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ELECTRIC DISCHARGE TUBE

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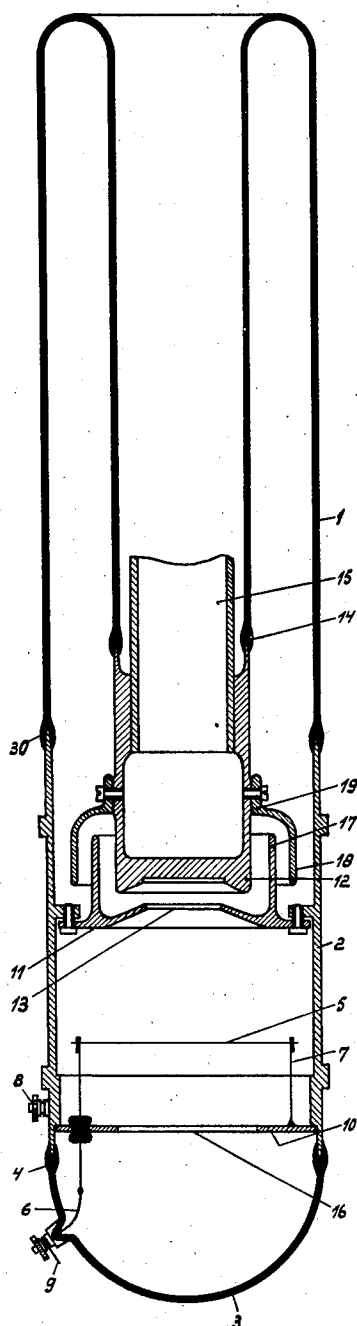


**Fig. 1.**

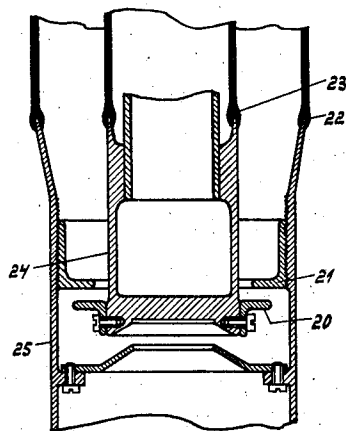


**Fig. 2.**

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## UNITED STATES PATENT OFFICE.

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## ELECTRIC DISCHARGE TUBE.

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This invention relates to discharge tubes provided with an incandescent cathode and having an envelope which consists partly of insulating material such as, for example, glass and partly of metal, the insulating part being sealed to the metal part. The invention relates in particular to discharge tubes of this kind for high tensions, such as for example, X-ray tubes.

Discharge tubes, part of the outer envelope of which consists of metal which is sealed to the insulating part of the envelope, have the disadvantage that electric charges, giving rise to disruption of the insulating material accumulate near the seal of the envelope.

In order to obviate this disadvantage, it has already been proposed to arrange in the neighbourhood of the seal of the envelope a metal wall which is electrically connected to the anticathode and serves to prevent the electrons emanating from the incandescent cathode, from reaching the seal of the envelope.

According to the invention, a number of metal walls which overlap each other, are insulated from each other and receive different potentials during the operation of the tube, are so arranged between the incandescent cathode and the seal of the envelope that electrons emitted by the incandescent cathode, would only be able to reach said seal after passing between the said walls.

The metal walls are preferably so arranged that considerable parts of them are parallel to each other.

By supplying suitable potentials to the adjacent walls, care can be taken that practically not any electron reaches the seal of the envelope. In discharge tubes for high voltages the metal walls are, preferably so arranged that during the operation of the tube there is a high potential difference between adjacent walls.

The invention may be applied with special advantages to X-ray tubes in which the incandescent cathode is arranged within a metal vessel forming wholly or partly part of the outer wall of the tube, the anticathode being separated from said metal vessel by an insulation that is capable of resisting the operating voltage which has to be supplied between the incandescent cathode and the anticathode. This metal vessel is so shaped

that the cathode rays are capable of striking the anticathode only on a limited area.

According to the invention, one or more of the said metal walls in such a tube are connected to the metal vessel and one or more to the anticathode. If in such a tube the anticathode is coaxially arranged within the metal vessel enclosing the incandescent cathode, the metal walls overlapping each other are, preferably, also coaxially arranged relatively to the metal vessel.

The accompanying drawing represents by way of example some constructions showing the application of the invention to an X-ray tube of the kind above described.

Figure 1 represents a longitudinal section of an X-ray tube in which the metal walls, provided according to the invention, are arranged coaxially to the anticathode.

Figure 2 is a longitudinal section of part of a different construction, in which the walls overlapping each other are at right angles to the side face of the anticathode.

The outer wall of the X-ray tube shewn in Figure 1, consists of an insulating part 1, made, for example, of glass and of a metal part 2 being at 30 hermetically sealed to the glass part. On the other side the vessel 2 is hermetically connected to a glass hood 3 which serves for the passage of the X-rays. An incandescent cathode 5, supported by leading-in wires 6 and 7, is arranged within the vessel 2. Terminals 8 and 9 serve to supply the current to the incandescent cathode; the terminal 8 is preferably connected to the negative pole of the battery for the current of incandescence. The leading-in wire 7 is connected to an angular bottom 10, from which the wire 6 passing through said bottom is insulated.

On the side of the anticathode 12 the metal vessel 2 is provided with a partition 11 having an aperture 13. Behind this aperture stretches the front face of an anticathode 12 which at 14 is hermetically sealed to the insulating part 1. The anti-cathode may be cooled in any suitable manner, for which purpose a cooling tube 15 is provided.

During the operation of the X-ray tube, the electrons emitted by the incandescent cathode 5, are capable of striking only a small area of the front face of the anticathode owing to the peculiar shape and the arrangement of the vessel 2 relatively to the

anticathode 12. The X-rays generated pass through the aperture 13, through an aperture 16 provided in the bottom 10 and through the glass hood 3.

5 If in the X-ray tube according to Figure 1 there had not been taken special measures, electric charges would be capable of accumulating near the places of connection 30 and 14, which might have the known detrimental  
10 consequences.

According to the invention, there are provided overlapping walls 17 and 18 which are arranged coaxially to the metal vessel 2 and to the anticathode and which form a  
15 kind of labyrinth packing. The wall 17 forms a whole with the partition 11, whereas the wall 18 is electrically connected to the anticathode, to which it is secured by means of screws 19.

20 The electrons emitted by the incandescent cathode, would still be capable of reaching the places of connection 30 and 14 but only after passing between the walls 17 and 18. They will however be prevented therefrom  
25 by the strong electric fields occurring between the walls 17 and 18 mutually, between the wall 17 and the anticathode 12 and between the wall 18 and the vessel 2.

The metal vessel 2 may advantageously  
30 consist of chrome iron of suitable composition. The body of the anticathode 12 may also be made of chrome iron, in which case an insertion piece of tungsten may be provided on the front face of the anticathode.

35 Figure 2 illustrates another embodiment of the invention. According to this figure overlapping walls 20 and 21 are provided in order to prevent electrons from reaching the places of connection 22 and 23. A wall  
40 20 is secured near the front face of an anticathode 24 and a wall 21 is screwed into a metal vessel 25 which forms part of the outer wall, the incandescent cathode which is not illustrated, being arranged within said metal vessel.

What we claim is:—

1. An electric discharge tube with an incandescent cathode and an envelope consisting partly of insulating material and partly of metal, which insulating part is sealed to  
50 the metal part, a number of metal walls insulated from each other within the envelope and receiving different potentials during the operation of the tube being so arranged as to form a labyrinth seal between  
55 the cathode as well as between the anticathode and the seal of the envelope.

2. An X-ray tube according to claim 1, in which the anticathode is arranged within a metal vessel which forms part of the outer  
60 wall of the tube and from which the anticathode is separated by an insulation that is capable of resisting the operating voltage to be supplied between the incandescent cathode and the anticathode, said vessel being  
65 so shaped that the cathode rays can strike the anticathode only on a limited area, one or more of the metal walls being electrically connected to the anticathode and one or more to the metal vessel.  
70

3. An X-ray tube according to claim 1, in which the anticathode is coaxially arranged within a metal vessel which forms part of the outer wall of the tube and from  
75 which the anticathode is separated by an insulation that is capable of resisting the operating voltage to be supplied between the incandescent cathode and the anticathode, said vessel being so shaped that the cathode  
80 rays can strike the anticathode only on a limited area, one or more of the metal walls, which extend coaxially between the anticathode and the said metal vessel, being electrically connected to the anticathode and one or more to the said metal vessel.  
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In testimony whereof we affix our signatures at the city of Eindhoven this 26th day of January, A. D. 1925.

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