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ELECTRICAL CIRCUIT FOR ELECTRICAL DISCHARGE LAMPS

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Fig. 1.

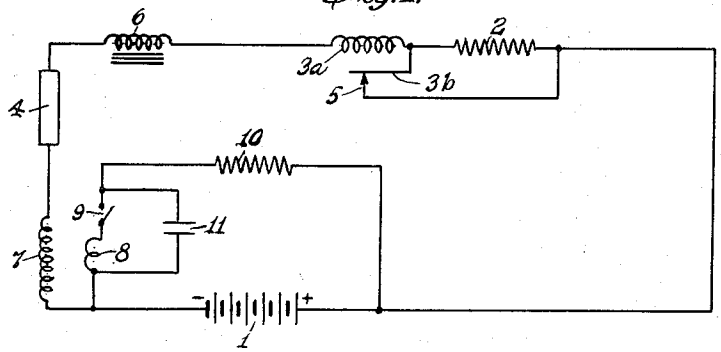
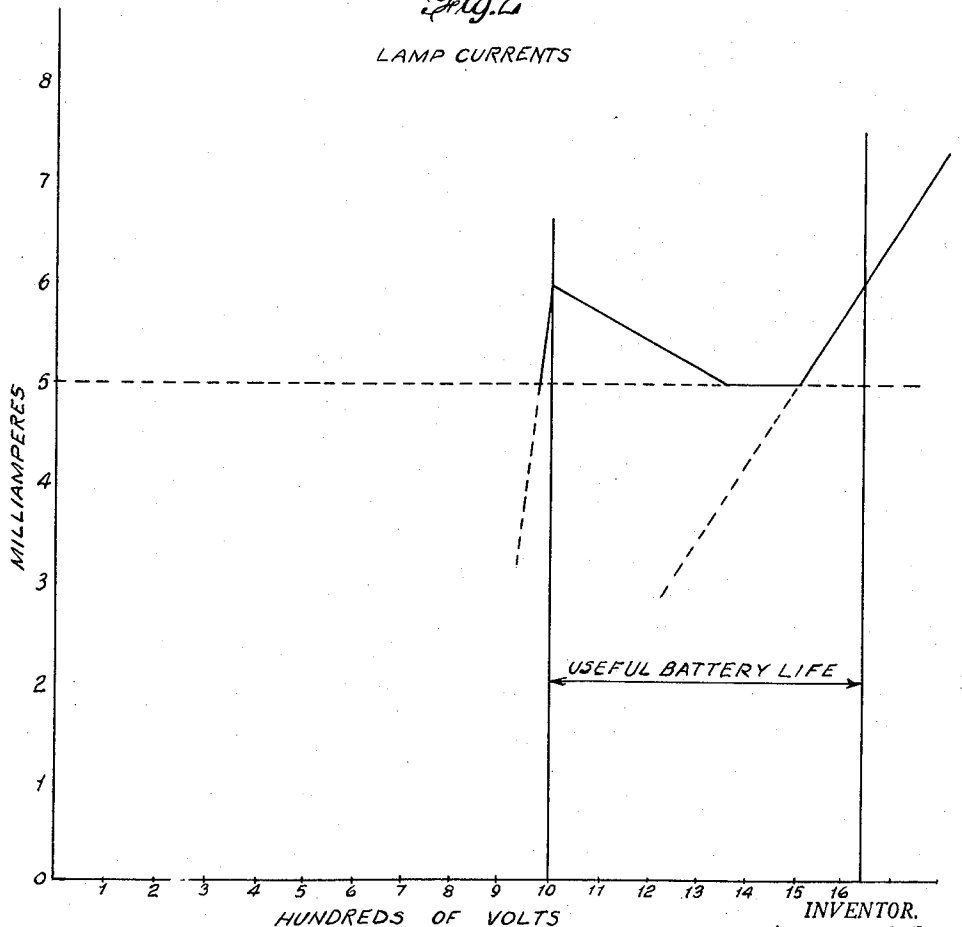


Fig. 2



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ELECTRICAL CIRCUIT FOR ELECTRICAL DISCHARGE LAMPS

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1 Claim. (Cl. 315—224)

The present invention deals with an electrical circuit for electrical discharge lamps and more particularly with an electrical regulating circuit energized by a source of voltage which deteriorates with use.

In an operating circuit for a discharge lamp whereby the circuit is energized by a battery, the current to the lamp is influenced by the ageing of the battery so that the light output of the lamp diminishes with the ageing of the battery. For example, a new battery may deliver 850 volts and when old the voltage delivering to the load may diminish about 35 percent or to about 500 volts. Not only is the light output diminished under such conditions, but the effective operative life of the battery is substantially short.

It is an object of the present invention to provide a regulating circuit for a battery energized lamp and operative to permit a lamp to operate at a low current value essentially independent of the declining voltage of the battery. It is another object of this invention to provide a regulating circuit for a battery energized lamp wherein the current supplied to the lamp is essentially constant for all values of battery voltages between a new and dead battery condition. It is a further object of the invention to provide a regulating circuit for a battery which extends the life of the battery as much as 500 percent. Other objects and advantages of this invention will become apparent from the description hereinafter following and the drawings forming a part hereof, in which:

Figure 1 is a schematic view of the regulating circuit according to the invention, and Figure 2 is a graphical representation showing the average lamp current throughout the discharge cycle of a battery.

The present invention relates in particular to an operating regulating circuit for a discharge lamp which permits the lamp to operate at a low current value that is essentially independent of the supply voltages when the lamp is operated from a battery that declines in voltage about 35 percent between a new and dead battery condition.

Referring to Figure 1, a battery **1** constitutes a source of voltage which deteriorates with use. Connected to one terminal of the battery is a series ballasting resistor **2** having a resistance of from about 85,000 to 125,000 ohms. A relay **3** is connected in series with the resistance **2**, said relay comprising a coil **3***a* operative on a current less than the minimum operating current for the lamp **4**, a relay armature **3***b* operatively associated with the coil **3***a* and moveable in accordance with the electromagnetic character of the coil-armature combination, and a contact **5** engageable with the armature **3***b* and shunting said resistor **2**. A choke coil **6** is connected in series to one end of the lamp **4** and to the coil **3***a* of relay **3**. The coil **3***a* may, for example, operate on a current of 5 milliamperes, the choke coil may have an inductance of about 100 henries at 5 milliamperes current, and the lamp may be a discharge lamp normally operating at about 450 volts and 5 milliamperes. Connected to the other

end of the lamp **4** is one end of a secondary coil **7** of a radio frequency transformer and comprising a component of an ignition circuit and having its other end connected to the battery **1**. An ignition circuit is connected across the battery **1**. The ignition circuit comprises a primary winding **8** of the radio frequency transformer composed of transformer windings **7** and **8**, a series switch **9** connected to the primary winding **8**, a series resistor **10** which limits the current flow when the starting switch **9** is closed, and a small capacitor **11** shunting both the switch **9** and primary winding **8** and whose discharge provides a radio frequency pulse to assist in starting the discharge lamp.

In operation the relay **3** is adjusted so that the armature **3***b* opens the contact when the current exceeds a minimum current value, e. g., 5 milliamperes. Opening of the contact between contact **5** and armature **3***b* allows the current to flow through the ballasting resistor **2** which reduces the current flow to a low value, i. e. below a predetermined minimum, e. g. 2 milliamperes, which cannot maintain the relay contact open and so the contact recloses causing the current to again increase above that required for the relay operation. The relay, therefore, opens and closes rapidly producing a variable current in the series circuit whose average value corresponds with an optimum predetermined low current value, e. g. 5 milliamperes. The relay operations produce pulsations in the light which are much too fast for any effects on the eyes of an observer and the light appears to be steady. The relay continues to vibrate until the maximum current in the circuit is usable to move the relay armature away from the contact point. This occurs at the time when the battery is dead and has to be replaced. If the minimum current in the series circuit is above that required for the armature of the relay to close the contact, the relay remains open until the battery voltage deteriorates so that the current declines and the relay armature closes the contact. From this current condition and throughout the decline in battery voltage, the relay continues to vibrate until the battery is dead.

If the discharge lamp does not light immediately upon the application of the battery voltage to the circuit, the switch **9** is operated manually causing a radio frequency discharge from the charge on capacitor **11**. This radio frequency voltage is amplified through the radio frequency transformer comprising coils **7** and **8** to produce a high voltage, additive to that of the battery, across the lamp and so initiates the ignition of the lamp.

Figure 2 illustrates a characteristic current curve showing an average predetermined lamp current throughout the discharge cycle of the battery. For example, the current starts out with a new battery at 6 milliamperes and ends up at 6 milliamperes when the battery is no longer useful. Such a circuit provides the least possible drain of current from the battery and, therefore, the longest service.

Modifications as to optimum current values in accordance with the battery voltage delivery and lamp voltage requirements are possible within the scope of the invention.

What I claim is:

In a power consumption reduction system, a discharge lamp, a battery, and means for supplying pulses of current to said lamp at a rate above the optical perception flicker rate of about 25 cycles per second, said means including a ballast resistor and a relay having its coil in series with said resistor, said lamp and said battery, an armature associated with said relay, and circuit means for shorting out said resistor when said armature is in

the unoperated position, said relay and resistor having a time constant of operation which is greater than said optical flicker rate.

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