SYSTEM OF PARALLEL MERCURY VAPOR LIGHTING
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This invention relates to lightning protection for parallel connected mercury vapor lamps. Mercury vapor lamps have been used in the past for street lighting and have usually been connected in series. Various means have been used for protecting the series connected mercury vapor lamps against lightning. However, mercury vapor lamps suitable for direct parallel connection to medium voltage supply lines have appeared on the market and the problem of protecting these lamps from lightning is entirely different from that involved in protecting high voltage series connected mercury vapor lamps. Constant current supply lines are usually employed in the series lighting system whereas in the parallel lighting systems constant voltage supply lines are used.

Hereinbefore in parallel connected mercury vapor lamps it has been the usual practice to provide isolating transformers, a separate transformer being used for each mercury vapor lamp. It is obvious that the above expedient is relatively expensive.

The constant voltage feeder circuits for street lighting are usually quite long and thus unfortunately provide considerable exposure to lightning. Mercury vapor lamps directly connected to the circuit are subjected to the full severity of lightning picked up by the long feeder circuit. This invention is designed to provide lightning protection for mercury vapor lamps directly connected in parallel to the feeder lines, thus avoiding the expense of isolating transformers hereinafore noted.

Further objects of this invention are to provide means for adequately and fully protecting mercury vapor lamps, although such lamps have a negative voltage coefficient of resistivity, and to provide means which will not only prevent damage to the mercury vapor lamps due to lightning strokes but will also prevent follow through current.

Embodiments of the invention are shown in the accompanying drawings in which:

Figure 1 is a diagrammatic view showing one form of the invention, a few of the mercury vapor lamps being shown with their associated lightning protectors, the constant voltage feeder lines being shown as a grounded system.

Figure 2 is a diagrammatic view of a mercury vapor lamp connected to a non-grounded supply line.

Referring to Figure 1 it will be seen that constant voltage supply lines or feeder lines are indicated by the reference character 1. The feeder line is usually grounded by grounding one side thereof as shown in Figure 1.

The mercury vapor lamps are indicated by the reference character 2 and are connected in parallel directly to the supply line. An inductive reactivity or coil 3 and a resistor 4 are connected in series with each lamp. A lightning arrester indicated by the reference character 5 is bridged across each mercury vapor lamp and is connected to the relatively short leads 6 extending to the mercury vapor lamps at points located between the reactor 3 and the resistor 4 and the supply lines. The lightning arrester is preferably of the type shown in the patent to Mittelstadt No. 2,165,697 of June 27, 1939 and the patent to Earle and Steinhauer Re. 22,504 of June 27, 1944 and assigned to the same assignee as this application. These lightning arrester units 5 consist of a spark gap assembly 7 and a resistor 8 having a negative voltage coefficient of resistivity to prevent follow through current as described in the above noted patents.

It is apparent from the description hereinafore given that if lightning strikes anywhere along the supply line that it will be by-passed around the mercury vapor lamp or lamps to the grounded part of the line. The reactor 3 and the resistor 4 protect the mercury vapor lamp from the lightning surge. The reactor 3 is a current limiting reactor needed to limit the current through the lamps to the rated value. Both the series reactor 3 and the series resistor 4 are used to adjust the current value to the exact needs of the mercury vapor lamp so as to fit or cooperate in a manner suitable for the characteristics of each individual mercury vapor lamp. The reactor 3 and the series resistor 4 have an additional function of enormously reducing the harmful effects of the lightning surge and of preventing the building up of undesirable high voltage across the mercury vapor lamp. The reactor 3 is very effective for a sharp or steep front wave and the resistor 4 assists in this capacity but also is highly effective for a lightning surge having a gradually rising front.

In the event the mercury vapor lamp is connected to an ungrounded supply system the arrangement illustrated in Figure 2 may be followed. In Figure 2 it will be seen that the same elements or component parts are used as those in Figure 1. In addition, the short leads to the mercury vapor lamps 2 are connected to the ground on each side as indicated at 9 through a lightning arrester 10. These lightning arresters 10 are connected on the line side of the reactor 3 and the resistor 4 as shown in Figure 2. They may be of identically the same type as that indicated at 8 in Figure 1 and described hereinafore.

In all events they are provided with a spark gap and valve material having a negative voltage coefficient of resistivity as previously described.

It is to be understood that in both forms of the invention a large number of the units are connected in parallel to the constant voltage supply lines.

It will be seen that this invention provides means for adequately protecting mercury vapor lamps against lightning surges although the mercury vapor lamps have a negative voltage coefficient of resistivity and although they are connected in parallel directly to medium voltage supply lines of considerable length which are thus exposed to lightning disturbances.

The problems involved in direct connected mercury vapor lamps arranged in parallel are different from those encountered in series systems. In series systems the mercury vapor lamps are connected in constant current circuits and the current at each lamp is relatively small and the problem of follow through current is not as pronounced as in parallel connected mercury vapor lamp systems. In parallel mercury vapor lamp systems the follow through current, if no means were provided for protecting against it would be enormous. However, as is apparent from the previous description, adequate means have been provided by this invention to protect each individual mercury vapor lamp against lightning damage and to guard against follow through current and to eliminate the necessity of using individual isolating transformers for each individual mercury vapor lamp.

It is to be understood that if desired the lightning arrester 10 shown in Figure 2 may be employed in the system shown in Figure 1 in identically the same manner as that shown in Figure 2.

It is also to be understood that if desired either impedance means 3 or 4 may be omitted and only one of
them used although it is preferable to use both of them. Also other impedance means or combinations thereof could be used in place of those shown in the drawings though it is to be understood that the form shown is the preferred form.

It is to be understood further that if desired the resistor alone can be used since the resistor plays a very important part as it affords protection to the lamp on all types of impulse voltages.

Other types of impedance means can be employed. For instance, a capacitor in parallel to the inductance can be used to form a wave trap and can be tuned to relatively high frequencies while still offering very low impedance to the 60 cycle current flow.

Although this invention has been described in considerable detail, it is to be understood that such description is intended as illustrative rather than limiting, as the invention may be variously embodied and is to be interpreted as claimed.

I claim:

1. A system of parallel connected mercury vapor lamps comprising a feeder line, a plurality of mercury vapor lamps connected in parallel to said feeder line, impedance means for each mercury vapor lamp connected in series between the mercury vapor lamp and the feeder line, and a lightning arrester connected in shunt to each of the mercury vapor lamps and connected between the impedance means and the feeder line.

2. A system of parallel connected mercury vapor lamps comprising a grounded feeder line, a plurality of mercury vapor lamps connected in parallel to said feeder line, impedance means for each mercury vapor lamp connected in series between the mercury vapor lamp and the feeder line, and a lightning arrester connected in shunt to each of the mercury vapor lamps and connected between the impedance means and the feeder line.

3. A system of parallel connected mercury vapor lamps comprising a feeder line, a plurality of mercury vapor lamps connected in parallel to said feeder line, impedance means for each mercury vapor lamp connected in series between the mercury vapor lamp and the feeder line, a lightning arrester connected in shunt to each of the mercury vapor lamps and connected between the impedance means and the feeder line, and a grounded lightning arrester connected on each side of said first mentioned lightning arrester.

4. A system of parallel connected mercury vapor lamps comprising a non-grounded feeder line, a plurality of mercury vapor lamps connected in parallel to said feeder line, impedance means for each mercury vapor lamp connected in series between the mercury vapor lamp and the feeder line, a lightning arrester connected in shunt to each of the mercury vapor lamps and connected between the impedance means and the feeder line, and a grounded lightning arrester connected on each side of said first mentioned lightning arrester.

5. A system of parallel connected mercury vapor lamps comprising a feeder line, a plurality of mercury vapor lamps connected in parallel to said feeder line by lead-in conductors, a lightning arrester connected in shunt to each lamp across the lead-in conductors for the corresponding lamp, an impedance means in each of said lead-in conductors between said lightning arrester and said lamp, and a grounded lightning arrester for each lead-in conductor connected at one end to the ground and at the other end to the corresponding lead-in conductor on the side of said impedance means nearest said feeder line.

6. A system of parallel connected mercury vapor lamps comprising a feeder line, a plurality of mercury vapor lamps connected in parallel to said feeder line, reactance means for each mercury vapor lamp connected in series between the mercury vapor lamp and the feeder line, a lightning arrester connected in shunt to each of the mercury vapor lamps and connected between the reactance means and the feeder line, and at least one grounded lightning arrester connected between the reactance means and the feeder line.

7. A system of parallel connected mercury vapor lamps comprising a feeder line, a plurality of mercury vapor lamps connected in parallel to said feeder line, a resistor for each mercury vapor lamp connected in series between the mercury vapor lamp and the feeder line, and a lightning arrester connected in shunt to each of the mercury vapor lamps and connected between the resistor and the feeder line.

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