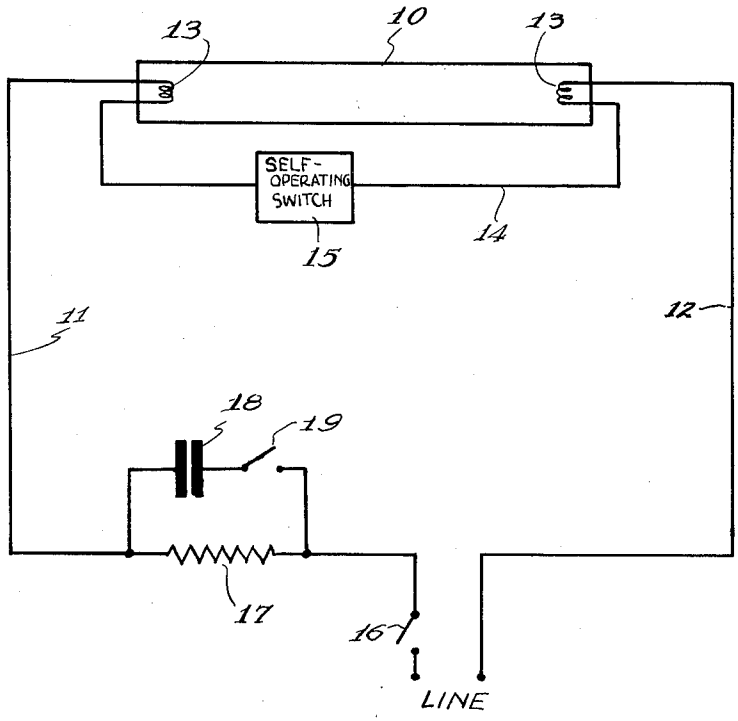
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GASEOUS DISCHARGE TUBE CIRCUIT

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GASEOUS DISCHARGE TUBE CIRCUIT

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This invention relates to an improved and simplified circuit for striking an arc and maintaining a constant operating voltage in a tube containing conductive gases.

The object of this invention is to provide a simple and fool-proof circuit for starting and operating gaseous discharge tubes, such as, for example, those known as fluorescent tubes.

Another object of the invention is to provide a simple circuit for starting and operating such gaseous discharge tubes as described which will utilize economical and compact impedance elements capable of being easily constructed and assembled and associated with the gaseous discharge tube.

A further object of this invention is to provide a new and improved method of initiating and maintaining the arc in a gaseous discharge tube.

A further object of this invention is to provide a novel and improved circuit for initiating and maintaining the arc in a gaseous discharge tube whereby when the tube is normally operating the power factor of the circuit will be as close as practicable unity.

Still a further object of the invention is to provide a novel and improved circuit for initiating and maintaining the arc in a gaseous discharge tube in which no reactive elements are effective in the circuit when the tube is normally operating.

Still a further object of the present invention is to provide a novel and improved circuit for initiating and maintaining the arc in a gaseous discharge tube in which circuit there will be eliminated many of the elements commonly used heretofore in circuits of this nature.

With the foregoing and other objects in view which will appear as the description proceeds, the invention consists of certain novel features of construction, arrangement and combination of electrical and mechanical parts and elements, procedures, modes and steps of practice, hereinafter fully described, symbolically illustrated in the accompanying drawing, and particularly pointed out in the appended claims, it being understood that the various changes in the form, proportion, size and minor details and arrangements of the various elements of the apparatus and in the details of procedure of the method may be made without departing from the spirit or sacrificing any of the advantages of the invention.

For the purpose of facilitating an understanding of my invention, I have illustrated in the accompanying drawing a preferred embodiment of the apparatus thereof, from an inspection and examination of which, when considered in connection with the following description, my invention, its mode of construction, assembly, operation, arrangement of the elements thereof, the mode of practicing same, and many of its advantages and features should be readily understood and appreciated.

Referring to the drawing, the figure is a diagrammatic representation of an electrical circuit used in connection with a fluorescent lighting tube and embodying my new invention.

The numeral 10 represents a gaseous discharge tube such as the type filled with conducting gas and having the walls thereof coated with materials which fluoresce when an arc in the tube causes emissions of electrons and the consequent production of rays of certain wavelengths, in a well-known manner.

The tube 10 is connected with a source of alternating current, such as an A. C. line by the leads 11 and 12, whereby an appropriate A. C. voltage may be impressed across the tube. The tube 10 is provided with filaments 13 at opposite ends thereof and between which the path of arc or discharge of the tube is adapted to be established. Said filaments are part of a branch circuit 14 arranged parallel to the discharge path, having a self-operating switch, and serving to short-circuit the arc or discharge path of the tube when the switch 15 is closed. The switch 15 is of a well-known type and includes a bi-metal member enclosed within a glow tube and adapted to be moved against a fixed electrical contact to close the circuit 14.

The lead 11 is provided with a resistor 17 and a condenser 18 in series with a switch 19, said condenser and switch 19 being connected across the resistor 17. The lead 11 is also provided with a line switch 16.

The device operates in the following manner.

Upon the switches 16 and 19 being closed, there will be impresed line voltage across the glow tube of the automatically operating switch 15. This will cause the bi-metal element of the tube to heat up and will thus bring about its engagement with the electrical contact therein to thereby close the circuit 14. The operation of the switch 15 is well -known and as the construction thereof per se forms no part of the present invention, it is not believed necessary to describe it in greater detail.

The closing of the circuit 14 will cause a flow of current through the entire circuit which will be limited merely by the resistance of the filaments 13 and that of the relatively high resistance 17. During this period clouds of electrons will be emitted by the heated filaments 13, thus causing the tube conductivity to be increased and thereby making it possible to ignite said tube at a comparatively low ignition voltage. During the time that the switch 15 is closed the voltage appearing across the resistor 17 will be a substantial portion of line voltage, since the voltage drop across both of the filaments 13 is comparatively

small. For example, in a 115 volt line circuit, utilizing a 20 watt tube, the voltage across the filaments will be about 25 volts.

The establishment of contact in the glow tube of switch 15 extinguishes the glow therein and consequently there is no heat to keep the bi-metal element in its engaged position.

The switch 15 will be opened as soon as the bi-metal element thereof has cooled and moved from engagement with its contact. Upon the opening of said switch the tube will be ignited by the combined voltages of the line plus the discharge voltage of the condenser 18, as will be now more fully explained.

The condenser 18 has a rather large capacity in order that it will require somewhat more than a half cycle of the line frequency to discharge. During the time that the switch 15 was closed, the condenser 18 was, of course, charged by the voltage existing across the resistor 17. When the switch 15 opens, the condenser 18 will begin to discharge at a constant polarity through the resistor 17. While this is occurring, the alternating line voltage is appearing across the tube 10. Since it requires more than a half cycle for the condenser 18 to discharge, during one of the half cycles of the full cycle immediately following the opening of the switch 15, the polarity of line voltage existing across the tube 10 will be the same as the polarity of the voltage set up across the resistor 17 by the discharging condenser 18. The effect will be that during this half cycle of common polarity the voltage across the tube will be equal to line voltage plus that portion of discharge voltage of the condenser 18 which has not as yet leaked off.

The combined voltages reach and exceed the ignition voltage of the tube, and therefore cause the arc to be struck. Since the conductivity of the tube when the arc has been struck is considerably greater than the conductivity of the resistor 17, the condenser 18 will discharge through the tube sustaining the ignition voltage a sufficient time to establish the arc in the tube.

The increased conductivity of the tube 10 will thereafter permit flow of current therethrough and cause the operation of the tube at the normal voltage. The condenser 18 and resistor 17 in parallel now serve as a current-limiting impedance.

The condenser 18 may now be removed from the circuit by opening the switch 19, and eliminating reactive influence upon the line. Thus with only the resistive element 17 in the circuit, the same will have a power factor of one. This is an important feature of my invention since it reduces operating costs of maintaining such a circuit.

It will be noted that by means of my invention I have eliminated from circuits of this nature the so-called "ballast" or inductive reactance which has heretofore been used. The economy in production effected thereby is obvious.

It is believed that my invention, its mode of construction, arrangement, assembly, association of parts, the mode of practicing the method thereof, and many of the advantages and features should be readily understood from the foregoing without further description, and it should also be manifest that while a preferred embodiment of the invention has been shown and described for illustrative purposes, the details are nevertheless capable of wide variation within the purview of my invention as defined in the appended claims.

What I claim and desire to secure by Letters Patent of the United States is:

1. In combination in a fluorescent lighting circuit, a fluorescent lighting tube having independent thermionic filament means at opposite ends operative when electrically heated to provide localized ionization of the gas filling the tube, an alternating current source having one lead connected to the filament means at one end of the tube alone and the other lead connected to the filament means at the other end of the tube alone so as to enable A. C. line voltage to be impressed through the tube for activating the fluorescent coating within the tube, a branch circuit in parallel to the discharge path of the tube and connecting said filament means, an automatically operating switch device in said branch circuit responsive to energization by said source to break the branch circuit after a predetermined interval of operation long enough to permit pre-ignition heating of the filament means, a resistor in one of said leads capable per se of serving as the entire overload-preventing device for running operation of the lighting circuit without the use of a conventional reactance ballast, and a condenser connected in parallel to said resistor in said one lead and of such capacity that it requires more than one half cycle to discharge following automatic opening of said switch device so that in the second half cycle following such opening the discharge voltage of the condenser will be additive to the line voltage as a result of coincidence of polarity and the combined voltages will temporarily attain to the ignition voltage of the tube to cause the arc to be struck therein between the filament means, the relationship of elements being such that after being struck as aforesaid the arc is maintained by the line voltage through said lighting circuit as limited by the resistor.

2. A fluorescent lighting circuit as defined in claim 1 in which a condenser-disabling switch is connected in series with the condenser for the purpose of removing the condenser from service after the arc has been struck in the fluorescent tube, leaving the resistor thereafter as the sole current limiting device in the circuit during normal operation of the fluorescent tube and attaining as nearly as practicable unity power factor in the lighting circuit.

3. A gaseous discharge tube circuit comprising, in combination, a gaseous arc discharge lighting tube having individual thermionic filaments at each opposite end providing a discharge path therebetween and capable of operating on A. C. line voltage modified only by appropriate resistance to prevent overloading, an alternating current source having separate leads respectively connected to said filaments, means short circuiting said discharge path and including a device automatically operative to open the short circuit after an interval of operation ample for heating the filaments to adequate thermionic condition, a resistor in one of said leads to limit the current in the circuit, a shunt across said resistor including a condenser of such capacity that as a result of opening of said short circuit at least the major proportion of the voltage discharge by the condenser is superimposed upon the line voltage for striking the lighting arc between the heated filaments, and a switch in said shunt for disconnecting the shunt from the tube circuit and rendering the condenser inactive during running operation of the tube circuit following lighting of the tube, whereby the normal operating power factor of the tube circuit will be as close as practicable unity.

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