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 ANODE FOR DISCHARGE TUBES.
 APPLICATION FILED MAY 22, 1912.

1,131,606.

Patented Mar. 9, 1915.

FIG. 1

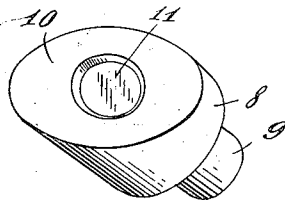
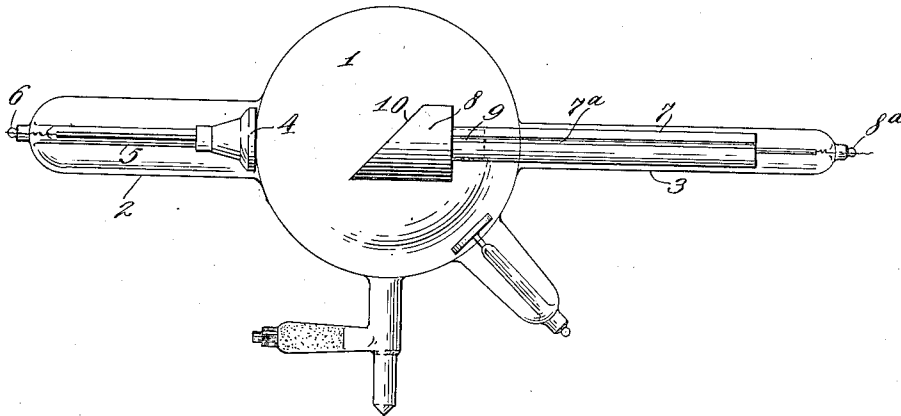


FIG. 2

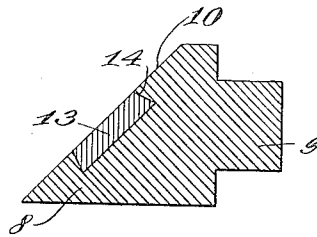


FIG. 4

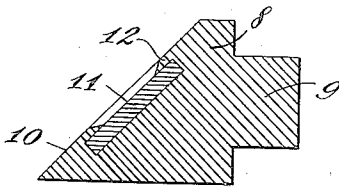


FIG. 3

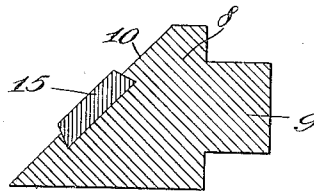


FIG. 5

WITNESSES:

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INVENTOR,

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 BY Hull & Smith
 ATTYS.

UNITED STATES PATENT OFFICE.

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ANODE FOR DISCHARGE-TUBES.

1,131,606.

Specification of Letters Patent.

Patented Mar. 9, 1915.

Application filed May 22, 1912. Serial No. 699,053.

To all whom it may concern:

Be it known that I, THEOPHIL H. GEBAUER, a citizen of the United States, residing at Cleveland, in the county of Cuyahoga and State of Ohio, have invented a certain new and useful Improvement in Anodes for Discharge-Tubes, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings.

This invention relates to anode for X-ray tubes and other apparatus, and more especially to the anodes or targets of said tubes. As usually constructed, these anodes or targets are composed of a body of "base metal," generally of wrought or forged copper, disposed substantially at the focal point and faced with a metal of high heat-resisting qualities, such as platinum. This facing is ordinarily secured in place by means of silver solder or pure silver, the purpose being to retain the heat resisting metal in place and provide a thermal contact between it and the backing.

In the operation of the apparatus referred to, it has been found that the use of a solder and, in fact, all other securing means with which I am familiar, has resulted in an inefficient thermal contact between the two metals as well as an inefficient means for retaining the facing in place. The intense heat concentrated on the facing melts the solder, silver, or other bonding agent, thereby impairing the thermal contact referred to and permitting the facing to drop out of place. It is also found that when silver or silver solder is employed the effect of the high temperature to which it is raised is to drive off a gas of some nature which reduces the vacuum and greatly impairs the operation of the tube.

It is the general object of this invention to produce a device of the kind referred to wherein there will be not only a substantially perfect thermal contact between the two metals constituting the anode or target

but the facing will be positively prevented from dropping or working out of place.

A still further and very important feature of the invention is the accomplishment of the foregoing results in a construction which is extremely simple and inexpensive.

In the drawings forming part hereof, I have shown my invention in three embodiments.

In said drawings, Figure 1 represents an elevation of an X-ray tube having my invention applied thereto; Fig. 2 a perspective view of the anode or target of said tube; Fig. 3 a central longitudinal sectional view through said anode or target; Figs. 4 and 5 are views, similar to Figs. 2 and 3, of modifications of the anode or target shown in the preceding figures.

Describing by reference characters the various parts shown in the drawings, 1 denotes an X-ray tube, the same comprising generally a globular central body of glass having tubular branches 2 and 3 projecting from opposite portions thereof. In the branch 2 there is mounted the cathode 4, there being a glass support 5 for the cathode arranged centrally with respect to the branch 2, said cathode being connected to a terminal 6 at the end of the branch.

In the tubular branch 3 there is mounted a support 7 preferably consisting of an iron or other metallic tube fitting closely in the branch 3 and having in its side a longitudinal slot 7^a to permit expansion or contraction thereof without damage to the glass. At its forward end is the anode 8, said anode having a reduced or neck portion 9 adapted to fit into said support. The outer end of the support is connected to a terminal 8^a at the end of its branch.

The anode or target comprises a relatively massive body of base metal, as copper, said body having a face 10 which is beveled at an angle of about 45° with respect to the axis of the cathode stream, and cast in the face of this body is a plate or disk 11 of high

heat-resisting metal, such as platinum or tungsten. In preparing the anode or target, the copper is cast entirely around this plate or disk and afterward the face of the target
5 is milled away so as to expose a portion of the face of this plate or disk while leaving the body thereof securely embedded in the baser metal.

By forming the anode or target in the
10 manner described, a perfect thermal contact is secured between the heat resisting and the baser metal, allowing the intense heat to which the former metal is subjected to be diffused and dissipated throughout the relatively large body of the base metal, and to
15 be conducted throughout the support 7, whereby an extremely large diffusing surface is obtained and rapid cooling secured. Furthermore, as will be evident, it will be impossible for the metal 11 to work loose
20 or drop out of its place, notwithstanding the great extremes of temperature to which the parts are subjected.

In Figs. 2 and 3 I have shown the face of
25 the plate or disk inset within the surface of the baser metal, there being a rim or lip 12 of the latter metal overlying the edge of the same.

In Fig. 4 I have shown a modification of
30 the anode wherein the plate or disk 13 is shown as cast in the body 8 in such manner that the outer face of the heat resisting metal is substantially flush with the face of the target body. In this case, the plate 13
35 is retained in place by inclining its sides inwardly from rear to front, in the manner shown at 14, making the plate 13 frusto-pyramidal in shape. By this construction, the metal of the body 8 will overhang the
40 sides and the rear portion of the heat resisting metal and firmly lock and retain the latter in place, securing the efficient results set forth in connection with the form of target described hereinbefore.

In Fig. 5 there is shown a further modification of the anode, which differs from that illustrated in Fig. 4 in that the high heat
45 resisting metal body 15 although of the same shape as the metal body 13, projects beyond the surface 10 of the target body. As in the prior modification, the metal of the body 8
50 overhangs the tapered sides of the plate 15 to a sufficient extent to secure a good thermal contact and prevent the same from working or dropping out. I esteem it preferable,
55 however, to cast the plate or disk entirely within the baser metal as illustrated in Figs. 2 and 3 in view of the fact that copper shrinks upon solidifying. In case the plate
60 or disk be entirely surrounded by the baser metal, the setting of the latter grips the plate into close and firm contact therewith, whereas if this plate or disk be disposed at

the surface of the baser metal, the shrinking upon setting is liable to draw the latter metal
65 away from the former thus defeating the very ends toward which my invention is aimed. I do not, however, intend to limit myself to this method of making an anode nor to any particular slopes or shapes of the
70 sides or surfaces of the plate or disk, as it is obvious that many modifications of this method may be employed within the scope of the claims annexed hereto.

Having thus described my invention, what
75 I claim is:

1. In a vacuum tube, an anode comprising a refractory body of high heat-resisting metal cast within a body of heat diffusing and dissipating metal, the former body being located at the focal point and having an
80 exposed surface adapted to receive the cathode stream, and the latter body being of a nature to contract upon passing from a liquid to a solid state whereby the inner
85 body is gripped.

2. In a vacuum tube, an anode comprising a heat-diffusing or dissipating body of material fusible at a high temperature and having a target face, and a smaller body of high
90 heat resisting metal cast in said body and having an exposed surface coöperating with the target face, the area of such exposed surface being smaller than the cross sectional area of such smaller body at a point to the
95 rear of such surface.

3. In a vacuum tube, an anode comprising a metallic body of high melting point and having a target face, and a relatively smaller body of high heat resisting metal cast in
100 said body and having an exposed surface coöperating with the target face, the said bodies having interlocking engaging portions arranged to prevent displacement of the smaller body.
105

4. In a vacuum tube of the type having a converging cathode stream, an anode comprising a body of refractory electrically conductive material supported substantially at the point of convergence of the cathode
110 steam, and a body of metal of high electric and heat conductivity cast about said first body, such first body being of an undercut nature, and said second body being of a material which contracts upon passing from a melted to a solid state whereby said first body may be gripped
115 powerfully therewithin and a maximum of heat and electric conductivity secured.

5. An anode for apparatus of the character set forth comprising a body of heat diffusing and dissipating metal having a
120 smaller body of high heat resisting metal cast entirely within the former body, the face of said former body being cut away to
125 expose a portion of said smaller body.

6. An anode for apparatus of the character set forth comprising a body of high heat resisting metal consisting essentially of tungsten secured by casting within a massive
5 body of cast copper and having the face thereof exposed to the cathode stream.

In testimony whereof, I hereunto affix my signature in the presence of two witnesses.

THEOPHIL H. GEBAUER.

Witnesses:

HAROLD E. SMITH,
BRENNAN B. WEST.