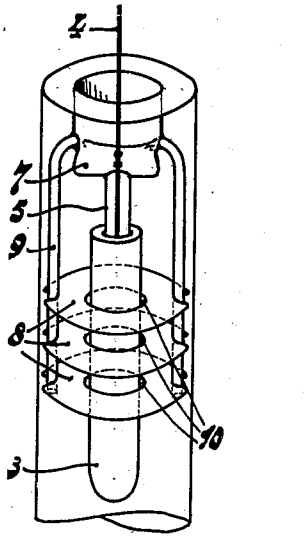
March 30, 1937. J. G. W. MULDER 2,075,355

DISCHARGE TUBE

Filed Nov. 3, 1930



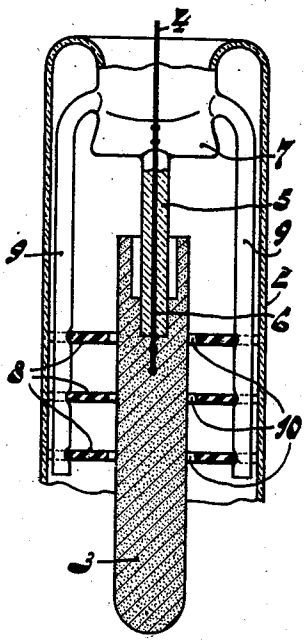


Fig. 2.

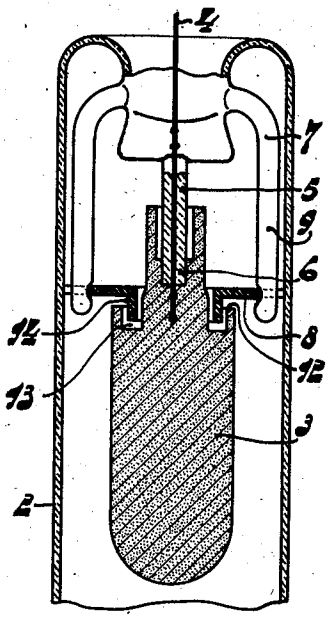


Fig. 3.

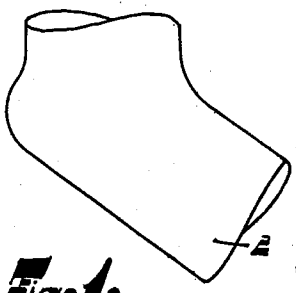


Fig. 1.

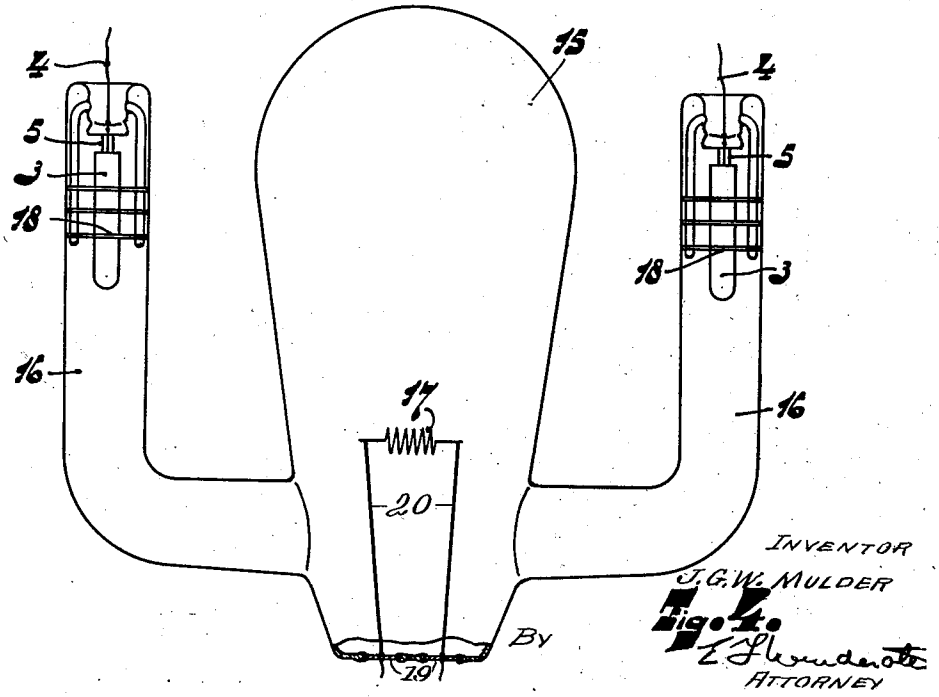


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Fig. 4.

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UNITED STATES PATENT OFFICE

2,075,355

DISCHARGE TUBE

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9 Claims. (Cl. 250—27.5)

This invention relotes to a discharge tube and in particular to a rectifying tube having a cathode and one or more anodes.

The invention has for its object to provide means for preventing in tubes of this type discharges being struck between the anodes or between the cathode and the anodes in the wrong direction.

For the anodes usually materials are used which lend themselves poorly to serve as cathode for such undesired discharges. Since the pole wire must be made of other materials than the anode, it is known already to separate these pole wires from the discharge space by means of screens.

I have found that the points at which the anode contacts with either the pole wires, or with the said screens, or with other portions, cause more readily undesired discharges than the remaining part of the anode. This phenomenon seems to be due to the fact that the surface of the anode at the just stated points, especially at high temperatures, takes up constituent parts of the foreign material with which it contacts, so that the quality of the anode is impaired at those points.

According to the invention those points at which the electrodes contact with their supports or with other portions, communicate with the discharge space only through paths which are long, narrow, or both long and narrow. This may be effected by surrounding each anode by one or more discs having a central orifice through which the anode extends, these discs barring the passage between the anode and the tube wall.

Preferably the anode extends with some amount of play through the central orifice of the discs. These ring-discs advantageously consist of mica.

In order to further increase the distance between the path of discharge and the points to be protected, the anode may be advantageously provided with one or more ring-grooves into which extend ring-discs which are mounted independently with regard to the anode. This embodiment may be extended still further by providing the ring grooves in annular surfaces formed at narrowed portions of the anodes, whereas the inner side of the co-operating ring-discs is provided with a projecting rim extending in the ring-grooves.

Preferably the anode is given an elongated shape. In a suitable embodiment a portion of the wall of the discharge tube closely surrounds the anode along its whole length or along part thereof. At the active end of the anode the wall of the discharge tube may have an enlarged portion, whereas the anodes may have one or more cavities at this end to enlarge the active surface of the anode.

In the foregoing as well as hereinafter, the expression "the wall of the discharge tube" is also to include the wall of lateral extensions or arms of the discharge tube which are provided for the anodes in the case of high voltage tubes.

The invention will be more clearly understood by reference to the accompanying drawing representing by way of example, one embodiment thereof.

Fig. 1 is a perspective schematic view of the lateral extension of a discharge tube to which the invention is applied.

Fig. 2 is a sectional side view on slightly enlarged scale of the extension illustrated in Fig. 1.

Fig. 3 is a sectional side view of a tube portion showing a stepped anode with a ring-disc.

Fig. 4 is a partly sectionized schematic view of a rectifying tube having anodes constructed in accordance with the invention.

In the drawing the wall of the tube is designated by **2**. In the embodiments illustrated the anode is assumed to be disposed in a lateral extension of the tube. The anode is denoted by **3**, and the leading-in wire by **4**. The latter is surrounded by a tube **5** which is made, for example, of steatite and engages the anode at **6**.

In Figs. 1 and 2 three ring discs **8** are supported from the pinch **7** by means of supports **9**, consisting, for example, of glass. The discs are made of mica or similar heat-resisting material. Between the anode **3** and the discs **8**, there are provided narrow annular apertures **10**. These apertures must be sufficiently narrow to greatly impede the passage of a discharge. On the other hand, they should provide sufficient clearance to prevent the anode from contacting the discs, and to prevent the formation of a deposit thereon during the passage of an undesired discharge, which discharge may be caused by some abnormal conditions. Such a deposit might result from the decomposition of the material of the discs **10** and would facilitate further undesired discharges.

While in the example shown the discs are carried by the stem, they may also be directly affixed to the wall of the tube.

In Fig. 3 an embodiment is shown in which the anode **3** has stepped portions and on its upper end the portion is provided with an annular groove **13** into which projects the downwardly extending rim **14** of a ring-disc **8**. In this way the contact point between the anode **3** and the support **5** is separated from the discharge space by a long restricted path.

Without deviating from the principle of the invention various other embodiments are possible, for example, discs **8** may have other shapes or may be otherwise supported. The rectifying tube

shown in Fig. 4 comprises an envelope having a central portion 15, from which extend two L shaped arms 16. Provided in the envelope portion 15 is an incandescible cathode 17 whose leads 20 are sealed to the wall of the tube by means of two metal discs 19; for example, in a manner described in U. S. Patent No. 1,734,809. Supported from one end of each of the arms 16 is an anode structure 18 made in accordance with the invention, and having, for example, the construction shown in Figs. 1 and 2.

What I claim is:

1. An electron discharge tube, comprising an envelope having walls, a cathode and an anode, said anode having a large active surface opposing the cathode, the anode and cathode having a discharge path therebetween, a member contacting with said anode, there being a long discharge path between the point of contact of the anode with the said member and the operating discharge path, and a member surrounding said anode, the said last-mentioned member comprising a disc of insulating material having a central aperture through which the anode passes and providing a slight clearance between the anode and the disc, said disc forming a partition in the space between the anode and the wall of the discharge tube.

2. An electron discharge tube, comprising an envelope having walls, a cathode, and an anode having a large active surface opposing the cathode, said anode having a shoulder and an annular recess therein, the anode and the cathode having a discharge path therebetween, and a disc of insulating material surrounding said anode, said disc comprising a portion extending into said annular recess and in close but spaced relation thereto, said disc forming a partition in the space between the anode and the wall of the discharge tube.

3. An electron discharge tube, comprising an envelope having an arm, a cathode, and an anode, said anode being placed in the said arm, the anode and cathode having a discharge path therebetween, a member contacting with said anode, there being a long discharge path between the point of contact of the anode with the said member and that portion of the anode which is active in the operating discharge, and a member in non-contacting spacial relationship with said anode and surrounding same with a clearance sufficiently small to prevent the passage of a discharge from the operating discharge path to the point of contact between the anode and the contacting member with a clearance sufficiently small to prevent the passage of a discharge from the operating discharge path to the point of contact between the anode and the contacting member.

4. An electron discharge tube comprising an envelope, a cathode, an anode having a large active surface opposing the cathode, the anode and cathode having a discharge path therebetween, a member contacting with said anode, there being a long discharge path between the point of contact of the anode with the said member and the operating discharge path and a plurality of disc members of insulating material having central apertures through which the anode passes in closed spaced relationship to said discs, and means supporting said discs, said supporting means being a considerable distance from said anode.

5. An electron discharge tube comprising an envelope, a cathode, an anode disposed in a cylindrical portion of said envelope to form an operating discharge path between said anode and cathode, said anode having a large active surface opposing the cathode, a member in contact with the anode, there being a long discharge path between the operating discharge path and the point of contact of the anode with said member, and a member obturating the cross-sectional area of said cylindrical envelope portion, said member surrounding said anode at a point between the active surface thereof and the point of contact of said contacting member with a clearance sufficiently small to prevent the passage of a discharge from the operating discharge path to the point of contact between the anode and said contacting member.

6. An electron discharge tube comprising a cathode, an anode surrounded by a cylindrical portion of the wall of said tube and having a large active surface opposing the cathode to form an unobstructed discharge path therebetween, a member contacting with said anode, there being a long discharge path between the point of contact of the anode with said member and the active surface of the anode, and a member surrounding said anode and partly intercepting the space between said anode and said cylindrical portion to form a high-resistance section in the path between the active surface of the anode and the point of contact between the anode and said contacting member.

7. An electron discharge tube, comprising a cathode, an anode having a large active surface opposing the cathode to form a discharge path therebetween, a member contacting with said anode, there being a long discharge path between the point of contact of the anode with said member and that surface of the anode which is active in the operating discharge, and a member in non-contacting spatial relationship with said anode and extending substantially perpendicularly to the surface thereof, said latter member partly intercepting said long discharge path and surrounding said anode with a clearance sufficiently small to prevent the passage of a discharge from the operating discharge path to the point of contact between the anode and the contacting member.

8. An electron discharge tube, comprising a cathode, an anode having a large active surface opposing the cathode, the anode and cathode having a discharge path therebetween, a member contacting with said anode, there being a long discharge path between the point of contact of the anode with said member and that surface of the anode which is active in the operating discharge, and a member of insulating material in non-contacting spatial relationship with said anode and surrounding same with a clearance sufficiently small to prevent the passage of a discharge from the operating discharge path to the point of contact between the anode and the contacting member.

9. An electron discharge tube, comprising an envelope having a cylindrical portion, a cathode, an anode axially disposed within said cylindrical portion and having a large active surface opposing the cathode, and a disc of insulating material closely surrounding said anode in non-contacting spatial relationship and disposed in a plane perpendicular to the axis thereof, said disc substantially obturating the annular space between said anode and said cylindrical envelope portion.

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