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POLYPHASE LUMINOUS TUBE AND CIRCUIT

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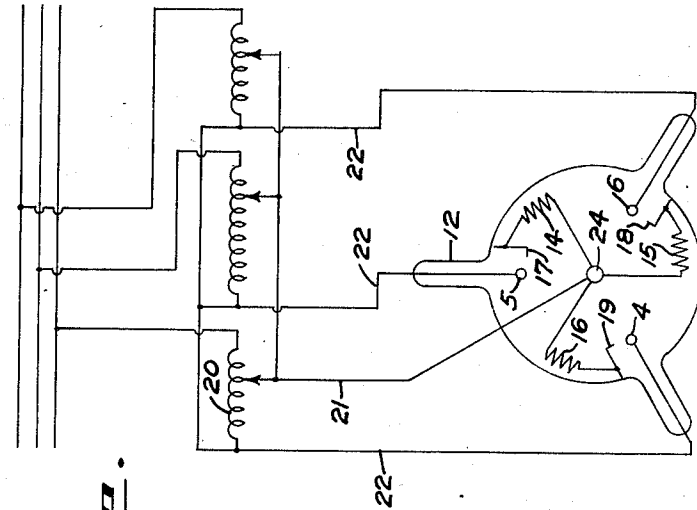


Fig. 1.

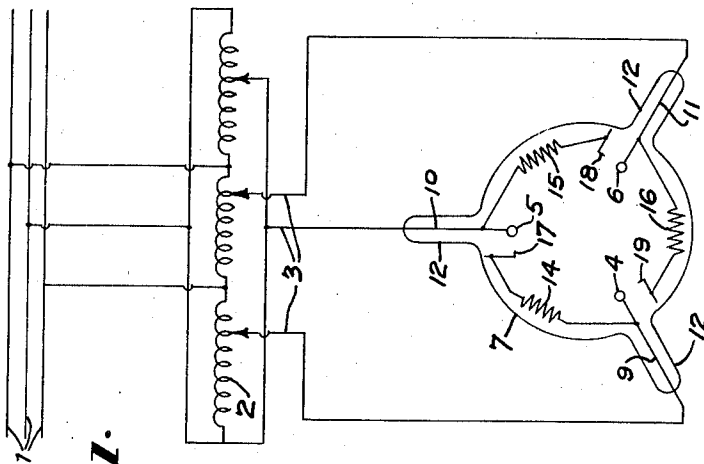
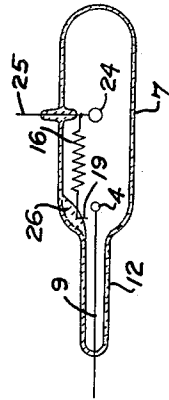


Fig. 2.

Fig. 3.



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POLYPHASE LUMINOUS TUBE AND CIRCUIT

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10 Claims. (Cl. 176-124)

Our invention relates to luminous tubes, and more particularly to a luminous tube operating on polyphase circuits to give substantially uniform light output. This application is a continuation in part of our prior application, Serial No. 129,544, filed March 8, 1937.

In our prior application above identified, we have described a system of illumination utilizing closely adjacent luminous tubes energized by polyphase alternating current in such a manner that the stroboscopic effect on moving objects illuminated by the system was greatly reduced. The application referred to also described a special lamp comprising a plurality of luminous tubes operating beneath a single reflector, in order that the total illumination from the group of tubes be maintained constant and the dark area continuously shifted.

The present application utilizes the same general system. The light, however, is produced from a single tube having electrodes therein so arranged that there will be continuous light emission therefrom, with a minimum of stroboscopic effect.

The main object of our present invention, therefore, is to provide a luminous tube operable upon polyphase currents, to the end that stroboscopic effects are greatly reduced.

Among other objects of our invention are: To provide a polyphase luminous tube of simple construction and which is self-starting; to provide a self-starting luminous tube having a rotating light source therein; to provide a luminous tube operating by gaseous conduction, in which the position of the luminous gas is continually changing; to provide a means and method of reducing the stroboscopic effect of a gaseous conduction lamp; to provide an illuminating system utilizing gaseous conduction lamps wherein the luminous column is rotating; and to provide a method of reducing stroboscopic effects in a gaseous conduction lamp.

Our invention possesses numerous other objects and features of advantage, some of which, together with the foregoing, will be set forth in the following description of specific apparatus embodying and utilizing our novel method. It is therefore to be understood that our method is applicable to other apparatus, and that we do not limit ourselves, in any way, to the apparatus of the present application, as we may adopt various other apparatus embodiments, utilizing the method, within the scope of the appended claims.

Referring to the drawing:

Fig. 1 is a diagram illustrating one form of our invention, energized from three-phase mains through a delta connection.

Fig. 2 is a diagram showing a modification of the tube of our invention attached to the three-phase mains through a Y connection.

Fig. 3 is a sectional view of a portion of the luminous tube shown diagrammatically in Fig. 2.

The broad aspect of our invention may be more fully understood by direct reference to the figures.

In Fig. 1, the a.-c. mains 1 are connected to an autotransformer 2, in a manner well known in the art, to produce a delta-energized line 3. Each leg of this line leads to equally spaced peripheral main electrodes 4, 5 and 6 in a tube envelope 7. The main electrodes 4, 5 and 6 may be of any desired shape or size proper to carry the current desired, and are supported on leads 9, 10 and 11, respectively, sealed through lateral arms 12 projecting from the envelope. It is not necessary that the envelope contour be spherical, as it may be compressed in one dimension to have a generally oval cross section.

Leads 9, 10 and 11 are connected to the legs of the delta-energized line 3. The electrodes 4, 5 and 6 are connected to one end of internal resistors 14, 15 and 16, respectively, the other ends of the resistors being connected to individual starting electrodes 17, 18 and 19, respectively. The starting electrodes terminate adjacent the next electrode around the periphery in one direction so that, for example, the starting electrode 17, connected to electrode 4 through resistance 14, is presented to electrode 5; the starting electrode 18, connected to electrode 5 through resistor 15, is adjacent electrode 6; and starting electrode 19, which is connected to electrode 6 through resistor 16, is presented to electrode 4. Thus, each electrode 4, 5 and 6 is provided with a starting circuit and a resistance of its own, self-contained within the envelope.

The tube is then exhausted in the usual manner, is filled with the gas it is desired to ionize, and is ready for operation. We prefer to utilize mercury vapor illumination, and therefore provide the tube with the proper amount of mercury, together with a small amount of starting gas, such as neon or argon.

In operation, when the delta line 3 is energized, the first high difference of potential between a starting electrode and a main electrode causes a breakdown of the starting gas, and ionization occurs across the starting gap. If sufficient mercury vapor is released immediately, then the full current flow will start between the tube electrodes

that have the highest difference in potential. If, however, sufficient mercury is not immediately vaporized, the next starting gap will break down, and if the tube is slow in heating up, the starting gaps will be serially energized, in accordance with the phases of the line, until sufficient mercury vapor is formed to strike the arcs directly between the main electrodes. When there is sufficient mercury vaporized for the arcs to strike between electrodes 4 and 5, 5 and 6, and 6 and 4, the resistance of these long paths will be less than the resistance of the short starting gaps, plus the starting resistors. Consequently, the starting gaps will be short-circuited and the illuminating current will be carried between the main electrodes.

If the current and voltage supply to these main electrodes be analyzed, it will be seen that two of the paths will be illuminated while the other one is dark; one of the gaps being illuminated on the negative half cycle, the next on the positive half cycle, the third being dark. As illumination continues in time, however, the gap that is dark will change position with the frequency of the supply current, so that what actually happens is that the dark gap is continually rotating within the tube. The total illumination emitted from the tube will be constant. The dark spot within the tube is continually shifting in position, and therefore shadows cast by the device will not remain in the same position. As a consequence, stroboscopic effects on illuminated objects are greatly reduced. It will be noticed that in the tube the arc paths are chords of the circle described by the ends of the rotating arcs.

While we have shown each electrode provided with a starting resistance and starting gap, it is of course obvious that the tube would operate by the use of a single starting circuit. However, in case any one resistor should accidentally fail for any reason, the other two are always available for use. The resistors also aid in warming up the tube quicker than if only a single starting circuit were utilized. The placing of the resistors inside the tube not only aids in warming up the tube, but also greatly reduces the number of leads sealed through the wall of the envelope.

In Fig. 2 we have shown the tube of our invention modified for use on a Y connection. In this case the Y transformer 20 is provided with a common lead 21 and Y leads 22. The common lead 21 is connected to a central common electrode 24, and the Y leads 22 are connected to the electrodes 4, 5 and 6 in the usual manner. Here, however, resistors 14, 15 and 16 are all connected at one end to the common electrode 24, and at the other end to the described starting electrodes 17, 18 and 19, respectively. In this type of tube the starting gaps will operate as described for the tube shown in Fig. 1.

The main arcs, however, are established between electrodes 4, 5 and 6 and the center electrode 24, and in this case the luminous columns will be radial and rotate as the spokes of a wheel, whereas in the tube shown in Fig. 1 the arcs are peripheral and rotate as the tire of a wheel. Both tubes have their uses, and the difference in the manner in which the luminous paths rotate will fit them for such specific uses as may come up in the art of illumination.

In Fig. 3 we have shown in section a portion of the particular tube shown diagrammatically in Fig. 2. Here, the central electrode 24 is supported by a central lead 25 sealed through the top of the device. The electrode 4 is supported

on lead 9 sealed through arm 12, and the resistor 16 is attached between the starting electrode 24 and the central electrode lead 25. The starting electrode 24 is sealed into an enlargement 26 of the envelope wall. Thus it can be seen that the starting resistors are solidly supported by their ends within the tube without the use of any insulating material, frames, etc., and that the entire tube is strong and sturdy.

Other practical constructions will immediately suggest themselves to those skilled in the art, and we do not wish to be limited by the exact illustrations herein which are given purely as examples.

It is also obvious that our invention is not limited to tubes operating on three-phase lines. Other polyphase lines may be utilized, and the number of peripheral electrodes increased to accommodate the number of phases desired.

We also do not wish to be limited as to size, as it is obvious that both very small and very large tubes may be built, embodying the same invention.

Having thus described our invention, what we claim and desire to secure by Letters Patent is:

1. A polyphase gaseous conduction lamp comprising an envelope containing a plurality of equally spaced main electrodes peripherally positioned, a filling of conductive gas, and a starting resistance inside of said envelope connected at one end to one of said electrodes and terminating close to one of the next adjacent electrodes.

2. A polyphase gaseous conduction lamp comprising an envelope containing a plurality of equally spaced main electrodes peripherally positioned, a filling of conductive gas, and a separate starting resistance connected to each of said electrodes and extending to terminate adjacent the next electrode around the periphery in one direction.

3. A polyphase gaseous conduction lamp comprising an envelope containing a plurality of equally spaced main electrodes peripherally positioned, a filling of conductive gas, a separate starting electrode terminating adjacent each main electrode to provide starting gaps, and means wholly within said envelope for supplying a starting voltage to said gaps when said main electrodes are energized.

4. A polyphase gaseous conduction lamp comprising an envelope containing a plurality of equally spaced main electrodes peripherally positioned, a filling of conductive gas, a separate starting electrode terminating adjacent each main electrode to provide starting gaps, and a resistive starting circuit wholly within said envelope, connected between each of said starting electrodes and the next main electrode on the periphery in one direction.

5. A polyphase gaseous conduction lamp comprising an envelope containing a plurality of equally spaced main electrodes peripherally positioned, a filling of conductive gas, a separate starting electrode terminating adjacent each main electrode to provide starting gaps, a centrally located common electrode, and a resistive starting circuit wholly within said envelope, connected between each of said starting electrodes and said common electrode.

6. A polyphase gaseous conduction lamp comprising an envelope containing a plurality of equally spaced main electrodes peripherally positioned, a filling of conductive gas, a starting resistance inside of said envelope connected at

one end to one of said electrodes and terminating close to one of the next adjacent electrodes, and means for energizing said peripherally positioned electrodes with one phase of a polyphase alternating supply.

5 7. A polyphase gaseous conduction lamp comprising an envelope containing a plurality of equally spaced main electrodes peripherally positioned, a filling of conductive gas, a separate
10 starting resistance connected to each of said electrodes and extending to terminate adjacent the next electrode around the periphery in one direction, and means for energizing said peripherally positioned electrodes with one phase of a
15 polyphase alternating supply.

8. A polyphase gaseous conduction lamp comprising an envelope containing a plurality of equally spaced main electrodes peripherally positioned, a filling of conductive gas, a separate
20 starting electrode terminating adjacent each main electrode to provide starting gaps, means wholly within said envelope for supply a starting voltage to said gaps when said main electrodes are energized, and means for energizing said
25 peripherally positioned electrodes with one phase of a polyphase alternating supply.

9. A polyphase gaseous conduction lamp comprising an envelope containing a plurality of equally spaced main electrodes peripherally positioned, a filling of conductive gas, a separate
5 starting electrode terminating adjacent each main electrode to provide starting gaps, a resistive starting circuit wholly within said envelope, connected between each of said starting electrodes and the next main electrode on the periphery in
10 one direction, and means for energizing said peripherally positioned electrodes with one phase of a polyphase alternating supply.

10. A polyphase gaseous conduction lamp comprising an envelope containing a plurality of
15 equally spaced main electrodes peripherally positioned, a filling of conductive gas, a separate starting electrode terminating adjacent each main electrode to provide starting gaps, a centrally located common electrode, a resistive
20 starting circuit wholly within said envelope, connected between each of said starting electrodes and said common electrode, and means for energizing said peripherally positioned electrodes with one phase of a polyphase alternating supply.

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