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ELECTRIC DISCHARGE TUBE

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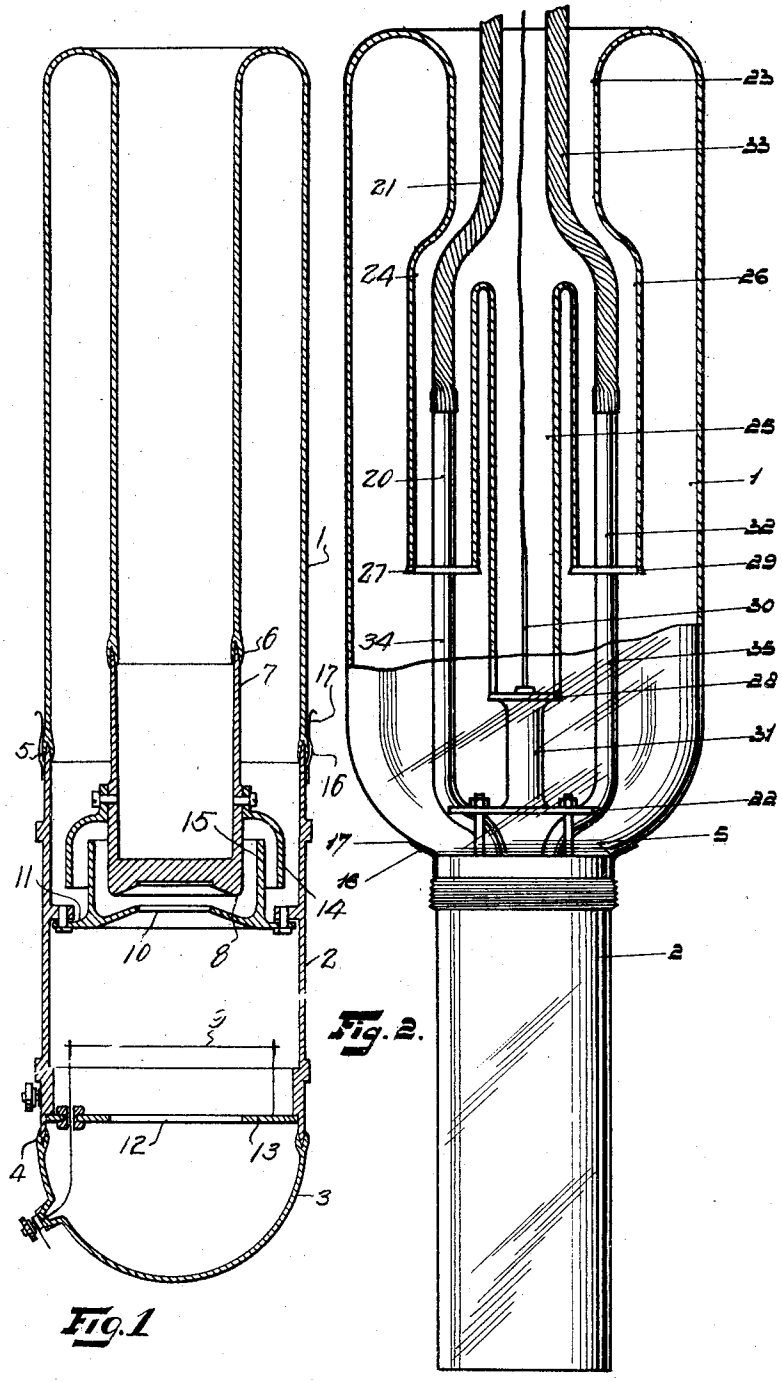


Fig. 1

Fig. 2.

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UNITED STATES PATENT OFFICE

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ELECTRIC DISCHARGE TUBE

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This invention relates to high-tension electric discharge tubes, and consists more particularly in an improved manner of protecting the seal of the envelope, which envelope consists partly of a conductor and partly of a non-conductor.

In discharge tubes it often occurs that the inner wall of the envelope is struck by charged particles which cause local charges to accumulate thereon. Also conduction through the glass and along the surface of the glass may cause local charges. If high tensions are required to be supplied between the electrodes, as in the case of X-ray tubes and transmission tubes, these charges may cause disruption or cracking of the envelope wall and other undesired phenomena. Accordingly, it has heretofore frequently been proposed to partly shield the wall of the tube from being struck by charged particles, for example by electrons, by arranging screens or shields within the tube at some distance from the wall.

The above mentioned phenomenon is particularly inconvenient if the envelope of the discharge tube consists partly of a conductor and partly of a non-conductor, for example of glass, in which case the conducting and non-conducting parts are sealed to each other. This seal of the envelope is not efficiently capable of resisting high potential difference and therefore in arranging the said screens or shields attention has been paid principally to keeping the seal or seals as far as possible beyond the reach of the electrons.

This invention has for its object to provide another means for obviating the said inconvenience in a simple and effectual manner.

According to the present invention, the surface of the discharge tube is provided with one or more conductive coatings which immediately cover the seal or seals. These coatings may consist, for example, of a strip of metal foil, such as lead foil or tin foil, disposed against the outer or inner surface of the seal; or either the outer or the inner wall of the tube may be coated locally with a metal coating, for example, a silver mirror. In all cases the conductive coating should preferably be in contact on one side with the conductive part of the envelope whereas on the other side it should extend some distance, at least some millimetres, beyond the seal.

The danger zone is thereby shifted from the seals between the conductive and the non-conductive parts of the envelope to the free ends of the conductive coatings where the non-conductive wall is better capable of resisting the tensions which occur. This may be explained by the fact that owing to the presence of the coating the danger zone is shifted from the interior of the non-conductive envelope to the outer or inner wall of the said envelope.

Frequently it may be advisable to have the free end of the coating terminate in a rounded edge rather than in a sharp edge in order to reduce the field intensity at the edge.

The device according to the invention is also adapted for use in combination with the above mentioned screens or shields.

The invention will be more clearly understood with reference to the accompanying drawings in which

Figure 1 represents an X-ray tube and Figure 2 represents a transmission tube, the invention being applied to both tubes.

The X-ray tube represented in Figure 1, consists of a glass part 1 having sealed to it at 5 a metal part 2, for example, of chrome-iron to which is sealed at 4 a glass window 3. The glass cylinder 1 has a re-entrant portion to which is sealed at 6 a metal tube 7 carrying on the lower side an anticathode 8.

The electrons emitted by the incandescent cathode 9, pass through a diaphragm 10 of a disc 11, and the rays emitted by the anticathode, can leave the tube through an aperture 12 of a disc 13 and through the window 3.

To the tube 7 is secured a shield 14 which has consequently the same potential as the anticathode and which, together with a second shield 15 which is secured to the disc 11 and therefore has the same potential as the cathode, forms a kind of labyrinth packing whereby the passage of primary as well as secondary electrons is made difficult.

In order to neutralize the harmful effect of the electrons which still penetrate, a conductive coating 16 consisting, for example of

tin-foil, is arranged around the seal 5 which is the weakest part of the tube. This coating on one side is in contact with the metal wall 2 and extends on the other side some distance, for example 1 centimetre beyond the seal 5. The danger zone is thereby shifted to the outer edge 17 of the strip 16 and the danger of breakdown of the seal 5 is therefore substantially eliminated. The edge 17 is bent outwards for the purpose of reducing the intensity of the field in the danger zone. Also the seal 6 may be provided, if desired, with a similar protecting coating which however is not shown.

The transmission tube represented in Figure 2 consists of a glass envelope 1 which has a re-entrant portion 23, and which at 5 is sealed to a metal cylinder 2, for example of chrome-iron, which serves as anode and can be screwed into the cover of a cooling vessel, not shown. The re-entrant portion 23 of the vessel 1 ends in three glass tubes 24, 25 and 26 which are closed respectively by metal discs 27, 28 and 29, for example of chrome-iron, and which serve for the supply of current to the incandescent cathode and to the grid. The current for the filament is supplied by flexible cables 21 and 33 and by wires 20, 34 and 32, 35 which are secured on either side of the leading-in discs 27 and 29 respectively. The conductive connection with the grid is made by a rod 31 and a wire 30 which are secured to both sides of the leading-in disc 28. The rod 31 carries a frame 22 on which is wound the grid wire not shown in the drawings.

The seal 5 is protected by a strip 16 of conductive material, for example of tin-foil, which is arranged around said seal on the outside and whereby in the manner above described the danger to the seal 5 is averted and shifted to the edge 17 of the protecting strip. This edge is not bent as it is not absolutely necessary. It may however be bent, if desired, as an extra measure of precaution.

If desired, metal mirrors may be substituted for the strips 16. The strips as well as the mirrors may be provided only on the inner surface of the seal or on the outer as well as on the inner surface.

What I claim is:

1. A high-tension discharge tube having an envelope which consists of a conductor hermetically sealed directly to a non-conductor and which is provided with a device for protecting the seal from high potential disruptive forces, said device consisting of at least one conductive coating which immediately covers the seal and extends longitudinally of the tube envelope on both sides of the seal and is provided on at least one side of the surface of the envelope.

2. In a high-vacuum discharge tube operating substantially without ionization, the combination of an envelope wall which includes a conductive and a non-conductive portion sealed together at their meeting edges, and means for protecting the seal from high potential disruptive forces comprising a conductive element which overlies the seal and extends along and in contact with the tube wall from a point on the conductive portion to a point on the non-conductive portion thereof that is beyond the seal.

3. In a high-vacuum discharge tube operating substantially without ionization, the combination of an envelope wall which includes a conductive and a non-conductive portion sealed together at their meeting edges, and means for protecting the seal from high potential disruptive forces comprising a strip of metal foil which overlies the seal and extends along and in contact with the tube wall from a point on the conductive portion to a point on the non-conductive portion thereof that is beyond the seal.

In testimony whereof I affix my signature, at the city of Eindhoven, this 16th day of September, A. D., 1925.

ALBERT BOUWERS.