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SERIES LIGHTING SYSTEM

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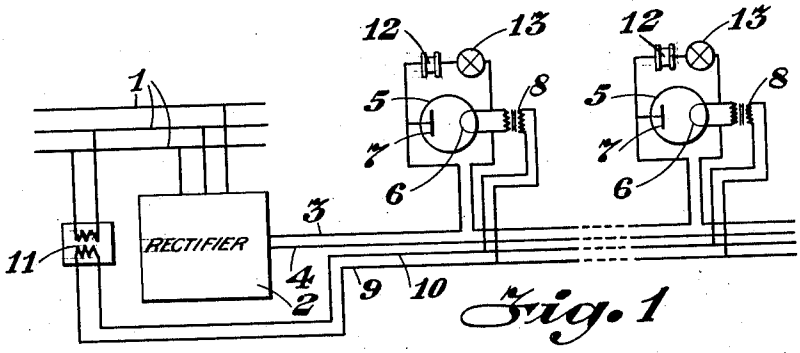


Fig. 1

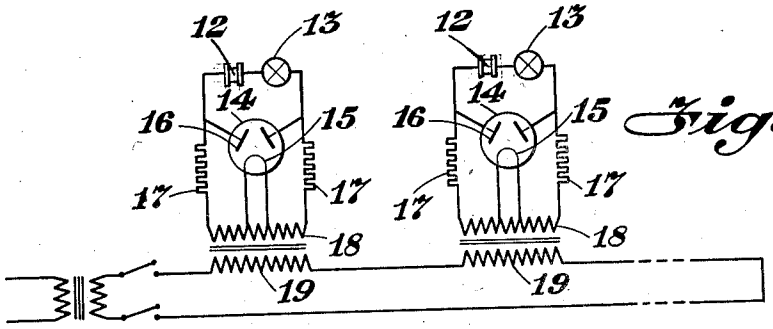


Fig. 2

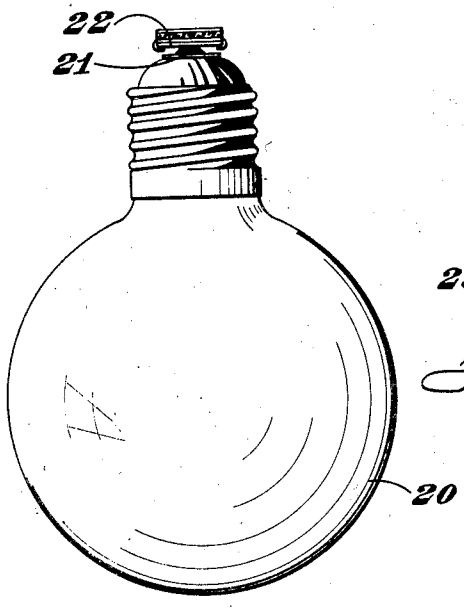


Fig. 3

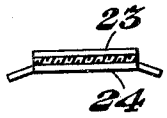


Fig. 4

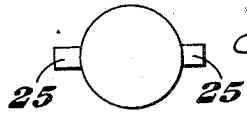


Fig. 5

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SERIES LIGHTING SYSTEM

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5 Claims. (Cl. 171—97)

The present invention relates to series lighting systems and more particularly the invention relates to improvements in series lighting systems using gaseous electric conduction devices as sources of illumination.

The object of the invention is to improve the reliability of such systems. Still further objects and advantages attaching to the device and to its use and operation will be apparent to those skilled in the art from the following particular description.

The invention attains its objects by connecting an incandescent lamp in parallel with each of the gaseous electric conduction lamp devices and by connecting a resistance element in series with said incandescent lamp. The resistance element is of such a character that the starting potential of the gaseous electric conduction lamp device is not high enough to overcome the resistance of the element and no appreciable current flows through the incandescent lamp, but when the gaseous conduction lamp device fails the resistance breaks down under the higher voltage and current flows through the incandescent lamp. The incandescent lamp then replaces the gaseous electric conduction lamp device in the system to afford uniterrupted illumination for roads, airports, or the like.

In the drawing accompanying and forming part of this specification an embodiment of the invention is illustrated in which,

Fig. 1 is a wiring diagram of a lighting system embodying the present invention,

Fig. 2 is a wiring diagram of another lighting system embodying the present invention,

Fig. 3 is a front elevational view of an incandescent lamp useful in the systems illustrated in Figs. 1 and 2.

Fig. 4 is a side, partly sectional view of a resistance element useful in the invention, and

Fig. 5 is a top view of the resistance element illustrated in Fig. 4.

Referring to Fig. 1 of the drawing a rectifying device 2, such as a mercury arc rectifier, is connected to the conductors 1 of a three phase power source. A plurality of gaseous electric conduction lamp devices 5 having an anode 7 and a thermionic cathode 6 are supplied with direct current and connected in series by the leads 3 and 4 of the rectifying device 2. Each of said gaseous conduction lamp devices 5 has a gaseous atmosphere therein comprising the starting and operating mixtures of gases now known in the art and is a mixture of neon and sodium vapor, or a mixture of argon and sodium vapor, when desired. When the gaseous atmosphere comprises sodium vapor the spectrum of the light emitted by the gaseous conduction lamp devices 5 is rich in yellow rays. The heater current for each of said thermionic cathodes 6 is supplied by a transformer 8 the primary of which is connected across the leads 9 and 10 of the transformer 11. The primary of said transformer 11 is connected to the neutral and one of the other of said conductors 1.

An incandescent lamp 13 is connected in parallel with each of said conduction lamp devices 5 and a resistance 12 is connected in series with said incandescent lamp 13. The characteristics of the resistance 12 are such that at the starting voltage of the lamp device 5, which is, of course, higher than the operating voltage of said lamp device 5, no current flows through the incandescent lamp 13. When the lamp device 5 fails to operate, however, the voltage applied to said resistance 12 is higher than the starting voltage of said lamp device 5, the resistance 12 breaks down and current flows through said resistance 12 and said incandescent lamp 13 connected in series therewith. The incandescent lamp 13 is thus instantly connected in series with the other, operative gaseous lamp devices 5 in the system and uninterrupted illumination is assured.

Resistance elements having the above described characteristics are well known in the art and will be described in detail hereinafter. It will be understood, of course, that where the spectrum of the light emitted by the conduction lamps 5 is strong in a particular color, as a sodium lamp for example, the incandescent lamps 13 are provided with a screen to cut off the light other than the light of that particular color, when desired.

In the embodiment of the invention illustrated in Fig. 2 the gaseous electric conduction lamps have a gaseous filling therein similar to that described in connection with Fig. 1 and have two anodes 16 and a thermionic cathode 15. Each of said anodes 16 is connected to the secondary 18 of a transformer 18, 19. The cathode 5 is connected to the mid-part of said secondary 18. The primaries 19 of said transformers 18 and 19 are connected in series to a source of alternating current of suitable potential. The incandescent lamp 13 and the resistance 12 are connected in parallel with said gaseous conduction lamps and in series with each other as in the embodiment of the invention illustrated in

Fig. 1 and the operation thereof is the same as in the system of Fig. 1.

An incandescent lamp useful in the invention is illustrated in Fig. 3 and a resistance element useful in the invention is illustrated in Figs. 3, 4 and 5. The resistance element indicated at 12 in Figs. 1 and 2 comprises two aluminum disks 23 and 24 oxidized on their contiguous surfaces and pressed together, as shown in Fig. 4. The plate 24 has two oppositely placed tabs 25, as shown in Figs. 4 and 5. The center contact 21 of the incandescent lamp 20 has a plate 22 welded or soldered thereon, as shown in Fig. 3. The resistance element 23, 24 is attached to the lamp device 20 by bending the tabs 25 under the disk 22 as illustrated in Fig. 3. The thin layer of aluminum oxide between said disks 23 and 24 is non-conducting at the starting potential of the gaseous conduction lamp 5, but is conducting at higher voltages, such as the voltage applied thereto when the gaseous conduction lamp 5 to which it is connected in parallel in the lighting systems illustrated in Figs. 1 and 2 fails. The resistance element 23, 24 is thus connected in series with the filament of the incandescent lamp, is easily and quickly replaced and the lamp 20 is screwed into the usual socket. It has been found, however, that it is not always necessary to replace this resistance after it has functioned, in other words, after it has been made conductive by a high voltage surge. If the current through the resistance and through the incandescent lamp is interrupted by unscrewing of the lamp, it has been found in many instances that the resistance device regains its initial resistance after a short time interval and can be used again.

While we have shown and described and have pointed out in the annexed claims certain novel features of the invention, it will be understood that various omissions, substitutions and changes in the forms and details of the device illustrated and in its use and operation may be made by those skilled in the art without departing from the broad spirit and scope of the invention.

What we claim as new and desire to secure by Letters Patent of the United States is:—

1. In a series lighting system, the combination of a plurality of hot cathode vapor discharge devices, a source of energy, means arranged to connect said devices in series with each other to said source, an incandescent lamp connected in parallel with each of said devices, and means connected in series with each of said lamps to cut said lamp into the circuit and short circuit said device on the failure of said device.

2. In a series lighting system, the combination of a plurality of hot cathode vapor discharge devices, a source of energy, means arranged to connect said devices in series with each other to said source, an incandescent lamp connected in parallel with each of said devices, and means connected in series with each of said lamps to cut said lamp into the circuit and short circuit said device on the failure of said device, said means being non-conducting at the starting voltage of said device and conducting at higher voltages.

3. An incandescent lamp adapted to be connected in parallel with a gaseous electric discharge device comprising a base, a contact on said base, a disc attached to said contact and an element mounted on said disc, said element being non-conducting at the starting voltage of said device and conducting at higher voltages.

4. An incandescent lamp adapted to be connected in parallel with a gaseous electric discharge device comprising a base, a contact on said base, a disc attached to said contact and an element comprising two aluminum discs having their contiguous surfaces oxidized mounted on said disc, said element being non-conducting at the starting voltage of said device and conducting at higher voltages.

5. In combination, an incandescent lamp provided with a screw base, a resistance device comprising two metal discs separated by a resistance which becomes conductive to operating current upon the application of a high voltage, and a holder for said device attached to the center contact of said screw base.

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