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DISCHARGE TUBE HAVING A METAL ENVELOPE

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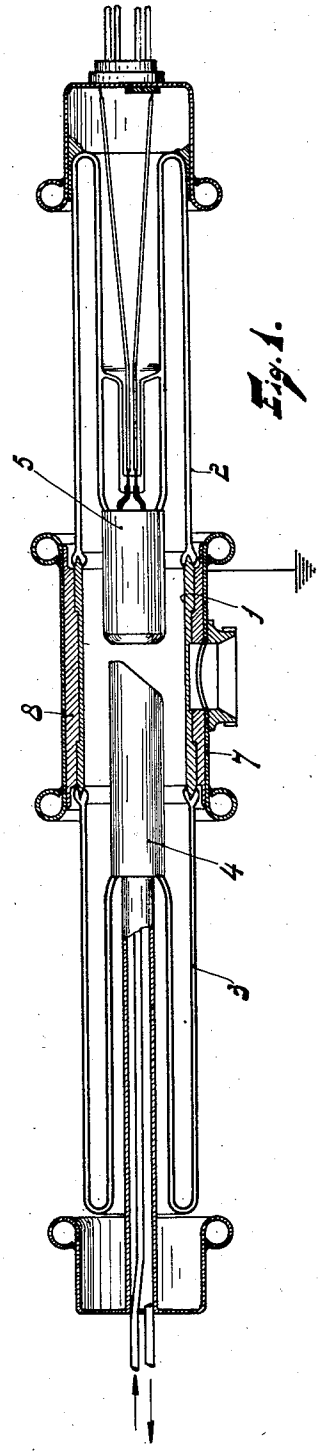

Fig. 1.

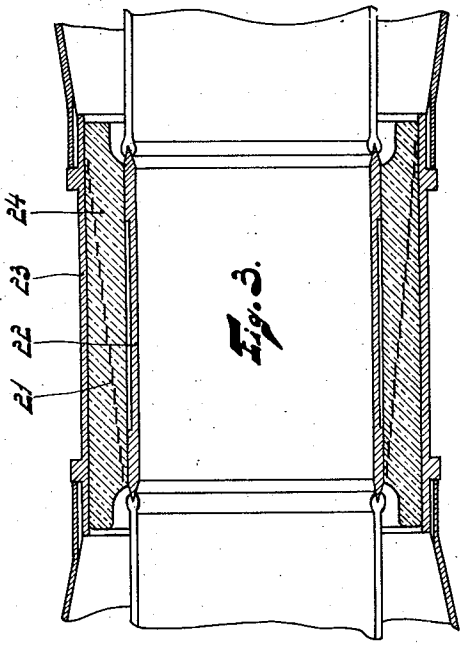

Fig. 3.

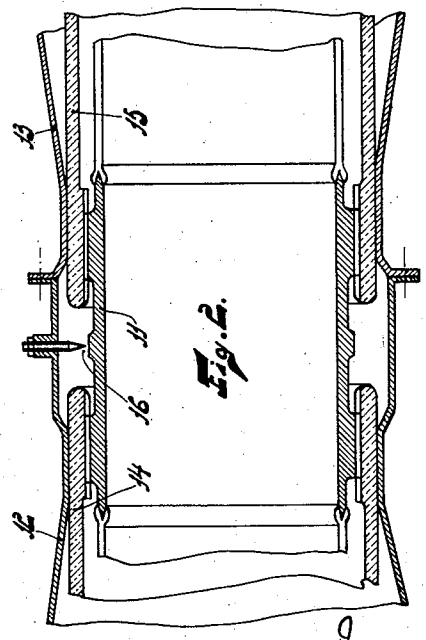

Fig. 2.

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DISCHARGE TUBE HAVING A METAL ENVELOPE

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14 Claims. (Cl. 250—34)

The invention relates to discharge tubes, more particularly X-ray tubes, in which the discharge path is surrounded by a conducting wall insulated from the electrodes, and which tubes are surrounded either entirely or partly by a metal envelope.

Such a metal envelope affords an excellent means for the attachment or support of the discharge tube, in which event it will be desirable in most cases that this member has ground-potential.

In some cases it has proved undesirable to directly ground the conducting wall surrounding the discharge path and constituted by a portion of the wall of the tube which consists entirely of metal or by a conducting coating of said wall. However it may be advisable to fix the potential of the wall portion.

According to the invention, the metal envelope of the tube is connected to the conducting wall via a resistance.

Electric charges produced on the conducting wall due to phenomena taking place within the tube are dissipated through this resistance, which may be constituted by an auxiliary discharge gap. In order to ensure that the potential of the wall has as constant a value as possible, use may be made of a resistance the conductivity of which increases with the current intensity. Alternatively, use may be made of a resistance which only becomes conductive above a determined voltage but which below this voltage passes substantially no current.

It may also be advantageous to use between the wall and the envelope a connection whose conductivity increases with the temperature.

The connecting resistance may be entirely enclosed between the wall of the envelope and in this case it may be constituted, for example, by a conducting or semi-conducting intermediate layer. It may also be constituted by a wire or band which is wound coaxially with the tube and which may be enclosed entirely or partly in an intermediate layer of insulating material. In the latter case a very useful construction is obtained by giving the resistance the shape of a spiral drawn out in the direction of the axis of the tube.

The invention is of particular importance with X-ray tubes but it may also be applied to other tubes, for example to valve-tubes, usually termed rectifiers.

The invention will be more clearly understood by referring to the accompanying drawing which represents by way of example some embodiments thereof.

Figure 1 is a sectional view of an X-ray tube in which use is made of an intermediate layer consisting of a material having relatively low conductivity.

Figures 2 and 3 are sectional views of portions of tubes in which the connection between the wall and the envelope has been established in another manner.

In the X-ray tube represented in Figure 1 the discharge path is surrounded by a metal wall 1 having sealed to it glass wall portions 2 and 3 which have a substantially equivalent insulating capacity and which connect the wall 1 to the electrodes of the tube, to wit to the anode 4 and the cathode 5. The latter is a filament surrounded by a metallic focussing device. The wall 1 is surrounded in its turn by a metal envelope 7.

If the incandescible cathode is arranged in such manner that the wall 1 is struck by electrons, this wall may acquire a charge which counteracts a uniform distribution of the potential. For the dissipation of this charge there has been provided between the wall 1 and the envelope 7 an intermediate layer 8 consisting of a material which has a high resistance but sufficient conductivity to dissipate undesirable charges.

In Fig. 2, which represents a portion of the wall of the tube, and in which the electrodes have been omitted, 11 denotes a metal wall corresponding to the wall 1 of Figure 1. To the wall 11 are secured, with the interposition of insulating cylinders 14 and 15, metal envelopes 12 and 13 which may be connected to ground. Between envelopes 12 and 13 and the wall 11 is connected a resistance 16, constituted by a spark gap. Instead of a spark gap, use may also be made of an ordinary ohmic resistance or again of a particular resistance having, for example, a conductivity which increases with an increasing current intensity. Use may be made inter alia of an enclosed discharge, such as a glow discharge. Neither is it necessary for the resistance to be located in the space between the wall and the envelope.

Figure 3 shows a mode of construction in which the resistance is constituted by a spirally wound wire 21 which has been drawn out in the direction of the axis of the tube and which connects the wall 22 to the envelope 23, the wire 21 being enclosed in an insulating mass 24 which absorbs X-rays. In this form of construction a resistance for a rather large power can be housed in a limited space. Besides, a correct distribution of the electric load of the insulating material 24

is facilitated thereby. As stated above, the resistance 8 or 21 may advantageously be of material having a negative temperature coefficient of resistance so that it conducts current more readily as its temperature increases.

What I claim is:

1. In an electric discharge tube, electrode members between which during the operation of the tube a high potential difference occurs, said members being spaced apart to provide a discharge gap, a metal section insulated from the electrode members and surrounding the discharge gap and the operative portions of the electrode members, a metal sleeve surrounding said metal section and insulated from said electrode members, and a substantial electric resistance for limiting the flow of electric current between said metal section and the surrounding metal sleeve.

2. In an electric discharge tube, a metal section surrounding a portion of the discharge space of the tube and subjected to the impingement of free electrons, a metal sleeve surrounding the tube and insulated from the operative elements thereof, and an electric resistance for limiting the flow of electric current between said metal section and said sleeve.

3. In an X-ray tube having electrodes spaced from each other so as to form a discharge gap, an enclosing envelope mechanically connecting the electrodes and embodying at least one part of conductive material causing a section of said wall to possess the same potential throughout its entire area and extending over the discharge gap, means for supporting the tube comprising a metal sleeve surrounding the tube and said part of conductive material but electrically separated from the latter and adapted to be grounded during the operation of the tube, said sleeve being insulated from the electrodes of the tube for substantially equal voltages, and a substantial electric resistance forming a connection between the sleeve and the part of conductive material.

4. An enclosing envelope having a conductive area, an electric discharge tube mounted therein comprising a closed wall, an anode member and a cathode member mounted in said wall, said members being electrically insulated from said conductive area for substantially equal voltages, said wall comprising a metal section surrounding the operative portions of said members and insulated from the electrodes for substantially equal voltages, said metal section being located within said enclosing envelope in spaced relation with said conductive area, and an electric resistance arranged in the space between the enclosing envelope and the metal section, said resistance connecting the said metal section with said conductive area.

5. A metal envelope, an electric discharge tube mounted therein, said tube having electrode members and an equipotential waist section insulated from the electrode members, said metal envelope having a central portion supporting the said waist section of the tube, and a layer comprising an electric resistance interposed between said envelope and waist section, said resistance conducting during the operation of the tube a sufficient quantity of electricity to establish a potential difference between said waist section and said envelope.

6. In combination, a hollow metal supporting member, an electric discharge tube mounted therein, said tube having electrode members and a central equipotential waist section, insulating supporting means interposed between the discharge tube and the supporting member, said waist section being situated within the hollow supporting member, and an electric resistance connecting said waist section and said supporting member, said resistance having a conductivity which increases with the intensity of an electric current flowing through it.

7. In combination, a hollow metal supporting member, an electric discharge tube mounted therein, said tube having electrode members and a central equipotential waist section, insulating supporting means interposed between the discharge tube and the supporting member, said waist section being situated within the hollow supporting member, and an electric resistance connecting said waist section and said supporting member, said resistance having a conductivity increasing proportionally with the intensity of an electric current flowing through it.

8. In combination, a hollow metal supporting member, an electric discharge tube mounted therein, said tube having electrode members and a central equipotential waist section, insulating supporting means interposed between the discharge tube and the supporting member, said waist section being situated within said hollow supporting member, and means for limiting the flow of electric current between the said waist section and said supporting member including a conductive path which above a predetermined voltage shows a considerable decrease of resistance.

9. In combination, a hollow metal supporting member, an electric discharge tube mounted therein, said tube having electrode members and a central equipotential waist section, insulating supporting means interposed between the discharge tube and the supporting member, said waist section being situated within said hollow supporting member, and means including an electric discharge gap with independent discharge for electrically connecting said waist section and supporting member.

10. In combination, a hollow metal supporting member, an electric discharge tube mounted therein, said tube having electrode members and a central equipotential waist section, insulating supporting means interposed between the discharge tube and the supporting member, said waist section being situated within said hollow supporting member, and a conductor for permitting the passage of a limited electric current between the said waist section and said supporting member, the resistance of said conductor decreasing with the temperature.

11. A device comprising an electric discharge tube provided with a conductive waist portion and insulating wall portions of substantially equal insulating capacities at both sides thereof, each carrying an electrode member, a conductive envelope surrounding said tube and leaving a space around the said waist portion of the tube, an insulating layer in said space and a filamentary resistance enclosed by said layer which is coaxially wound with the tube, said resistance having one end in contact with said conductive waist portion and its other end with said conductive envelope.

12. A device comprising an electric discharge tube provided with a conductive waist portion and insulating wall portions of substantially equal insulating capacities at both sides thereof, each carrying an electrode member, a conductive envelope surrounding said tube and leaving a space around the said waist portion of the tube,

an insulating layer in said space, and a filamentary resistance embedded in said layer which is coaxially wound with the tube and has the shape of a spiral drawn out in the direction of the axis of the tube, said resistance having one end in contact with said conductive waist portion and its other end with said conductive envelope.

13. An X-ray installation comprising an X-ray tube having a cathode and an anode, the wall of said X-ray tube having an equipotential central area and insulating portions withstanding each a voltage of the same order of magnitude, said insulating portions supporting the anode and the cathode respectively in operative relation to each other and to said central area, at least one insulating member supporting said central area and being supported by a protective metal envelope which is grounded and encloses the X-ray tube, said envelope being out of direct contact with said central area of the X-ray tube, and a substantial electric resistance permitting the passage of a limited flow of electrons from the interior of the X-ray tube over the central area of the tube wall and the enclosing envelope to the ground.

14. A device comprising an electric discharge tube provided with a conductive waist portion and insulating wall portions of substantially equal insulating capacity at both ends thereof, each of said insulating wall portions carrying an electrode member, a conductive member surrounding said waist portion with an intermediate space, and a layer provided in said space, said layer being of a material which permits the passage of a limited electric current between said member and said waist portion.

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