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METHODS OF AND APPARATUS FOR INCREASING INCANDESCENT LAMP LIFE

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Fig. 1.

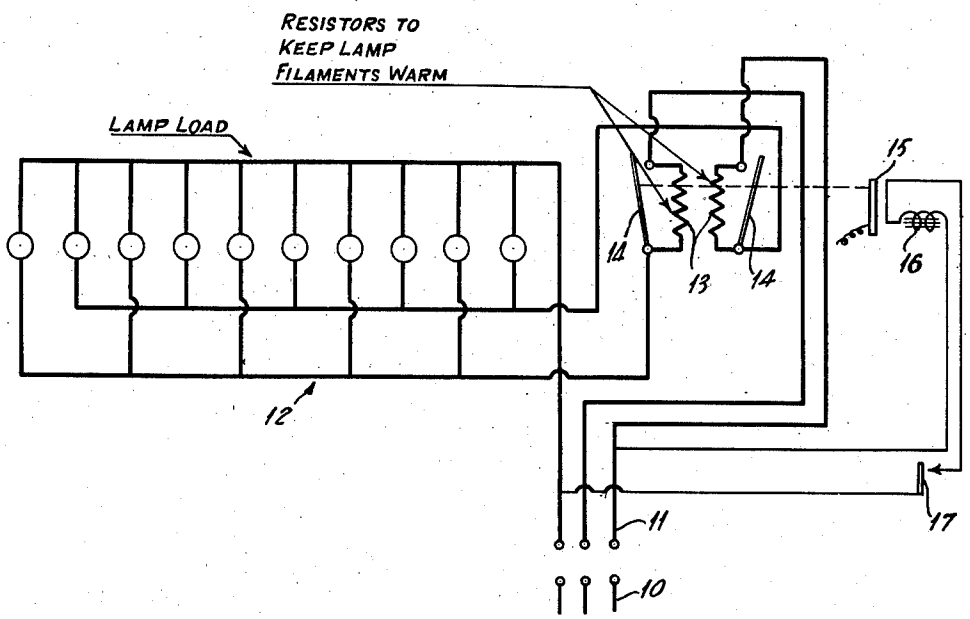
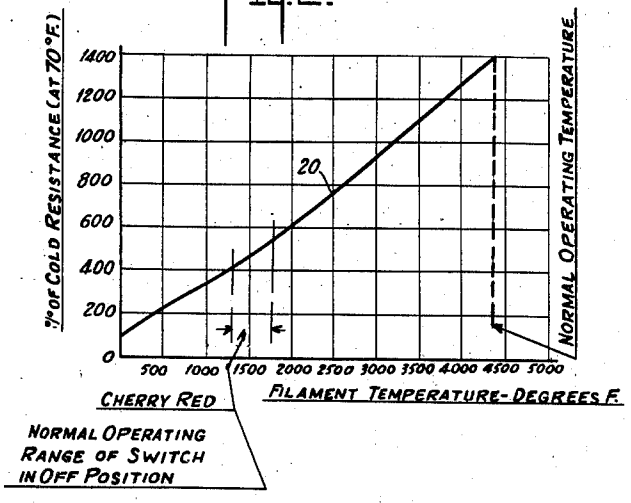


Fig. 2.



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METHOD OF AND APPARATUS FOR INCREASING INCANDESCENT LAMP LIFE

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4 Claims. (Cl. 315—291)

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The present invention relates to methods of and apparatus for increasing incandescent lamp life.

The rate of life of tungsten filament incandescent lamps is generally given as 1000 hours. These tests are made under standard laboratory conditions and contemplate freedom from shock or excessive vibration and continuous burning. As such lamps burn the filaments became weaker on account of evaporation of filament material. It is well known that when a lamp filament has been weakened by this evaporation of filament material final lamp failure usually occurs when the switch is turned on due to increase of current through the cold filament.

The tungsten lamp filament is self-regulating and the current flow is limited by the increase in resistance with the temperature. The cold resistance is comparatively low about 7% of the resistance at rated voltage so that about 14 times the current flows initially as when the lamp is hot. It requires about two-thirds of a second for a 1000 watt lamp to build up its normal hot resistance.

A cold tungsten filament is much more brittle than a hot filament. In industrial locations such as steel mills, drop forge shops, press shops, aeroplane engine test cells, turbine rooms etc., the vibration is of sufficient magnitude to cause cold lamp filaments to rupture long before their rated life of 1000 hours. By keeping the filament hot enough to prevent it from becoming brittle the actual life can be made to approach normal rated life where vibration is absent.

According to the present invention a low current is maintained, when the lighting is not required, which is sufficient to keep the filament at a substantial elevation in temperature above the room temperature so as to materially increase the resistance. The voltage applied to the lamps is below such voltage as will render the lamps luminous. From an illumination standpoint the lamps are completely extinguished. The temperature of the filament will be operated at about 1600° F. (cherry red) at which temperature the resistance of the filament is 500% of the room temperature resistance so that the initial current flow will be reduced to one-fifth of that for a cold resistance. When the resistors are in the "lights off" position the voltage across the lamps will be reduced to about 11% of the normal voltage and the filament resistance will be reduced to about 36% of the normal resistance and the total load will be about 30% of the normal load.

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The accompanying drawing shows, for purposes of illustrating the present invention, an embodiment in which the invention may take form, it being understood that the drawing is illustrative of the invention rather than limiting the same.

In the drawing:

Figure 1 is a circuit diagram; and

Figure 2 is a diagram illustrating the filament resistance at various filament temperatures.

In Figure 1 a three-wire power supply is indicated at 10 and a main switch at 11. The lamp load is indicated at 12. Each side of the lamp load 12 is connected to the main switch through a resistor 13. The resistors 13 are adapted to be short circuited by switch blades 14, 14 under the control of the armature 15 and in response to a solenoid 16 operated by a remote control switch 17. When the switch 17 is opened and the main switch 11 is opened and the amount of current flowing to the lamp load will depend upon the resistances 13. When the lamps are to be lighted the control switch 17 is closed and the resistors are then short circuited by the contacts 14, 14.

In Figure 2 relation of the filament temperature and the percentage of cold resistance at 70° F. is shown by the curve 20. It will be seen that the hot resistance is about fourteen times the cold resistance. When, however, the voltage applied to the lamp is reduced so that the lamp filament is from about 1350° F. to 1750° F. it has from four to six times the cold resistance and the filament is no longer luminous. It gives off no light, but is a dull cherry red. When in this state it is not brittle as when cold and has a high enough resistance to avoid the surge of current which occurs when the cold lamp is connected in circuit.

A typical circuit arrangement with a load of ten 1000 watt lamps on a 230/115 volt circuit would employ two 8.5 ohm resistors. When the switches are opened the load is 375 watts for the lamps and 2675 watts for the resistors, or a total of 3050 watts or 30.5% of the load when lighting is being had. The voltage on the lamp is reduced to 13 volts. The increase in lamp life is not dependent upon any critical temperature. Temperatures as low as 1000° F. are effective. The filaments should be hot enough to have a substantial increase in resistance over the cold resistance and exceeding a temperature in excess of 2000° F. is merely wastage of electrical energy. The lamps may operate under these conditions indefinitely.

Since it is obvious that the invention may be

embodied in other forms and constructions within the scope of the claims, I wish it to be understood that the particular form shown is but one of these forms, and various modifications and changes being possible, I do not otherwise limit myself in any way with respect thereto.

What is claimed is:

1. The method according to which the filament of an incandescent lamp is alternately subjected to a subnormal voltage which maintains it at a temperature of upwards of 1000° F. but below 2000° F. and to normal operating voltage to bring it to full operating temperature of approximately 4350° F., without allowing the lamp to cool to room temperature.

2. The method of increasing incandescent lamp life as compared with the life of the lamp with usual on and off operation, which comprises alternately inserting in series with the lamp a current limiting resistance when the lamp is being extinguished to bring the filament resistance to four to six times its cold resistance to correspondingly reduce filament temperature, and

short circuiting the resistance without allowing the lamp to cool to room temperature.

3. A lighting circuit comprising an incandescent lamp load of known power consumption at rated voltage, and means to increase the lamp filament resistance to about four to six times of the room temperature resistance whereby the lamp filaments are cooled below effective lighting temperatures and yet maintained at a temperature of from 1000° F. to 2000° F.

4. A lighting circuit comprising an incandescent lamp load of known power consumption at rated voltage, a resistor in series with the lamp load and a resistor cut-out switch for short circuiting the resistor, the resistor being of such value as to increase the lamp filament resistance to about four to six times the room temperature resistance whereby the lamp filaments are cooled below effective lighting temperatures and yet maintained at a temperature of from 1000° F. to 2000° F.

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