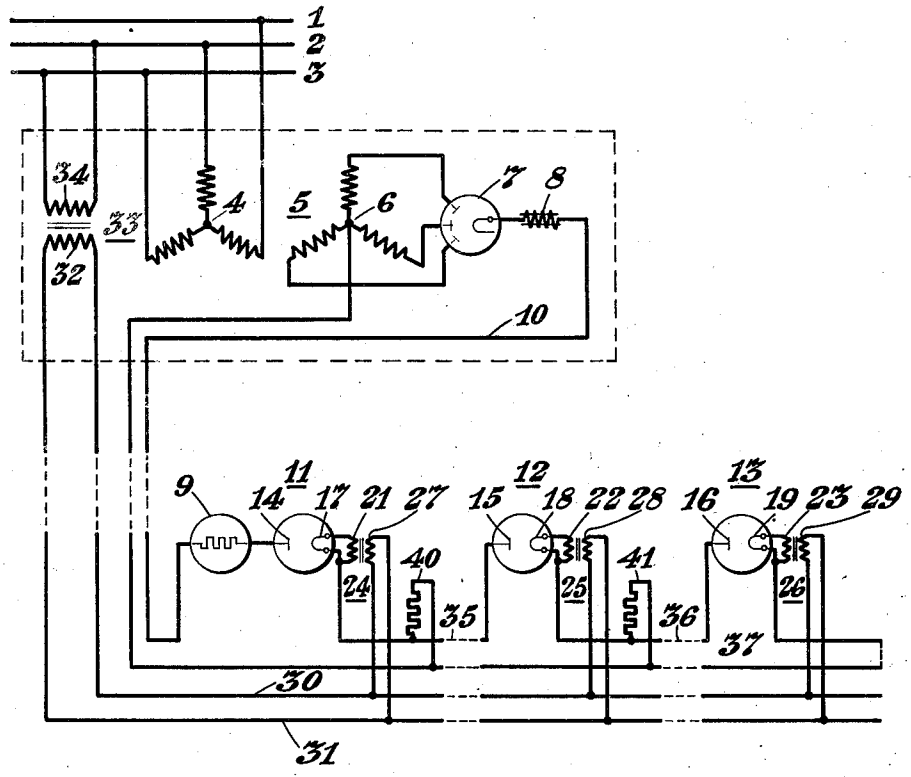
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GASEOUS ELECTRIC DISCHARGE LAMP DEVICE

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GASEOUS ELECTRIC DISCHARGE LAMP DEVICE

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The present invention relates to gaseous electric discharge lamp devices generally and more particularly the invention relates to illuminating systems comprising such devices the gaseous atmosphere of which comprises the vapor of a difficultly vaporizable material.

By a difficultly vaporizable material I mean a material the vapor pressure of which at a temperature of approximately 200° C. is but a fraction of a mm. The discharge current in such devices can be maintained substantially constant, when desired, by connecting a current variator, such as a resistance wire having a high positive thermal coefficient of electric resistance mounted in a container having an inert gaseous atmosphere therein, in series with the discharge lamp devices.

The operating characteristics of the discharge lamp devices of the type described above are affected by ambient temperature changes. When the current through the devices is regulated so that maximum operating efficiency of the device is obtained for a certain ambient temperature a change in ambient temperature lowers the efficiency of the device. When the ambient temperature drops, for example, the heat radiated by the device increases, the temperature thereof drops and the vapor pressure therein decreases which lowers the efficiency of the device. An increase in ambient temperature causes a higher vapor pressure and consequently the efficiency of the device is lessened.

The object of the present invention is to avoid the difficulties pointed out heretofore. 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 mounting and connecting the current variator in the circuit in such manner that it is subjected to the same ambient temperature changes as the gaseous electric discharge lamp device or devices with which it is connected in series. When the ambient temperature drops the variator allows a stronger current to flow through the device which increases the heat developed by the device to offset the increased heat radiation thereof and the metal vapor pressure remains unchanged. When the ambient temperature increases the current variator cuts down the current flowing through the lamps, the heat developed in said lamps diminishes as the radiation of heat therefrom diminishes and the vapor pressure therein remains unchanged. The vapor pressure is thus maintained substantially constant and the device operates at its maximum efficiency regardless of ambient temperature changes.

When a plurality of lamp devices, the gaseous atmosphere of which comprises sodium vapor, for example, and the series connected current variator are used in an illuminating system for highways, city streets, airports or the like both the variator and the lamps are mounted in the open air. I have observed that in this type of installation the effect of changes in ambient temperature on the efficiency of the lamp devices is much less than in installations wherein the current variator therefor is protected from the ambient temperature changes to which the lamps are subjected.

In the drawing accompanying and forming part of this specification an embodiment of the invention is shown, the lamp devices and the current variator being shown schematically and the circuit being shown diagrammatically.

Referring to the drawing the new and novel illuminating system comprises a three phase current source having conductors 1, 2 and 3. The primary 4 of the transformer 5 is connected to said conductors 1, 2 and 3. The secondary winding 6 of transformer 5 is a star-connected three-phase winding, the ends of which are connected to the anodes of a rectifier 7. Rectifier 7 may be of any suitable type. It may be a mercury arc rectifier or it may be a hot cathode mercury vapor discharge tube which is a type now known in the art. The rectifier is connected in series with an iron core inductance coil 8, a current regulator 9 and discharge tubes 11, 12 and 13.

The discharge lamp devices are of the thermionic, electron emitting cathode type and are filled with a mixture of a rare gas and a metal vapor, such as a mixture of neon and sodium vapor, or a mixture of argon and sodium vapor, for example. The gas or vapor filling in the lamp is dependent upon the color of the light that is desired and other factors, such as, for example, operating and starting voltages. When the gaseous atmosphere of the lamp consists of or comprises a difficultly vaporizable material, such as sodium it is desirable to provide a heat conservator for said lamps in order to obtain an effective vapor pressure therein during the operation thereof a double walled jacket having the space between the walls thereof evacuated is effective for this purpose.

The discharge devices, or tubes, 11, 12 and 13 are respectively provided with anodes 14, 15 and 16 and thermionic cathodes 17, 18 and 19. The cathodes are respectively energized by the sec-

ondary windings 21, 22 and 23 of transformers 24, 25 and 26. The primary windings 27, 28 and 29 of these transformers are respectively connected in multiple to the conductors 30 and 31 and secondary winding 32 of transformer 33 whose primary 34 is connected to the source conductors 2 and 3.

Cathode 17 is connected to anode 15 by conductor 35 and cathode 18 is connected to anode 16 by a conductor 36. The cathode 19 may be connected to another anode and the number of lamps may be thus increased. In the present case, however, it is connected to the return conductor 37, which is connected to the neutral point of the transformer winding 6. The discharge paths of the lamps are thereby connected in series with each other and the cathodes are each energized by a separate transformer winding, the respective primary windings of the transformers being connected, in multiple, to the main power source through another transformer.

In order to reduce the starting voltage of the system, leakage resistors 40 and 41 are connected between neutral conductor 37 and the conductors 35 and 36, respectively. These resistors are of a very high resistance, and permit the application of the starting voltage of the system to the lamps, in multiple, whereby the lamps start up at substantially the same time and with the system voltage substantially equal to the starting voltage of a single lamp.

The regulator 9 is connected in series with the lamp circuit to regulate the discharge current. Said regulator 9 comprises an iron wire having a high positive thermal coefficient of electric resistance, a container for said wire and an inert gaseous atmosphere in said container. The regulator 9 is mounted in such position with respect to the lamps 11, 12 and 13 that it is subjected to the same changes in the ambient temperature as said lamps 11, 12 and 13. As pointed out heretofore when the ambient temperature drops the current regulator or variator 9 permits a stronger current to flow through the lamp devices 11, 12 and 13 which increases the heat developed in said lamps to offset the increased heat radiation thereof. Likewise when the ambient temperature rises the regulator 9 cuts down the current flow to said lamp devices 11, 12 and 13, the lamp devices then generate less heat which is advantageous since the lamps do not radiate as much heat. The temperature of the container and consequently the vapor pressure therein of the lamp devices 11, 12, and 13 is thus maintained substantially constant and the illuminating system operates at maximum efficiency regardless of ambient temperature changes.

In the operation of the above described system a starting voltage somewhat higher than the starting voltage of a single lamp is applied to the system. A potential substantially equal to the source is thereby built up across each lamp through the resistors, as above described, and a discharge through each lamp is thereby started simultaneously. Since the resistances between lamps are too high to carry the discharge current, the lamps thereafter operate in series with each other and the system voltage is adjusted to the normal operating voltage. The current is thereafter regulated, as above described.

While many different types of gaseous electric discharge lamp devices can be used as sources of illumination in the above described circuit I prefer sodium lamp devices of the type in which the physical dimensions and electrical characteristics are such that the discharge is an arc discharge without a positive column. A potential of approximately 17 volts is sufficient to start lamp devices of this type into operation and the operating voltage is of course lower than the starting voltage thereof. Thirty of such devices can be used in the illuminating system described above in which case the voltage of the direct current provided by rectifier 7 is approximately 500 volts, the voltage of the secondary 32 of the transformer 33 is preferably 110 or 220 volts and the voltage of the secondaries 21, 22 and 23 of the transformers 24, 25 and 26 respectively is approximately 2 to 2½ volts.

While I have shown and described the invention in considerable detail, I do not desire to be limited to the exact arrangement shown, but seek to cover in the appended claims all those modifications that fall within the true spirit and scope of the invention.

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

1. An illuminating system comprising in combination, a plurality of vapor discharge lamps and a current variator responsive to ambient temperature changes connected in series with said lamps, said variator being subjected solely to the same ambient temperature changes as said lamps during the operation of said system.

2. An illuminating system comprising, in combination, a plurality of vapor discharge lamps and a current variator responsive to ambient temperature changes connected in series with said lamps, said variator being subjected solely to the same ambient temperature changes as said lamps and regulating the current through said lamps to compensate for said temperature changes during the operation of said system.

GILLES HOLST.