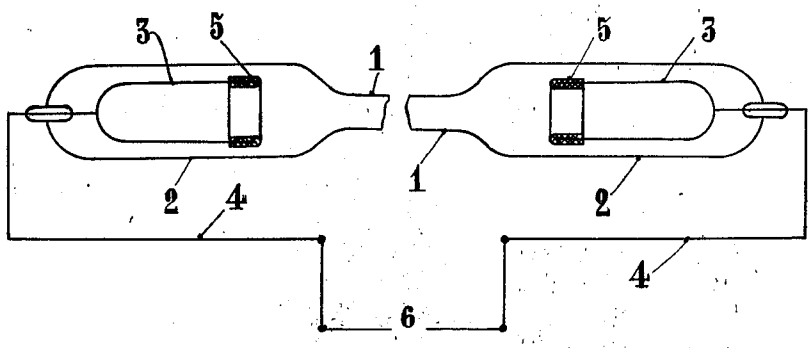
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ELECTRIC LIGHTING APPARATUS

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ELECTRIC LIGHTING APPARATUS

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9 Claims. (Cl. 176—126)

The present invention relates to electric lighting apparatus and more particularly to gaseous discharge apparatus.

In my U. S. patent application Serial No. 570,451, filed October 22, 1931, relating to electric lighting devices which comprise more particularly a discharge apparatus functioning on the arc principle and in which the gaseous mass is at a very low pressure, the value of which perhaps may be equal to a few hundredths of a millimeter of mercury, I have described methods of constructing anodes having for their object reduction of absorption of the gas due to the electric discharge and the obtaining of an apparatus of great durability of working and high output of energy.

One way of constructing an anode of this kind consists in covering with a suitable dielectric, for example silica, glass, or quartz, the parts of the anode, and notably its edges, which are liable to disintegrate by projecting particles of the anodic material on to the cold parts or insufficiently heated parts of the discharge apparatus.

I have discovered that this method of construction is equally applicable to the electrodes of electric discharge apparatus with rare gases functioning on the luminescent principle. The result obtained is such that, with electrodes having an equal surface and nature, the life of the lighting apparatus is considerably increased, and it thus becomes possible to construct electric discharge apparatus functioning on the luminescent principle in which for the same or a greater duration of working the pressure of the gaseous mass (rare gas or mixture of rare gases) has a value distinctly lower than that of the apparatus functioning on the luminescent principle at present employed and which with an equal consumption of energy have the additional advantage of possessing an illuminating power distinctly superior to that of present apparatus. Furthermore, in these apparatus it is possible, while maintaining these advantages, to increase the consumption of energy without modifying the surface of the electrodes.

For example, it is well-known that luminescent tubes having an atmosphere of helium can only operate under conditions of durability acceptable in industry by using relatively high pressures, of the order of ten millimeters of mercury, and with low current intensities. The utilization of electrodes of large surface cannot reduce with low pressures, the accelerated absorption of helium. On the contrary a rare gas electric discharge apparatus, and notably a helium gas apparatus functioning on the luminescent principle, and provided with electrodes of which the parts capable of disintegration are covered with a dielectric has a considerably increased life and it is thus possible to produce an apparatus of this kind provided with electrodes of reduced surface subjected to great current intensities and containing a gaseous atmosphere at low pressure assuring a high luminous output.

Advantages equally valuable can also be obtained with electric discharge apparatus containing gas mixtures in which it is necessary to preserve the constancy of proportions of the gaseous constituents during the life of the apparatus, such as when one or several of the constituents of the gas mixtures employed is by its nature particularly absorbable, as for example helium, or when one or several of the constituents is in very weak proportions, the gas mixture containing for example a very low percentage of neon in an atmosphere of helium.

An electrode according to the present invention may be obtained, for example, by dipping in melted borax or in enamel the open end of a closed metal cylinder constituting the electrode.

The diagrammatic drawing annexed shows by way of example only and without in any way limiting the scope of the invention, an arrangement constructed on the lines above stated.

In this drawing, 1 is a luminous tube containing a rarefied gaseous mass formed for example of helium. This tube is provided at each of its ends with a chamber 2 containing an electrode 3, which is adapted in this case to act alternately as anode and cathode. These electrodes are connected to an external electric circuit 4—4. Each of these electrodes is constituted by a metal cylinder closed at one of its ends. At its opposite open end each electrode is covered externally and internally with a layer 5 of a dielectric material. This layer may have been obtained, for instance, by plunging this open end of the electrode into a bath of melted borax or into a bath of enamel, in such a manner as to enclose or sheath the free edge of the said electrode and the external and

internal surface of the same er the length desired.

The dielectric coating thus obtained has the advantage of being extremely light, and consequently not appreciably increasing the weight of the electrode or the tube.

The electric discharge apparatus thus formed is connected by the conductors 4—4 to a source of electrical energy 6 which forms with these conductors and this apparatus an electric circuit the characteristics of which are such that the electric discharge apparatus 1 operates on the luminescent principle. In these conditions, an electric discharge apparatus 1 charged with helium at an initial pressure of less than five millimeters of mercury, for instance two millimeters has a duration of working equal to and even superior to that obtained with a similar discharge apparatus provided with electrodes with free edges and charged with helium at a pressure of ten millimeters of mercury, and this lighting apparatus according to the invention has furthermore the additional advantage of having an energy output distinctly superior to that of the usual lighting apparatus.

I have observed that the use of the device above described is particularly effective when it is applied to cathodes which are capable of acting as anodes, and which comprise, according to a known arrangement, a deposit giving rise to a small cathode drop, lower than 20 volts: this deposit may consist for example either of alkaline or alkaline-earth metal, such as potassium and barium, or of oxides having a high emissive power, such as the oxides, peroxides or suboxides of rare earths. In the latter case, these oxide deposits may be brought to incandescence by known means.

I claim as my invention:

1. An apparatus for producing an electric discharge in a gaseous atmosphere consisting of helium at a pressure of about 2 millimeters, comprising a plurality of electrodes, each of which is adapted to serve both as a cathode and an anode, each of said electrodes having the portion thereof subject to disintegration, to form deposits on the cold walls of the apparatus, provided with a dielectric coating, said electrodes in addition being provided with a deposit for effecting a small cathodic drop containing a metal selecter from the group consisting of alkali and alkali earth metals, and means for maintaining a current density in the apparatus of less than 0.75 milliampere per square millimeter of cross section.

2. An apparatus for producing an electric discharge in a gaseous atmosphere consisting of helium at a pressure of about 2 millimeters, comprising a plurality of electrodes, each of which is adapted to serve both as a cathode and an anode, each of said electrodes having the portion thereof subject to disintegration, to form deposits on the cold walls of the apparatus, provided with a dielectric coating, said electrodes in addition being provided with a deposit of metallic oxide having a high emissive power for effecting a small cathodic drop, said deposit being adapted to be brought to incandescence during operation of the discharge apparatus, and means for maintaining a current density in the apparatus of less than 0.75 milliampere per square millimeter of cross section.

3. An apparatus for producing an electric discharge in a gaseous atmosphere, comprising an envelope filled with a gaseous atmosphere containing at least one rare gas, a plurality of spaced electrodes positioned in said envelope, each of which serves at the same time as a cathode and anode, said electrodes having thin free edges subjected to an intense electric field, a dielectric coating on the portions of each electrode which are subjected to an intense electric field, and a deposit covering the electrodes for producing a small cathodic drop and containing a metal selected from the group consisting of alkali and alkaline earth metals.

4. An apparatus for producing an electric discharge in a gaseous atmosphere, comprising an envelope filled with a gaseous atmosphere containing at least one rare gas, a plurality of spaced electrodes positioned in said envelope, each of which serves at the same time as a cathode and anode, said electrodes having thin free edges subjected to an intense electric field, a dielectric coating on the portions of each electrode which are subjected to an intense electric field, and a deposit of an alkaline earth metal oxide covering the electrodes for producing a small cathodic drop, said deposit being adapted to be brought to incandescence during operation of the apparatus.

5. An apparatus for producing an electric discharge in a gaseous atmosphere, comprising an envelope filled with a gaseous atmosphere containing at least one rare gas at a pressure less than 5 millimeters of mercury, a plurality of spaced electrodes positioned in said envelope, each of which serves at the same time as a cathode and anode, said electrodes having thin free edges subjected to an intense electric field, a dielectric coating on the portions of each electrode which are subjected to an intense electric field, and a deposit covering the electrodes for producing a small cathodic drop and containing a metal selected from the group consisting of alkali and alkaline earth metals.

6. An apparatus for producing an electric discharge in a gaseous atmosphere, comprising an envelope filled with a gaseous atmosphere containing at least one rare gas at a pressure less than 5 millimeters of mercury, a plurality of spaced electrodes positioned in said envelope, each of which serves at the same time as a cathode and anode, said electrodes having thin free edges subjected to an intense electric field, a dielectric coating on the portions of each electrode which are subjected to an intense electric field, and a deposit of an alkaline earth metal oxide covering the electrodes for producing a small cathodic drop, said deposit being adapted to be brought to incandescence during operation of the apparatus.

7. An apparatus for producing an electric discharge in a gaseous atmosphere, comprising an envelope filled with helium at a pressure less than 5 millimeters of mercury, a plurality of spaced electrodes positioned in said envelope, each of which serves at the same time as a cathode and anode, said electrodes having thin free edges subjected to an intense electric field, a dielectric coating on the portions of each electrode which are subjected to an intense electric field, and a deposit covering the electrodes for producing a small cathodic drop and containing a metal selected from the group consisting of alkali and alkaline earth metals.

8. An apparatus for producing an electric discharge in a gaseous atmosphere, comprising an envelope filled with helium at a pressure less than 5 millimeters of mercury, a plurality of spaced electrodes positioned in said envelope, each of

which serves at the same time as a cathode and anode, said electrodes having thin free edges subjected to an intense electric field, a dielectric coating on the portions of each electrode which are subjected to an intense electric field, and a deposit of an alkaline earth metal oxide covering the electrodes for producing a small cathodic drop, said deposit being adapted to be brought to incandescence during operation of the apparatus.

9. An apparatus for producing an electric discharge in a gaseous atmosphere, comprising an envelope filled with a gaseous atmosphere containing at least one rare gas at a pressure less than 5 millimeters of mercury, a plurality of spaced electrodes positioned in said envelope, each of which serves at the same time as a cathode and anode, said electrodes having thin free edges subjected to an intense electric field, and a dielectric coating on the portions of each electrode which are subjected to an intense electric field.

ANDRÉ CLAUDE.