

Nov. 13, 1951

L. F. BIRD
OPERATING SYSTEM FOR DISCHARGE
DEVICES AND VAPOR ARC LAMPS

2,575,001

Filed Feb. 7, 1948

2 SHEETS—SHEET 1

Fig. 1.

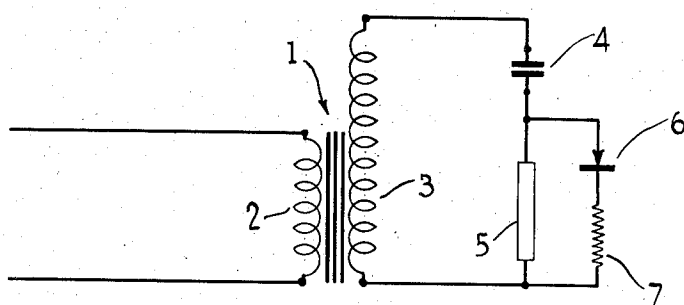
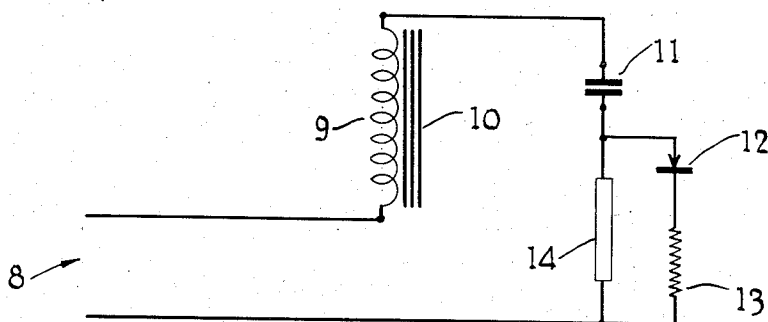


Fig. 2.



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2 SHEETS—SHEET 2

Fig. 3.

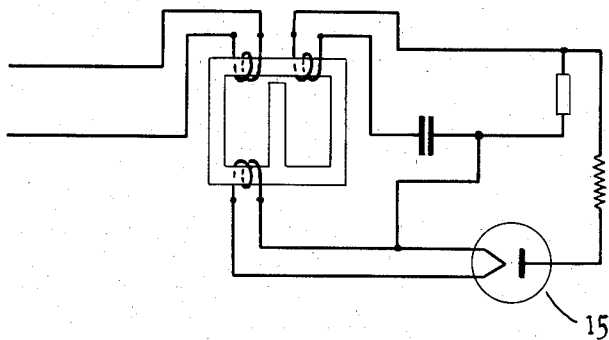


Fig. 4.

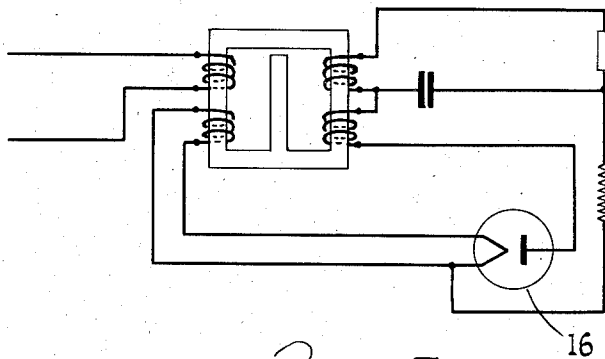
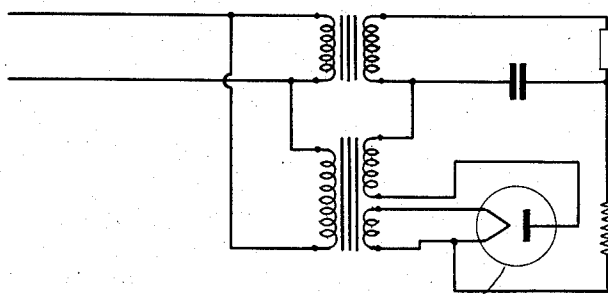


Fig. 5.



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2,575,001

OPERATING SYSTEM FOR DISCHARGE DEVICES AND VAPOR ARC LAMPS

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Application February 7, 1948, Serial No. 6,908

4 Claims. (Cl. 315—276)

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This invention deals with an operating system for discharge devices and vapor arc lamps and more particularly with an operating and ignition circuit therefor.

Conventional measures for the initial breakdown or ionization of gases contained in discharge devices or vapor arc lamps, in regard to the ignition of such devices and lamps, include the provision of elevated secondary voltages from a transformer, the provision of transient surge voltages to momentarily boost the potential across the discharge device or lamp, etc. Such provisions involve a transformer having a kva. rating large enough to operate a discharge device or arc lamp which necessitates elevated secondary voltages for the initial ignition. Since the secondary transformer voltage is directly proportional to the transformer kva. rating, it is obvious that the kva. rating of the transformer must be determined by the peak ignition potential. Providing a transformer with a kva. rating determined by the peak ignition potential for a discharge device or arc lamp adds to the cost of manufacturing such transformer and also to the cost of operating lamps, etc., by such transformer. Moreover, such transformer is substantially large and bulky.

The present invention avoids the provision of a transformer having the abovementioned disadvantages of conventional transformers. For example, it eliminates greatly elevated secondary transformer voltages and assures lighting, i. e. lighting of a vapor arc lamp, even though the ignition potential necessary to light the arc lamp may be substantially greater than that instantaneous potential of the secondary transformer voltage.

It is an object of this invention to provide a simple operation and ignition circuit for discharge devices and vapor arc lamps. It is another object of this invention to provide an economical operation and ignition circuit for arc lamps and discharge devices. It is a further object of this invention to provide, in combination with other embodiments of the invention, a transformer of minimum size adapted to operate a discharge device or vapor arc lamp. Other objects and advantages of this invention will become apparent from the description hereinafter following in connection with the accompanying drawings forming part hereof, in which:

Figure 1 is a diagrammatic representation of the operating and igniting circuit according to the invention,

Figure 2 is a diagrammatic representation of a modification of the operating and ignition circuit according to the invention,

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Figure 3 is a diagrammatic representation of a circuit according to this invention including a thermionic type rectifier,

Figure 4 is a diagrammatic representation of a circuit according to this invention including a thermionic type rectifier with independent rectifier supply voltage, and

Figure 5 is a diagrammatic representation of a circuit according to this invention including a thermionic type rectifier with an independent supply transformer.

In order to avoid the provision of a transformer having greatly elevated secondary voltage for starting the initial discharge of vapor arc lamps and discharge devices, I add a rectifying system to the lamp or discharge device circuit. The rectifying system is primarily adapted for building up a direct current potential across a series capacitor, said direct current potential being capable of approaching the peak value of the maximum instantaneous potential of the secondary alternating current transformer voltage. Due to the nature of this direct current potential, it becomes additive with the transformer secondary voltage when the instantaneous alternating current voltage of the transformer and said direct current potential are in the same direction. This characteristic provides almost twice the value of the peak instantaneous potential of the secondary voltage alone. Therefore, ignition of a vapor arc lamp or discharge device is assured with this greatly amplified starting potential. After a discharge is initiated, the rectifying system has no further effect upon the normal operating current of a discharge device or vapor arc lamp.

Referring to the drawings, Figure 1 shows the operating and ignition circuit of the invention having incorporated therein an electrical transformer 1 having a primary coil 2 and a secondary coil 3 in inductively coupled relationship. A series capacitor 4 is located in the circuit between one terminal of the transformer secondary and the discharge device so that all of the current to the discharge device or arc lamp 5 and the rectifier circuit passes therethrough, said rectifier current producing the direct current potential built up by the rectifying system illustrated as a rectifier unit 6 and a current limiting resistance 7. The transformer 1 may, for example, have a primary winding 2 designed to receive an operating current from a source of 60 cycle alternating current at 120 volts. The secondary transformer coil 3 may have an unloaded voltage of 285 volts. Although the figure is purely diagrammatic, the transformer unit characteristically has primary and secondary windings located on a magnetic core

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structure having a magnetic leakage shunt path for the magnetic flux such that the secondary coil is loosely coupled to the primary coil and so has an inductive reactance equivalent to a series reactance in the secondary circuit outside of the transformer structure. The capacitor 4 is connected in a series circuit with a discharge device or arc lamp, the whole being connected to the secondary winding of the transformer, and may be of about 13 microfarads capacity with a rating of 500 volts alternating current voltage. The load, i. e. an arc lamp 5, may be designed to operate normally at 120 volts and about 2.0 amperes. A rectifier 6 may be composed of two units of miniature selenium rectifier stacks having an inverse voltage rating of about 380 volts per unit and a rectified current rating of 100 milliamperes. The current resistor 7 is in series with the rectifier and may have a value of about 1000 ohms and may be employed to limit the rectified current to the capacitor as needed. Upon the application of power to the primary of the transformer, the open circuit voltage, i. e. 285 volts, is applied across the discharge device or lamp and across the rectified circuit. If the lamp lights immediately nothing further happens, but if the lamp fails to start the rectifier immediately starts to charge the capacitor with a direct current potential. The direct current potential each alternate half cycle is additive with the peak of the alternating current voltage and so eventually the combination can provide a potential at almost twice the peak of the alternating current potential alone for igniting the discharge.

Figure 2 shows a modification of the circuit described under Figure 1, said modification illustrating a circuit in which a series reactor is connected between the capacitor-lamp-rectifier circuit and the power supply in place of a transformer. This circuit comprises a suitable source of power 8, a stabilizing reactance 9 having a magnetic core 10, a capacitor 11 having approximately twice the reactance at the line frequency of the series reactor 9, a suitable rectifier unit 12 comprising a current limiting resistance 13, and a discharge device or arc lamp 14.

Upon the application of power to the circuit, either the lamp is immediately ignited or the rectifier starts to develop a direct current potential across the series capacitor. As this potential increases, the ignition potential for the lamp is passed and the lamp is ignited. The operation of this circuit is identical with the operation of the circuit described under Figure 1 and it is apparent in comparing both circuits that the invention is not limited in any way to the use of a transformer in order to attain the advantages thereof.

In accordance with the broad scope of the invention, the heretofore described elements of the circuit are not limited to the values given in relation thereto. For example, the rectifier unit may consist of any type of rectifier which is suitable and which will withstand the inverse voltage built up by the addition of a direct current to and in combination with the peak voltage of the alternating current voltage. Also, the invention is not limited to the manner in which the rectifier is applied to the operating circuit as long as its performance results in a direct current potential being developed across the series capacitor. More particularly, such other types of rectifiers and their application may include thermionic

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types of rectifiers 15 in place of selenium plate or dry plate type rectifiers, thermionic rectifiers 16 with independent rectifier supply voltages, or thermionic rectifiers 17 with independent supply transformers as shown for illustrative purposes in Figures 3, 4 and 5 respectively.

While I have shown and described particular embodiments of my invention, it is to be understood that I do not wish to be limited thereto since other modifications are possible within the true scope of the invention.

What I claim is:

1. A vapor electric discharge device operating system comprising a main circuit, a source of alternating current therefor, a vapor electric discharge lamp connected in said main circuit, a shunt circuit connected directly across said discharge lamp, a capacitor connected in the main circuit of said system in series with both of said circuits, said shunt circuit comprising a rectifier means for charging said capacitor with a D. C. potential, said shunt circuit being operative only when said lamp remains non-conductive with a peak A. C. potential, the normal A. C. potential of said source being sufficient to continue lamp conduction after ignition.

2. A vapor electric discharge device operating system comprising a main circuit, a transformer, a source of alternating current therefor, said main circuit being connected across said transformer, a vapor electric discharge lamp connected in said main circuit, a shunt circuit connected directly across said discharge lamp, a capacitor connected in the main circuit of said system in series with both of said circuits, said shunt circuit comprising a rectifier for charging said capacitor with a D. C. potential only when the lamp ignition potential exceeds the peak A. C. voltage, the normal A. C. potential of said source being sufficient to continue lamp conduction after ignition.

3. A vapor electric discharge device operating system comprising a main circuit, a source of alternating current, a vapor electric discharge lamp connected in said main circuit, a shunt circuit connected directly across said discharge lamp, a capacitor connected in the main circuit of said system in series with both of said circuits, a reactor connected in said main circuit in series and between said capacitor and the source of current, said shunt circuit consisting of a rectifier and a resistance in series therewith, said rectifier being operable to charge said capacitor with a D. C. potential only when the lamp ignition potential exceeds the peak A. C. voltage, the normal A. C. potential of said source being sufficient to continue lamp conduction after ignition.

4. A vapor electric discharge device operating system according to claim 3, wherein said rectifier is a thermionic rectifier, an independent A. C. power supply connected to said rectifier.

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