

Description

This invention relates to electronic ballast systems for gas discharge tubes.

Ballast systems for gas discharge tubes and fluorescent lightbulbs are known, and include ballast systems for multiple fluorescent lightbulbs as well as single fluorescent lightbulbs. However, many prior art electronic ballast systems require a relatively large number of components and this has led to ballast systems having relatively large volumes. These large volumes are due in part to the number of electrical components contained within the circuit, but also to the need for additional components to dissipate the heat generated by the electrical components.

Other types of ballast systems are known which operate at relatively low frequencies but these have very low operating efficiencies.

The present invention seeks to provide electronic ballast systems for fluorescent light sources which are highly efficient in transforming electrical energy into electromagnetic energy in the visible bandwidth of the electromagnetic spectrum and which require a minimum of electrical components thereby to minimize heat output and permit installation of the ballast system in confined spaces. Other objects and advantages of the system provided in accordance with this invention will become apparent as the description proceeds.

In accordance with this invention there is provided an electronic ballast system for lighting systems comprising a gas discharge tube having a first and second filament, wherein the ballast system comprises.

(a) a first capacitor connectable to one electrode of the first filament of said gas discharge tube,

(b) a transistor, the collector of which is connected to the first capacitor on the side remote from said first filament,

(c) a transformer having a primary winding connected at one end to the junction of said transistor and said first capacitor and connectable at its other end to a source of pulsed d.c., and having a secondary winding the ends of which are respectively connected to the base and the emitter of said transistor thereby to form a positive feedback bath around the transistor, and

(d) means for generating and applying a pulse voltage to the second filament of said gas discharge tube, comprising a second capacitor connected in series connection between the secondary winding and one electrode of said second filament, the second electrode of said second filament being connected to the emitter of the transistor thereby closing the positive feedback loop.

The invention will be further described with reference to the accompanying drawing which is a circuit diagram of an electronic ballast system according to the invention for use with a single gas discharge tube.

Referring to the drawing there is shown an electronic ballast system 10 according to the

invention for operation of a single gas discharge tube 12, which is a standard fluorescent tube. As will be detailed, gas discharge tube 12 is an integral part of the circuitry associated with the electronic ballast system 10. System 10 operates at an extremely high frequency when taken with respect to prior art fluorescent lighting systems. Such prior art fluorescent lighting systems operate at approximately twice the line frequency, or approximately 120 cycles. The present electronic ballast system 10 however operates at approximately 20,000 cycles which provides the advantage of minimizing any type of flicker effect. Further, with the high frequency of operation, the average light output of gas discharge tube 12 is substantially greater than that provided by prior art fluorescent lighting systems for a particular power source output. Further, as will be seen in following paragraphs, the duty cycle of system 10 is minimized and thus, reliability is increased when taken with respect to the electronic components contained therein. Further, with a low duty cycle as provided in the present electronic ballast system 10, temperature gradients and temperature increases of the electronic components are minimized when taken with respect to prior art ballast systems. The minimization of temperature effects increases the overall reliability of ballast system 10 in that overheating problems are minimized.

In the drawing power source 14 is electrically coupled to switch W through power source output line 18. The AC power source 14 may be a standard 120N 200 volt AC power source such as found in most residential power systems, although other sources may be used. The parameters given hereinafter assume a 120 volt AC supply. Switch W is a standard off/on type switch, used merely for closing the overall circuit and coupling electrical line 16 to line 18 when closed. Diode input line 16 is connected to the anode side of diode D₁, which may conveniently be the diode commercially available under the designation 1N4004. Diode D₁ functions as a conventional half-wave rectifier to provide half-wave rectification of the AC signal coming in on line 16, where such half-wave rectification is output on line 20 on the cathode side of diode D₁.

Capacitor C₁ is connected on opposing ends thereof to the output of diode D₁ and return power source line 34. Thus, capacitor C₁ is connected in parallel with diode D₁ and AC power source 14, as is clearly seen in the circuit diagram. For purposes of this disclosure, capacitor C₁ has a value approximating 100 microfarads, and functions as a filter which charges during the half-cycle that diode D₁ passes current and discharges during the remaining portion of the cycle. Thus, the voltage being input to transformer T on line 36 is a DC voltage having a small ripple at line frequency.

The pulsating DC current is applied to transformer T on transformer primary input line 36. Transformer T is a ferrite core type transformer and has the characteristics of allowing the core to

saturate relatively early in the voltage rise time and fall time of each pulse across primary winding 22. The secondary voltage pulse amplitude is limited to a predetermined value by the turns ratio of primary and secondary windings 22 and 24. However, it is to be understood that the energy to base 44 of transistor Tr is a function of both the voltage ratio and the differentiation of capacitor C_3 and the resistance of second filament 32. Primary winding 22 includes terminals A and B and secondary winding 24 has associated therewith terminals C and D. The transformer T is of conventional construction and for purposes of this disclosure, may suitably comprise a primary winding of 160 turns of number AWG 28 wire wrapped around a ferrite core. Secondary winding 24 of transformer T is formed of approximately 18 turns of AWG number 28 wire. As shown in the circuit diagram, transformer T is phased in such a manner that as a voltage charge appears between terminal B with respect to terminal A of primary winding 22, there is produced a proportional voltage change between terminals C and D of secondary winding 24 of transformer T. However, this proportional voltage change is of opposite polarity as measured between lines 51 and 34. Thus, when a voltage increase is applied to collector 38 of transistor Tr, a voltage of opposite polarity is applied to base 44 of transistor Tr.

The output of primary winding 22 from terminal B on line 40 is coupled to collector 38 of transistor Tr on line 60. Additionally primary winding 22 is similarly coupled to capacitor C_2 through line connections 40 and 50. Thus, this type of coupling provides for parallel paths for current exiting primary winding 22 for purposes and objectives to be seen in following paragraphs.

Transistor Tr is a commercially available transistor of the NPN type. Transistor Tr includes collector 38, base 44 and emitter 42. One particular transistor Tr which may successfully be used is a commercially available MJE13002 produced by Motorola Semiconductor, Inc. Transistor Tr operates as a switch in ballast system 10 and the current path through transistor Tr is provided when the voltage of base 44 to emitter 42 is greater than a predetermined value, which in the case of the particular transistor Tr referred to above is 0.7 volts. This 0.7 voltage drop of base 44 to emitter junction 42 is typical of this type of silicon transistor Tr.

Current flow from terminal B of primary winding 22 also passes through a second line 50 into first capacitor C_2 . First capacitor C_2 is a commercially available capacitor having a value of about 0.050 microfarads. As is the usual case, as current passes through primary winding 22 of transformer T, first capacitor C_2 is charged to the voltage available at terminal B. Output from first capacitor C_2 is fed via line 70 to one end of gas discharge tube first filament 30. When this filament is positive with respect to the second filament 32, electrons will be attracted to filament 30; conversely when filament 30 is negative, elec-

trons are emitted and negative filament 30 will be heated by ion bombardment. When transistor Tr is "on", first and second filaments 30 and 32 are respectively a cathode and an anode; conversely, when transistor Tr is "off", first filament 30 is an anode and second filament 32 is a cathode. Initially, as base 44 becomes more positive, electrons flow from emitter 42 to collector 38. This makes output line 40 more negative than terminal A. At the same time, electron current flows from first filament 30 through tube 12, second filament 32, line 80, emitter 42, collector 38 into line 60 and 50 and finally to capacitor C_2 . Thus, first filament 30 acts as a cathode connection during this phase of the cycle.

Gas discharge tube 12 may be a standard commercially available type of fluorescent tube, e.g. that commercially available under the designation F20T12/CW 20 watt. As can be seen, gas discharge tube 12 becomes an integral part of the overall circuit of electronic ballast system 10. Second filament 32 is coupled to return power source line 34 of AC power source 14 through electrical line 80. Thus, during this phase of the lighting cycle, second filament 32 acts as an anode for gas discharge tube 12. As is evident, the discharging current of first capacitor C_2 flows through gas discharge tube 12 which has a high resistance during the initial phases of the lighting cycle. Specifically, gas discharge tube 12 of the aforementioned type has a resistance of approximately 1100 ohms.

Second filament 32 in opposition to first filament 30 does have a measurable current flowing therethrough which is used to heat filament 32 by Joule Effect and provides an aid in ionization of the contained gas in gas discharge of fluorescent tube 12. Current flowing through second filament 32 is provided by secondary winding 24 of transformer T. In the transformer T being used, secondary winding 24 is 18 turns of number 28 wire wound on the ferrite core, as previously described. Terminal D of secondary winding 24 is coupled to second capacitor C_3 through line 46. Current on line 46 is differentiated by capacitor C_3 and exits on line 48 which is coupled directly to second filament 32. Second capacitor C_3 also acts to establish the desired duty cycle by the resonant frequency of the inductance of secondary winding 24 coupled to capacitor C_3 .

Returning to secondary winding 24 of transformer T, it is noted that secondary winding 24 is phased with respect to primary winding 22 in a manner such that as voltage increases across primary winding 22 from terminal A to terminal B, the voltage at the secondary winding 24 is provided such that terminal C increases with respect to terminal D.

Current passing through second filament 32 is brought back to secondary winding terminal C of secondary winding 24 through secondary filament output line 80 through either diode element D_2 or the base-emitter junction defined by elements 42 and 44 of transistor Tr, and then back through line 51 to terminal C of secondary wind-

Fig 24. Diode D_2 is a commercially available diode element, e.g. that commercially available as Model No. 1N4001. Determination of whether current passes through Diode D_2 or transistor Tr is made by the polarity of the secondary voltage of secondary winding 24. Thus, there is a complete current path during each half-cycle of the secondary voltage being produced.

For possible ease of understanding electronic ballast system 10, the overall system may be considered as having a primary circuit and a secondary circuit. The primary circuit provides for a charging current through gas discharge tube 12 between first and second filaments 30 and 32. The primary circuit includes primary winding 22 of transformer T with primary winding 22 being electrically coupled on opposing ends to first filament 30 and AC power source 14. In detail, the primary circuit may be seen to provide a path from AC power source 14 through diode D_1 through primary winding 22 of transformer T into first capacitor C_2 . Additionally, the current path from first capacitor C_2 passes into first filament 30, through the resistance of tube 12, into filament 32, and passes into output line 80 and finally into return line 34 and AC power source 14. The primary circuit provides for a source of alternating positive and negative voltage pulses having different amplitudes. When the positive pulse is applied to base 44 of transistor Tr from the secondary circuit, transistor Tr is turned "on". Collector 38 is quickly brought to the potential of emitter 42 and line 34 since there is substantially no resistance between emitter 42 and line 34. Current then flows from line 36 through transistor Tr, primary winding 22, to line 34. This induces a voltage drop across primary winding 22 opposing the applied voltage from terminal A with terminal B being more negative than terminal A. The magnetic lines of force created by the current moves outward from the core of transformer T.

The drop of voltage across primary winding 22 is substantially equal to the potential difference between lines 36 and 34 due to the fact that collector 38 is substantially at the potential of emitter 42.

As transistor Tr ceases to conduct due to the negative potential applied to base 44, the DC current falls substantially to zero and the negative lines of force collapse back toward the coil which induces a voltage. The direction of the voltage is such as to try to maintain the same direction of current flow as previously described, due to the fact that the induced voltage makes primary winding 22 act as the source in which case the current flows from negative to positive within the source.

Thus, terminal B now becomes more positive than terminal A. Ordinarily, the induced voltage value $L di/dt$ would make this voltage greater than the source on lines 34, 36; however, very importantly, the gas discharge in tube 12 between first and second filaments 30 and 32 becomes a bi-directional voltage limiter. Thus, tube 12 acts as if tube 12 were constructed of two Zener diodes in

back-to-back relation, thus preventing deleterious effects on transistor Tr caused by large voltage peaks. Tube 12 thus produces light with energy which would otherwise have been dissipated as heat.

When transistor Tr is in the "off" mode, there is a singular path of current flow. Transistor Tr does not draw current from the charge of capacitor C_2 by the voltage pulse $L di/dt$ and the source line 36. With line 50 more positive than line 70, first filament 30 will become an anode and second filament 32 a cathode when transistor Tr turns "on" again and capacitor C_2 discharges current into tube 12.

The secondary circuit for actuating the primary circuit and transistor Tr, and controlling gas discharge in gas discharge tube 12, includes secondary winding 24 of transformer T coupled to second capacitor C_3 and second filament 32. The path of current of the secondary circuit passes through output filament line 80 through either diode D_2 or transistor Tr into line 51 and then into terminal C of secondary winding 24.

In overall operation, electronic ballast system circuitry 10 provides for sufficient electrical discharge within gas discharge tube 12 for transforming electrical energy from power source 14 into a visible light output. Prior to a first closure of switch W, there is obviously no potential drop across any portion of ballast system 10, thus, as in all other portions of the overall circuit, the potential difference across transistor Tr and between lines 40 and 70 is substantially zero.

Upon an initial closure of switch W, AC power source 14 provides a current flow in electronic ballast circuit 10 which is half-wave rectified by diode D_1 connected within lines 16 and 20. Condenser of filter means C_1 is coupled between line 20 and return supply line 34 in parallel coupling with AC power source 14. Filter or capacitor C_1 charges during the half-cycle that diode D_1 passes current, i.e., during the positive half-cycle on line 16, and is reverse biased during the other half preventing discharge back to source 14. Thus, on line 36 being input to primary winding 22 of transformer T, there is pulsating DC current.

At this time, transistor Tr is not biased and there is not sufficient potential difference to cause a discharge in gas discharge tube 12. The resistance of collector 38 to emitter 42 of transistor Tr is extremely high, being for practical purposes, infinite, with the exception of a small leakage. Transistor Tr for all practical purposes, has no voltage on base 44 and emitter 42, and thus, transistor Tr is in an "off" state and no current flows from emitter 42 to collector 38. The only current that flows is charging capacitor C_2 through lines 40 and 50. The current flows from line 36 to line 70 through both primary winding 22 and capacitor C_2 and is small and insufficient to induce a voltage in secondary winding 24 of transformer T.

Transformer T is a ferrite core type transformer, and is used due to the fact that, in this type of transformer, the core becomes saturated in a

rapid manner using less than one-tenth of the current needed to energize tube 12. Thus, the core transmits the maximum magnetic flux to secondary winding 24 prior to the voltage reaching its peak value on primary winding 22. Prior to saturation, the difference in secondary voltage is obtained as the primary voltage continually increases. Capacitor C_2 charges at a rate determined by the capacitance value and the resistance in gas discharge tube 12 which, for the F20T12/CW 20 watt tube above described, is about 1100 ohms during gas discharge and greater prior to discharge.

When switch W is then opened and closed for a second time, an impulse or secondary pulse is produced through primary winding 22. The impulse provides for a current change on primary winding 22 which is large and secondary winding 24 generates a current sufficient in the ultimate passage of current through circuit 10 to turn transistor Tr into an "on" state. With transistor Tr turned to the "on" state, the voltage drop across collector 38 to emitter 42 is extremely small and capacitor C_2 on line 50 is coupled to supply line 34 through lines 60 and transistor Tr.

Capacitor C_2 has been charged positively on line 50 and negatively on line 70 up to this point. A negative current is now output since capacitor C_2 is coupled to return line 34 through line 60 and transistor Tr. Since there is a negative output on line 70, filament 30 becomes a cathode. Second filament 32 which is at the potential of the return side of power supply 14, thus becomes an anode. At this time, capacitor C_2 becomes the current source for gas discharge tube 12 since one end of capacitor C_2 is coupled to return line 34 through lines 50, 60 and transistor Tr and the opposing end of C_2 is coupled to discharge tube 12 through first filament 30, and the return path from filament 32 of gas discharge tube 12 to return line 34.

The end of capacitor C_2 coupled to line 50 was charged positively and is at this time coupled to return line 34. Negative current is applied to discharge tube 12 on line 70 and the voltage produced is greater than the approximate 85.0 volts which for this tube 12 is the breakdown voltage, and there is produced the usual light output. As is evident, the plasma within gas discharge tube 12 is effectively an electrical resistor. The temperature of filaments 30 and 32 of gas discharge tube 12 are maintained at a sufficiently high value to ensure emission of electrons as long as the pulses of voltage are applied from capacitor C_2 . For the 20.0 watt tube referred to above, the time constant of capacitor C_2 in series with the tube 12 is about 50.0 microseconds.

Secondary winding 24 of transformer T provides for a differentiated signal through capacitor C_3 to the base 44 of transistor Tr. Thus, a narrow pulse is supplied to transistor Tr and once transistor Tr is turned to the "on" state, the current in secondary winding 24 will become substantially zero and place transistor Tr in the "off" state. The cycle is then repetitive and capacitor C_2 again charges as previously described.

Going back in the cycle, as the case of transformer T is being saturated, a potential is applied across diode D_2 which is a positive pulse of voltage which is also applied across the base to emitter junction of transistor Tr. This positive pulse is due to the fact that line 40 to transformer T is at a lower voltage than line 36.

Thus, there is a positive signal pulse on line 51 generated from secondary winding 24.

Due to the fact that diode D_2 is reverse biased, it does not conduct when line 51 is positive. The base emitter junction is forward biased and conducts current and limits the voltage drop between lines 51 and 62 which, for ballast system 10, approximates 1.0 volts. Transistor Tr then goes to an "on" state and during the "on" state of transistor Tr, voltage in secondary winding 24 is induced with a potential on line 40 being approximately zero.

When transformer comes out of saturation, line 51 becomes negative. This now forward biases diode D_2 and reverse biases the base emitter junction of transistor Tr. Secondary current flows through diode D_2 and the voltage across D_2 is clamped at minus 1.5 volts on line 51 with respect to line 62. Line 40 goes from substantially zero to a positive level. Thus, once again, current flows between lines 40 and 36 and a pulse of positive polarity is applied to line 70 across capacitor C_2 . The positive polarity pulse is applied to first filament 30 of gas discharge tube 12 and the plasma ignition is maintained.

It is to be understood that a further resistor may be placed between lines 40 and 51. With the placement of such a resistor, the necessary pulse to the secondary winding 24 will be provided by a single closing of switch W. Thus, with the insertion of a resistor between lines 40 and 51, once saturation has occurred in transformer T, a pulse is provided for initiation of the overall cycle of ballast system 10.

Claims

1. An electronic ballast system in a gas discharge tube lighting system, the gas discharge tube having a first and a second filament, characterised by

(a) a first capacitor (C_2) connectable to one electrode of the first filament (30) of said gas discharge tube (12),

(b) a transistor (Tr), the collector (38) of which is connected to the first capacitor (C_2) on the side remote from said first filament (30),

(c) a transformer (T) having a primary winding (22) connected at one end (B) to the junction of said transistor and said first capacitor (C_2) and connectable at its other end (A) to a source of pulsed d.c., and having a secondary winding (24) the ends of which (C, D) are respectively connected to the base (44) and the emitter (42) of said transistor thereby to form a positive feedback path around the transistor (Tr), and

(d) means for generating and applying a pulse voltage to the second filament (32) of said gas

rapid manner using less than one-tenth of the current needed to energize tube 12. Thus, the core transmits the maximum magnetic flux to secondary winding 24 prior to the voltage reaching its peak value on primary winding 22. Prior to saturation, the difference in secondary voltage is obtained as the primary voltage continually increases. Capacitor C_2 charges at a rate determined by the capacitance value and the resistance in gas discharge tube 12 which, for the F20T12/CW 20 watt tube above described, is about 1100 ohms during gas discharge and greater prior to discharge.

When switch W is then opened and closed for a second time, an impulse or secondary pulse is produced through primary winding 22. The impulse provides for a current change on primary winding 22 which is large and secondary winding 24 generates a current sufficient in the ultimate passage of current through circuit 10 to turn transistor Tr into an "on" state. With transistor Tr turned to the "on" state, the voltage drop across collector 38 to emitter 42 is extremely small and capacitor C_2 on line 50 is coupled to supply line 34 through lines 60 and transistor Tr.

Capacitor C_2 has been charged positively on line 50 and negatively on line 70 up to this point. A negative current is now output since capacitor C_2 is coupled to return line 34 through line 60 and transistor Tr. Since there is a negative output on line 70, filament 30 becomes a cathode. Second filament 32 which is at the potential of the return side of power supply 14, thus becomes an anode. At this time, capacitor C_2 becomes the current source for gas discharge tube 12 since one end of capacitor C_2 is coupled to return line 34 through lines 50, 60 and transistor Tr and the opposing end of C_2 is coupled to discharge tube 12 through first filament 30, and the return path from filament 32 of gas discharge tube 12 to return line 34.

The end of capacitor C_2 coupled to line 50 was charged positively and is at this time coupled to return line 34. Negative current is applied to discharge tube 12 on line 70 and the voltage produced is greater than the approximate 85.0 volts which for this tube 12 is the breakdown voltage, and there is produced the usual light output. As is evident, the plasma within gas discharge tube 12 is effectively an electrical resistor. The temperature of filaments 30 and 32 of gas discharge tube 12 are maintained at a sufficiently high value to ensure emission of electrons as long as the pulses of voltage are applied from capacitor C_2 . For the 20.0 watt tube referred to above, the time constant of capacitor C_2 in series with the tube 12 is about 50.0 microseconds.

Secondary winding 24 of transformer T provides for a differentiated signal through capacitor C_3 to the base 44 of transistor Tr. Thus, a narrow pulse is supplied to transistor Tr and once transistor Tr is turned to the "on" state, the current in secondary winding 24 will become substantially zero and place transistor Tr in the "off" state. The cycle is then repetitive and capacitor C_2 again charges as previously described.

Going back in the cycle, as the case of transformer T is being saturated, a potential is applied across diode D_2 which is a positive pulse of voltage which is also applied across the base to emitter junction of transistor Tr. This positive pulse is due to the fact that line 40 to transformer T is at a lower voltage than line 36.

Thus, there is a positive signal pulse on line 51 generated from secondary winding 24.

Due to the fact that diode D_2 is reverse biased, it does not conduct when line 51 is positive. The base emitter junction is forward biased and conducts current and limits the voltage drop between lines 51 and 62 which, for ballast system 10, approximates 1.0 volts. Transistor Tr then goes to an "on" state and during the "on" state of transistor Tr, voltage in secondary winding 24 is induced with a potential on line 40 being approximately zero.

When transformer comes out of saturation, line 51 becomes negative. This now forward biases diode D_2 and reverse biases the base emitter junction of transistor Tr. Secondary current flows through diode D_2 and the voltage across D_2 is clamped at minus 1.5 volts on line 51 with respect to line 62. Line 40 goes from substantially zero to a positive level. Thus, once again, current flows between lines 40 and 36 and a pulse of positive polarity is applied to line 70 across capacitor C_2 . The positive polarity pulse is applied to first filament 30 of gas discharge tube 12 and the plasma ignition is maintained.

It is to be understood that a further resistor may be placed between lines 40 and 51. With the placement of such a resistor, the necessary pulse to the secondary winding 24 will be provided by a single closing of switch W. Thus, with the insertion of a resistor between lines 40 and 51, once saturation has occurred in transformer T, a pulse is provided for initiation of the overall cycle of ballast system 10.

Claims

1. An electronic ballast system in a gas discharge tube lighting system, the gas discharge tube having a first and a second filament, characterized by

(a) a first capacitor (C_2) connectable to one electrode of the first filament (30) of said gas discharge tube (12),

(b) a transistor (Tr), the collector (38) of which is connected to the first capacitor (C_2) on the side remote from said first filament (30),

(c) a transformer (T) having a primary winding (22) connected at one end (B) to the junction of said transistor and said first capacitor (C_2) and connectable at its other end (A) to a source of pulsed d.c., and having a secondary winding (24) the ends of which (C, D) are respectively connected to the base (44) and the emitter (42) of said transistor thereby to form a positive feedback path around the transistor (Tr), and

(d) means for generating and applying a pulse voltage to the second filament (32) of said gas



charge tube, comprising a second capacitor (C₃) connected in series connection between the secondary winding (24, end D) and one electrode of said second filament (32), the second electrode of said second filament (32) being connected to the emitter (42) of the transistor (Tr) thereby closing the positive feedback loop.

2. An electronic ballast system according to claim 1, characterised in that means (80) are provided for connecting the second filament (32) of the discharge tube (12), when connected to the ballast system to the return side of said AC power source and to the emitter of said transistor (Tr).

Patentansprüche

1. Elektronisches Vorschaltssystem in einem Beleuchtungssystem mit Gasentladungsröhre, wobei die Gasentladungsröhre einen ersten und einen zweiten Glühfaden aufweist, gekennzeichnet durch

(a) einen ersten Kondensator (C₂), welcher mit einer Elektrode des ersten Glühfadens (30) der Gasentladungsröhre (12) verbindbar ist,

(b) einen Transistor (Tr), dessen Kollektor (38) mit dem ersten Kondensator (C₂) auf der dem Glühfaden (30) abgelegenen Seite verbunden ist;

(c) einen Transformator (T), mit einer Primärwicklung (22), die an einem Ende (B) an die Verbindung zwischen dem Transistor und dem ersten Kondensator (C₂) angeschlossen ist und an ihrem anderen Ende (A) mit einer Quelle gepulster Gleichspannung verbindbar ist, und mit einer Sekundärwicklung (24), deren Enden (C, D) mit der Basis (44) bzw. mit dem Emitter (42) des Transistors verbunden sind und dadurch einen positiven Rückkopplungspfad um den Transistor (Tr) bilden, und

(d) Mitteln zum Erzeugen und Aufbringen einer gepulsten Spannung auf den zweiten Glühfaden (32) der Gasentladungsröhre, welche einen zweiten Kondensator (C₃) aufweisen, der in Reihe zwischen die Sekundärwicklung (24, Anschluß D) und eine Elektrode des zweiten Glühfadens (32) geschaltet ist, wobei die zweite Elektrode des zweiten Glühfadens (32) mit dem Emitter (42) des Transistors (Tr) verbunden ist und damit die positive Rückkopplungsschleife schließt.

2. Elektronisches Vorschaltssystem nach Anspruch 1, dadurch gekennzeichnet, daß Mittel (80) für den Anschluß des zweiten Glühfadens (32) der Entladungsröhre (12), wenn sie an das Vorschaltssystem angeschlossen ist, zu der Rückführseite der Wechselstromquelle und zu dem Emitter des Transistors (Tr) vorgesehen sind.

Revendications

1. Système de ballast électronique dans un système d'éclairage à lampe à décharge à gaz, la lampe à décharge à gaz comportant un premier et un second filament, caractérisé par

(a) un premier condensateur (C₂) pouvant être couplé à une électrode du premier filament (30) de ladite lampe à décharge à gaz (12),

(b) un transistor (Tr), dont le collecteur (38) est couplé au premier condensateur (C₂) sur le côté éloigné dudit premier filament (30),

(c) un transformateur (T) comportant un enroulement primaire (22) couplé à une extrémité (B) à la jonction dudit transistor (Tr) et dudit premier condensateur (C₂) et pouvant être couplé à son autre extrémité (A) à une source de courant continu pulsé, et comportant un enroulement secondaire (24) dont les extrémités (C, D) sont respectivement couplées à la base (44) et à l'émetteur (42) dudit transistor afin de former une voie de réaction positive autour du transistor (Tr), et

(d) des moyens pour produire et appliquer une tension à pulsations au second filament (32) de ladite lampe à décharge à gaz, comprenant un second condensateur (C₃) couplé en série entre l'enroulement secondaire (24, extrémité D) et une électrode dudit second filament (32), la seconde électrode dudit second filament (32) étant couplée à l'émetteur (42) du transistor (Tr) de sorte à fermer la boucle de réaction positive.

2. Système de ballast électronique selon la revendication 1, caractérisé en ce qu'un moyen (80) est prévu pour relier le second filament (32) de la lampe à décharge (12), lorsque couplé au système de ballast au côté de retour de ladite source de courant alternatif et à l'émetteur dudit transistor (Tr).

