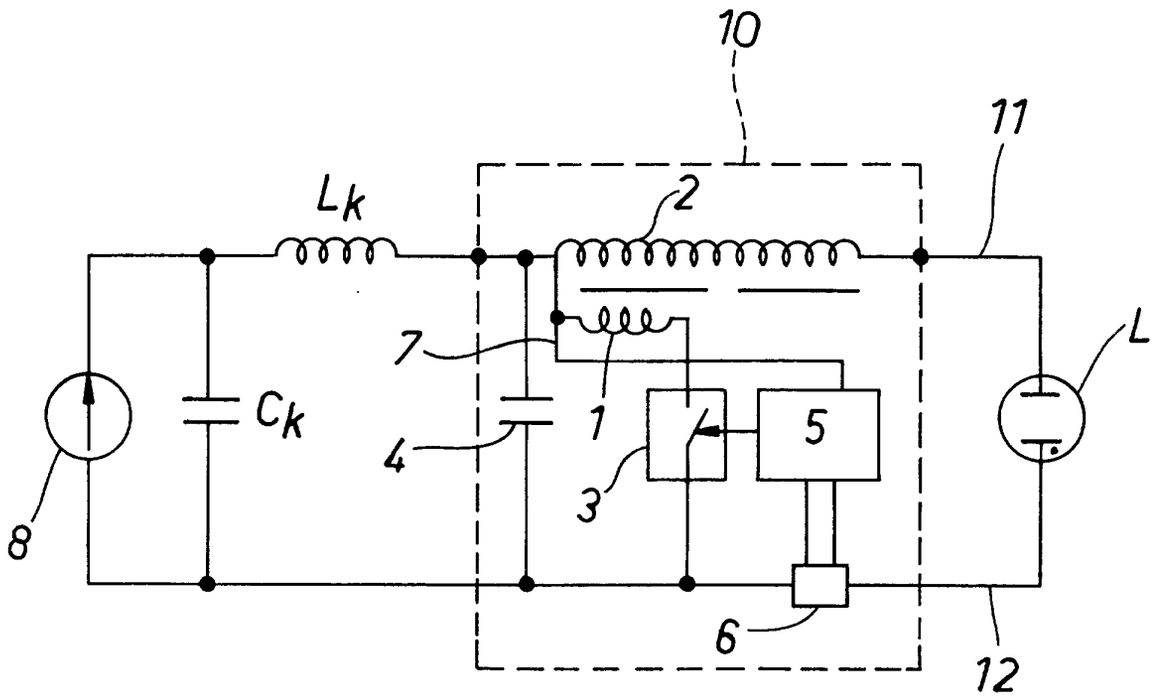
   - a pulse transformer, which has its secondary winding (2) subjected to a through-going lamp current and which is connected in series with a current ballast (Lk),
   - a switch (3) in series with the pulse transformer's primary winding (1),
   - a pulse capacitor (4), which is connected in parallel with a series connection established by the switch (3) and the primary winding (1),
   - an intelligent control device (5) for a controlled opening and closing of the switch (3), and
   - a first and second load circuit line (11, 12), between which the lamp (L) is connectable,

the controlled closing of the switch (3) developing ignition voltage pulses in the secondary winding (2) as the capacitor's (4) charge is able to oscillate in an oscillating circuit established by the capacitor (4) and the primary winding (1), **characterized in that** the secondary winding (2) and the primary winding (1) of a pulse transformer associated with the load current line (11) have confluent ends thereof connected to the second load current line (12) by way of the capacitor (4), that the primary winding (1) has its free end also connected to the second load current line (12) by way of said switch (3), and that the intelligent control device (5) for the switch (3) comprises a microprocessor, which receives a control message from a lamp current and/or lamp voltage measuring element (6, 7) and which is programmed, on the basis of said control message, to provide the switch (3) with a controlled closing period which is sufficiently long for turning off the lamp.

8. An ignition circuit as set forth in claim 7, **characterized in that** the controlled closing cycles of the switch (3) for ignition pulses are shorter than half-cycles of mains power and for a lamp switch-off period longer than a single mains cycle, preferably in the order of 1-2 seconds, and that, in the process of turning off the lamp, the controlled opening of the switch (3) is effected as the lamp current has its instantaneous value preferably at zero.

9. An ignition circuit as set forth in claim 7 or 8 or an ignition circuit capable of implementing a method as set forth in any of claims 1-6, **characterized in that** the intelligent control device (5) is programmed to collect in its memory status data about a lamp.

10. An ignition circuit as set forth in claim 9, **characterized in that** the intelligent control device (5) transmits its status data to a receiver as requested.


10
11
L_k
2
7
1
L
C_k
4
5
3
8
6
12