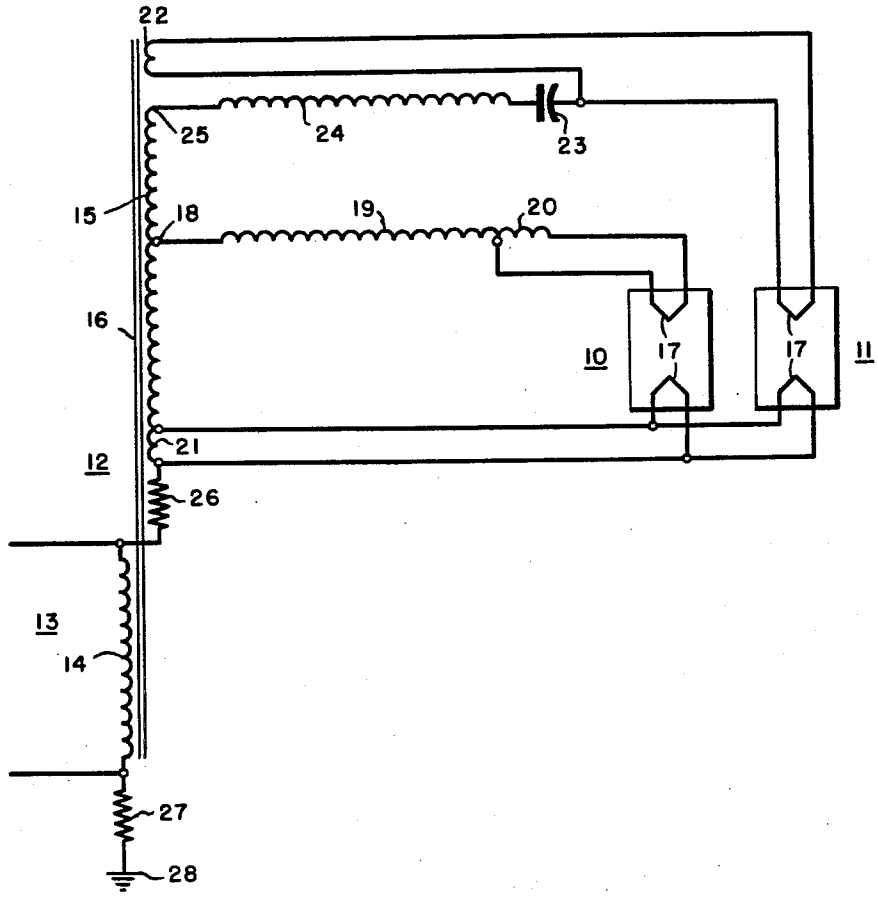
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STARTING AND OPERATING CIRCUITS FOR ELECTRICAL DISCHARGE LAMPS

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WITNESSES

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# STARTING AND OPERATING CIRCUITS FOR ELECTRICAL DISCHARGE LAMPS

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1 Claim. (Cl. 315—100)

The invention relates generally to a supply circuit system for gaseous discharge lamps and more particularly to a supply circuit for gaseous discharge lamps having a high volts-to-ground characteristic relative to the open circuit voltage across the ballast circuit.

The object of the invention is to provide for increasing the volts-to-ground of a circuit system for supplying gaseous discharge lamps to enable a reduction in the open-circuit voltage across the ballast and a decrease in the size of the ballast parts.

It is also an object of the invention to provide for a high volts-to-ground value in the circuit system for supplying gaseous discharge lamps to effect the starting of the lamps with a relatively low voltage across the ballast.

Another concurrent object of the invention is to reduce the fault current available at the lampholders to ground.

Other objects of the invention will in part be obvious and will in part appear hereinafter.

The invention accordingly comprises the features of construction, combinations of elements, and arrangement of parts, which will be exemplified in the construction hereafter set forth in the scope of the application of which will be indicated in the claim.

For a fuller understanding of the nature and objects of the invention, reference should be made to the following detailed description taken in connection with the accompanying drawing in which the single figure is a diagrammatic view of a circuit system embodying the features of the invention.

Referring now to the drawing, the circuit system for supplying the gaseous discharge lamps shown generally at 10 and 11 comprises an autotransformer shown generally at 12 which is supplied by the feeder system 13 connected to any suitable power source (not shown). Power sources capable of supplying 115 to 120 volts are generally satisfactory as supply circuits for gaseous discharge lamps.

The autotransformer shown generally at 12 comprises a primary winding 14 connected through the feeder system 13 to the power source, a secondary winding 15 and a core 16 on which the primary and secondary windings are disposed. The ratio of the turns in the primary winding 14 and secondary winding 15 will depend on the conditions to be met. The ratio in this embodiment of the invention is of the order of 1 to 2, thus if the voltage impressed across the primary winding is of the order of 115 volts the voltage across the secondary winding would be around 220 to 230 volts. When the autotransformer is provided with separate primary and secondary windings the supply system will have a predetermined volts-to-ground as determined by the secondary. In order to effect the rapid starting of the lights, the ballast of the lamp circuit system will be designed accordingly to engender a high open circuit voltage.

The gaseous discharge lamps 10 and 11 are each provided with two electrodes 17 which are made from a metal capable of emitting electrons. In the present circuit supply system provision is made for the heating of the electrodes prior to firing. This facilitates the firing of the lamps.



As shown, the lower electrode 17 of the gaseous discharge lamp 10 is connected across a section 21 of the secondary winding 15 of the transformer 12. The upper electrode 17 of lamp 10 is connected across a number of turns of a reactance secondary coil 19 which is part of the ballast and may be mounted on a high reactance part of core 16.

When current is supplied through the reactance coil 19, it introduces into the system a lagging characteristic. In order to prevent any substantial change in the power factor of the supply circuit this lagging characteristic is compensated for in a manner that will be described hereinafter.

As pointed out hereinbefore, the gaseous discharge lamps may be ignited or fired by a lower voltage if the electrodes are adequately heated. In this embodiment of the invention the upper electrode 17 of the lamp 10 is connected across a number of turns 20 of the reactance coil 19 which when the circuit is closed, supplies current to this electrode. The lower electrode 17 of the lamp 10 as described hereinbefore, is connected across a small number of turns 21 of the secondary winding 15 and is heated when the transformer is energized.

The lower electrode 17 of the lamp 11 is connected across the same turns 21 of the secondary winding 15 as the lower electrode 17 of the lamp 10. The upper electrode 17 of the lamp 11 is connected across an independent secondary coil 22 mounted on the core 16.

The voltage supplied by the heater windings 20, 21, 22 need not be large. About 3.5 to 4 volts is adequate to heat the electrodes. As soon as the feeder system 13 is connected to the source of supply, current will flow from the heater windings to the electrodes 17 of both lamps 10 and 11.

As pointed out hereinbefore, the current supply to the lamp 10 is given a lagging characteristic by the reactance coil 19. In order to offset the effect of the lagging current a capacitor 23 is connected in series-circuit relationship with the reactance coil 24 which is connected between the upper terminal 25 of the secondary winding 15 of the transformer 12 and the upper electrode 17 of the lamp 11. The capacitor will be of the proper value to give a leading current which will balance with the lagging current caused by the supply of current through the secondary reactance coil 19 to the lamp 10. In this manner, the power factor of the supply system will not be substantially changed.

In the building of supply systems for gaseous discharge lamps the cost may be substantially affected by the cost of the ballast necessary for the system and the watts loss in the ballast. Therefore, it is highly desirable that the ballast be kept as small as possible to keep down the cost. Further, the ballast depends to some extent on the voltage that is required to effect the ignition or firing of the gaseous discharge lamps.

It has been found that the firing of the gaseous discharge lamps depends largely on the volts-to-ground of the circuit system. In order to increase the volts-to-ground of the circuit supply system, a resistor 26 is connected between a terminal of the primary winding 14 and some point on the secondary winding 15. In this embodiment of the invention, the resistor 26 is shown connected between the end terminal of the primary winding 14 and an end terminal of the secondary winding 15. In this manner, the volts-to-ground of the supply circuit is increased. When the volts-to-ground of the supply circuit is increased, then the open circuit voltage across the

ballast may be reduced. It has been found that by connecting the resistor **26** between the primary and secondary windings that the open circuit voltage across the ballast may be reduced from 10% to 15% of that required when a transformer with two unconnected windings is employed.

When the open circuit voltage across the ballast is reduced in the manner described, the ballast or reactance coils **19** and **24** and capacitor **23** may be reduced in size, thus saving both copper and iron. The weight of the ballast will be reduced somewhat which is an advantage in most installations. Further, it has been found that with lower open circuit voltage across the ballast the lamps will not tend to instant start. This is desirable since it gives the heating windings more time to raise the temperature of the electrodes to a value where they readily emit electrons and can be fired with a lower voltage. This gives the gaseous discharge lamps a longer life.

In addition to the resistor **26** another resistor **27** is connected between the primary winding **14** and ground **28**. This resistor is desirable particularly in ungrounded systems since it insures maximum volts-to-ground and thus the certain starting or firing of the lamps **10** and **11**. Obviously, the resistor **26** will limit the fault current in the event of a ground at the lamp terminals or lampholder contact.

Since certain changes may be made in the above construction and the different embodiments of the invention to be made without departing from the scope thereof, it



is intended that all matter contained in the above description or shown in the accompanying drawing shall be interpreted as illustrative and not in a limiting sense.

I claim as my invention:

In a circuit system for supplying two gaseous discharge lamps, in combination, an autotransformer comprising a core and primary and secondary windings disposed on the core, a resistor connected between the primary and secondary windings of the transformer to increase the volts-to-ground of the system, a heater winding series connected across a portion of the secondary winding to supply a filament of each gaseous discharge lamp, a reactance coil disposed on said core and connected to the secondary winding at an intermediate point, a heater winding coupled across a portion of the reactance coil to supply a second filament of one gaseous discharge lamp, a second reactance means connected in series with said secondary winding and having a condensor in series therewith, a separate heater winding connected in parallel with said secondary reactance disposed on said core and connected to supply a second filament of the other gaseous discharge lamp, whereby the open circuit voltage supplying the filaments may be reduced without affecting the ability of the circuit to start the gaseous discharge lamps.

**References Cited** in the file of this patent

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# UNITED STATES PATENT OFFICE

# CERTIFICATION OF CORRECTION

Patent No. 2,963,623 December 6, 1960

Archie R. Cornell

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 4, lines 19 and 20, strike out "connected in parallel with said secondary reactance".

Signed and sealed this 20th day of June 1961.

(SEAL)
Attest:

ERNEST W. SWIDER
Attesting Officer

DAVID L. LADD
Commissioner of Patents