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LUMINESCENT TUBE

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No Drawing. Continuation of application Serial No. 44,767, October 12, 1935. This application December 15, 1937, Serial No. 179,947

4 Claims. (Cl. 176—122)

This application is a continuation of my application entitled "Luminescent tubes", Ser. No. 44,767, filed October 12, 1935.

The present invention relates to a coating material used in producing a new and novel effect in luminescent tubes of the type utilizing the electric discharge through a rarefied rare gas. The use of this coating material on the electrodes followed by the normal processing of the tube during exhaustion affords a means whereby the discharge is caused to no longer fill the entire bore of the glass tube but to fill only a portion thereof and to wander and waver around throughout the length of the discharge tube, thus producing a very unique and novel effect—that of a longitudinally striated discharge.

By utilizing the method now disclosed it is possible to produce tubes with one or more longitudinal streamers through the tube, the streamer not filling the bore of the tube and not continuing in a quiescent discharge along the tube but wandering about in a manner apparently directed only by local and varying conditions within the tube.

Applicant believes himself to be the first to have produced such a discharge at will and to be the only one who has been able to produce such a discharge by treating the electrode of the discharge tube.

The metal of the electrode is coated thoroughly with an oil, grease or oily, fatty or waxy substance and the tube is then subjected to the usual procedure of heating by an electric current sufficient to outgas the glass walls of the tube and to heat the electrodes sufficiently to cause them to emit any excess gas that may interfere with the operation of the tube after it has been sealed from the pump.

In an endeavor to find special virtues in the materials used in producing the so-called ripple effect I have used a very wide variety of oils and fats. I have used mineral oil of both asphalt and paraffine base. I have also used a number of vegetable oils such as cottonseed oil and linseed oil. I have used animal fats such as fat obtained from the pig, beef and rabbit. I have used fat from fowls, oil obtained from fish and even bees wax and paraffine. In all cases the ripple is readily produced.

In the processing of the tube, after the electrodes have been sealed to the tube and the tube sealed to the pump, I pump the tube until the pressure remaining is in the neighborhood of one millimeter. The discharge is now started and pumping continued intermittently to remove the gas that is liberated by the electrodes and the material with which they have been coated. If the final heating of the tube is accomplished at a current of say one hundred milliamperes the experienced operator will soon be able to judge from the rate of emission of gas by the electrodes when exhaustion has proceeded to the extent that the tube may be filled and thereafter be able to withstand the normal operating current of say thirty milliamperes.

When the usual processing of the tube has been completed the tube is thoroughly pumped to remove any remaining gases, the discharge having been stopped. The tube is then filled with one of the rare gases such as argon and a small quantity of mercury is introduced to cause the tube to present a bluish appearance. I have used other gases than argon, such as neon and various mixtures of neon and argon or neon and krypton. The pressure of argon used is in the neighborhood of ten millimeters as is normal in luminescent tube practice.

The exact manner in which the coating material functions to cause the ripple is not well understood. It seems probable that the residue on the electrode causes the emission or formation of a small quantity of gas in the neighborhood of the electrode and perhaps a distribution of this gas throughout the tube. It is certain that some of this gas is attached to the walls of the tube. The presence of this gas in combination with the rare gas and the mercury vapor causes the discharge to not fill the entire area of cross-section of the tube but to occupy only a portion thereof.

If one places the oily substance on the walls of the glass tube instead of on the electrodes themselves it is also possible during bombardment of the tube in processing it to vaporize enough of the material that some of it condenses on the electrodes or on the glass walls throughout the tube so that the tube is thereby caused to have the same ripple appearance when completed that it would have if the material had been placed on the electrodes only. It is therefore obvious that it is not imperative that the material shall be placed on the electrodes although it may be convenient. The essential feature is that during the processing of the tube by the heating effect of an electric current a vapor from the oil fills the tube so that at least a part of the bombardment takes place in this vapor affording an opportunity for it to form a layer on the walls of the tube. I have also prepared tubes by maintaining the oil in a side-

tube which is ultimately to be sealed off, thus permitting only the vapor to penetrate the tube during the processing.

It is obvious from the foregoing that I provide a coating on the interior surface of the tube, which coating is of an oily substance the ionizing potential of whose molecules is slightly different from the ionizing potential of the inert gas conductor with which the tube is charged.

While I have described the effect as a ripple and as a longitudinal striation the terminology available is insufficient, the word striation not being intended to convey the impression that the discharge is multiple lined. The diameter of the luminous streamer of the discharge is frequently as small as five millimeters in a tube of fifteen millimeters diameter. The discharge apparently clings to one wall of the tube for a few centimeters or inches of its length then moves sidewise as if in encountering a more easily ionized path. The discharge is thus laterally unstable, moving in a general circumferential manner along the inner wall of the tube. This results in a somewhat rotary motion about the axis of the tube although at a given moment the motion of rotation is seldom consistent throughout the length of the tube. While the streamer frequently is multiple lined such is not necessarily the case.

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

1. The method of producing a luminescent tube having a longitudinally striated discharge which consists in coating the electrode of the tube with an oily substance, heating the glass of the tube and the electrodes thereof to deprive them of occluded gases, evacuating said tube and filling the tube with an inert gas at reduced pressure.

2. In a luminescent tube the process of coating an electrode with an oily substance, freeing the tube and electrodes of excess gases and filling the tube with rare gas at reduced pressure, so that the resulting discharge is longitudinally striated.

3. The process of producing a luminescent tube having a longitudinally striated discharge which comprises introducing an oily substance into the tube, evacuating said tube, heating said tube by passing therethrough an electric charge to gasify said substance and cause an oily film to be formed on the inner surface of the tube, withdrawing excess gases resulting from such heating, discontinuing said heating charge, and subsequently filling the tube with an inert gas at reduced pressure.

4. The process of producing a luminescent tube operable by a normal electric current of approximately thirty milliamperes to produce a longitudinally striated discharge, said process comprising introducing an oily substance into the tube, evacuating said tube to a pressure of approximately one millimeter, heating said tube by passing therethrough an electric current to gasify said substance and cause an oily film to be formed on the inner surface of the tube and completing such heating under a current potential of approximately one hundred milliamperes, withdrawing excess gases resulting from such heating, discontinuing said heating current, and subsequently fitting the tube with an inert gas at reduced pressure.

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