May 27, 1930. W. C. SPROESSER ET AL 1,760,667

MULTIFILAMENT LAMP

Filed Oct. 8, 1926

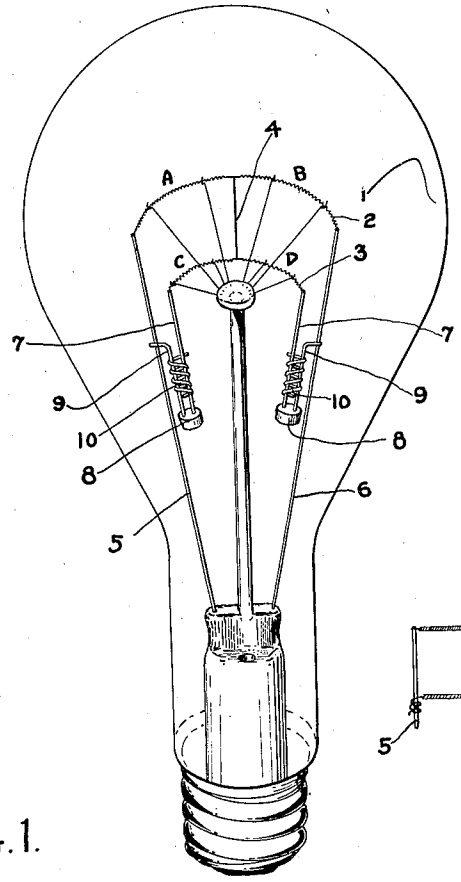


FIG. 1.

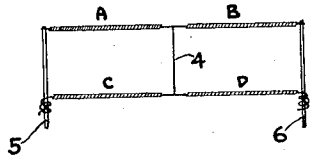


FIG. 2.

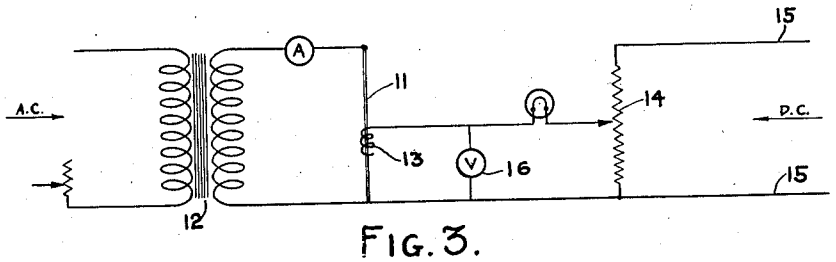


FIG. 3.

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Patented May 27, 1930 1,760,667

UNITED STATES PATENT OFFICE

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MULTIFILAMENT LAMP

Application filed October 8, 1926. Serial No. 140,281.

This invention relates to an incandescent electric lamp and more particularly to a lamp having a plurality of filaments arranged so that upon the destruction of one of the filaments the lamp is not rendered useless but another filament may be brought into circuit.

In gas-filled incandescent filament lamps the normal life of the filament is around 1000 hours. At the end of this period the bulb is only slightly discolored, due to the deposit of tungsten thereon and the gas is still in a very pure condition so that apart from the destruction of the filament, the lamp is in every way well capable of operation for another thousand hours.

One of the objects of the present invention is to provide an incandescent lamp which will have a plurality of filaments, one or more being held in reserve so that after the first filament fails, another filament is automatically shunted in the circuit and the life of the lamp prolonged.

Another object is to provide a novel means of bringing into use a reserve filament upon failure of the main filament.

Another object is to provide a novel manner of insulating the reserve filaments from the current conductors, which may be broken down at any desired potential to automatically insert the reserve filaments in the electrical circuit of the lamp.

Other objects and advantages will hereinafter appear.

In accordance with one phase of the present invention the lamp is provided with a plurality of filament sections arranged in parallel or shunt relation. One of the filament sections is joined electrically to the leading-in conductors of the lamp and is termed the main filament. The other filament sections are insulated from the leading-in conductors and for convenience, are termed reserve filaments. The insulation of the reserve filament is so designed that upon destruction of the main filament the insulation is broken down and a reserve filament shunted in the circuit.

Preferably, the mid points of each of the filament sections are joined together electrically by a current conductor so that upon burning out of the filament at any particular point, the entire filament section is not rendered useless and only that half of the filament section in which the burn-out occurs is cut out of the circuit.

Any desired form of insulation for the reserve filaments may be employed, such as a film of insulting material as, for instance, a condensate product, shellac, resins, etc., which will break down at the required potential. We prefer, however, to form an oxide film or layer on the surface of the support of such thickness that it is broken down only at the desired voltage.

In order that this invention may be more fully understood reference will be had to the accompanying drawing in which:

Fig. 1 is a perspective view of a lamp embodying our invention;

Fig. 2 is a diagrammatic representation of the electrical arrangement of the filament sections; and,

Fig. 3 is a circuit diagram illustrating the method of forming the insulating film on the support for the reserve filaments.

The lamp illustrated in Fig. 1 comprises an envelope 1 having therein a main filament 2 and a reserve filament 3. While only a single reserve filament is shown, it is to be understood, of course, that any desired number of reserve filaments may be employed. The filament sections 2 and 3 are joined at the mid points by an electrical conductor 4, thereby dividing the main filament 2 into substantially equal portions A and B and similarly dividing the reserve filament 3 into equal portions C and D. The main filament 2 is secured directly to the ends of the support wires 5 and 6 through which current is supplied thereto. The reserve filament 3 is carried at each end by auxiliary support wires 7 supported by glass beads 8 rigidly supported from the leads 5 and 6 by stiff wires 9, spot welded to the leads. The wires 9 are provided with an insulating coating or surface. This insulating coating, as before stated, may consist of a layer of a suitable insulating enamel or the wire may be composed of a metal having a relatively stable oxide, such as aluminum, tantalum,

chromium, tungsten, etc., and the surface thereof may be oxidized to a sufficient extent to render the same resistant to voltages below a given value but is readily punctured when this value is exceeded. A flexible wire 10 preferably of copper, is wound about the auxiliary support 7 and the insulating member 9 to complete the circuit to the reserve filament 3 on destruction of the insulation surrounding wire 9.

Assuming, for instance, that the lamp is designed to operate at 110 volts, the normal course of the current is through the sections A and B of the main filament 2 and the drop in voltage through either section is around 55 volts. The insulation on the wire 9 is designed so that it will not break down at this voltage. Upon destruction of either of the portions A and B of the filament 2 as for instance, the portion A, the full line potential between the leading-in wires 5 and 6 will be impressed across the insulation of the wire 9, and by proper design, the insulation may be adapted to break down at this voltage, thus shunting into the circuit the portion C of the filament section 3 in place of the burned-out portion A. The lamp circuit is then completed through the portion C, wire 4 and portion B. Upon burning out of the portion B the insulation on the other wire 9 will be broken down and the portion D of the filament 3 energized.

It will be noted that upon burning out of any particular part of the filament 2 the entire filament is not rendered useless but the stronger portion is permitted to burn until it also has reached the end of its life. It will be further noted that it is not necessary to manually cut in the reserve filament but that the same is accomplished automatically by the increase in potential across the insulating member 9.

In order to produce an oxide film on the wire 9 of such thickness that it will break down at the desired voltage, as for instance between 55 and 110 volts, the arrangement shown in Fig. 3 may be employed. In this figure the wire which it is desired to oxidize, is indicated at 11. Current is passed through this wire from the secondary winding of a transformer 12 to heat the wire to a sufficient temperature to cause rapid oxidation in the atmosphere. In the case of nickel wire, for instance, the current should be sufficient to raise the temperature of the wire to a dull red heat. The time required to oxidize the wire so that it will have a break down potential of around 80 volts, for instance, will vary with the temperature but I have found that in the case of nickel, a period of about 3 minutes is required. In order to determine when the wire 11 is sufficiently oxidized a soft copper wire 13 is tightly coiled thereabout and joned through a suitable potentiometer 14 to one side of a direct current line 15. The other side of the line 15 is electrically connected to the oxidized wire 11. The potentiometer 14 is then adjusted until the oxide film on the wire 11 breaks down, at which time the break down voltage is determined by the voltmeter 16. If this break down voltage is found to be too low the wire 11 is further heated to increase the thickness of the oxide film thereon.

Obviously other methods of oxidizing the surface of the wire may be employed, such as electrolysis and we do not desire to be limited to the particular details set forth herein. It is also obvious that many changes may be made in the construction of the lamp without departing from this invention.

What is claimed is:

1. An incandescent electric lamp having a main filament and a reserve filament therein, leading-in conductors for said filaments, from which said reserve filament is normally insulated, said main and reserve filaments being connected electrically intermediate their lengths whereby upon destruction of the main filament the potential difference across said insulation is increased to break down the same and bring into circuit a portion of the reserve filament.

2. An incandescent electric lamp having a main filament, a reserve filament, leading-in conductors for said main filament from which each end of said reserve filament is normally electrically disconnected, an electrical connection between intermediate portions of said main and reserve filament, and means operable on destruction of one portion of said main filament for automatically bringing a portion of the reserve filament into circuit with the remaining portion of said main filament.

3. An incandescent electric lamp comprising an envelope, leading-in wires extending therein, a main filament and a reserve filament disposed in said envelope in shunt relation, an insulating medium interposed between said reserve filament and said leading-in wires, said main and reserve filaments being electrically connected intermediate their ends so that upon destruction of one portion of said main filament the potential across said insulation is increased to the break down value thereof to substitute a portion of said reserve filament for the burned-out portion of said main filament.

4. An incandescent electric lamp comprising an envelope, a main filament and a reserve filament therein, main support wires for said main filament, auxiliary support wires for said reserve filament, said main and auxiliary support wires being electrically insulated, and said main and reserve filaments being electrically connected intermediate their ends so that the voltage impressed across said insulation is less than the rated voltage of the lamp, said insulation being incapable of being broken down at the normal voltage impressed thereacross but is capable

of being readily broken down at the rated voltage of the lamp, to permanently electrically connect said main and auxiliary support wires.

In testimony whereof, we have hereunto subscribed our names this 7th day of October, 1926.

WILLIAM CHARLES SPROESSER.
ERNEST ANTON LEDERER.