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R. T. HUMMEL

2,269,852

ANODE

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*Fig. 1.*

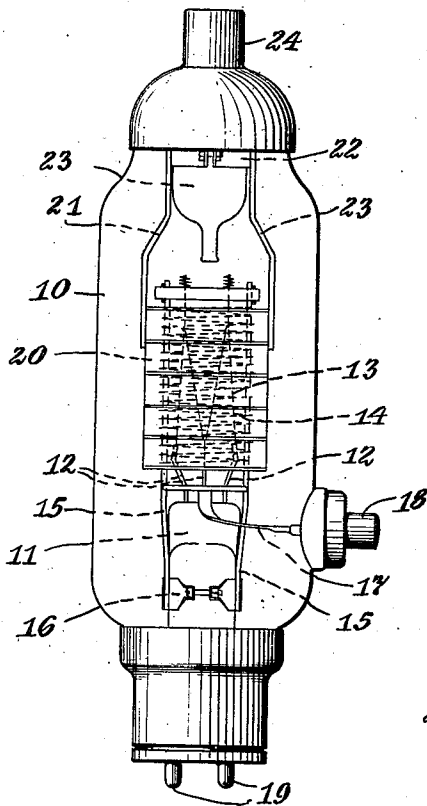


*Fig. 2.*

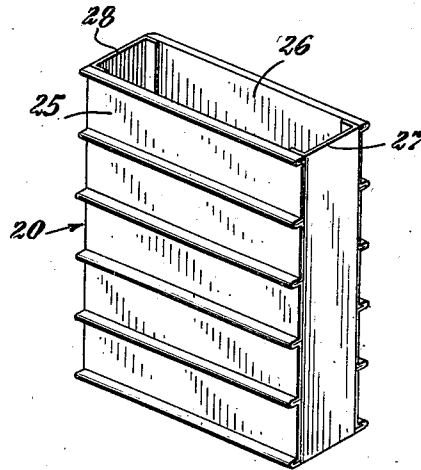


*Fig. 3.*

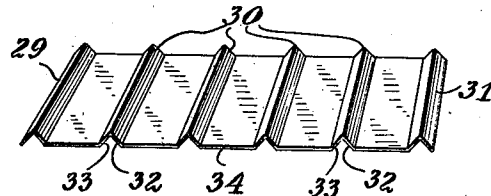


*Fig. 6.*

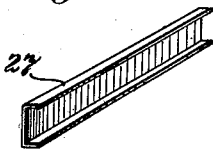


*Fig. 4.*

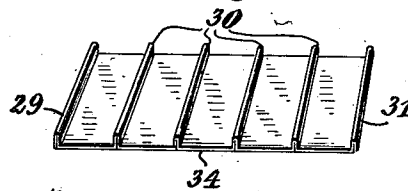


*Fig. 5.*

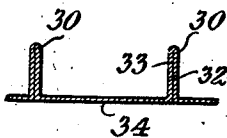
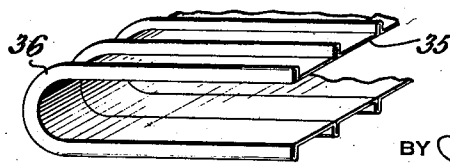


*Fig. 7.*



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## UNITED STATES PATENT OFFICE

2,269,852

## ANODE

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Application May 31, 1939, Serial No. 276,637

7 Claims. (Cl. 250—27.5)

My invention relates to discharge devices, and especially to the anode structure thereof.

An object of the invention is to provide an anode structure which is very economical in cost of materials.

Another object of the invention is to provide a mechanically strong and rigid anode assembly.

A further object is to provide a ribbed anode plate having a substantially plane active surface facing the other electrodes.

A still further object of the invention is to provide an anode structure that can utilize a desirable material such as tantalum in a manner that will overcome its mechanical weakness.

Other objects and advantages of the invention will be apparent from the following description and drawing in which:

Figure 1 is a front elevation of a typical discharge device incorporating the invention.

Figure 2 is a perspective view of a preferred embodiment of my anode structure.

Figure 3 is a perspective view of an anode plate in process of formation.

Figure 4 is a perspective of the plate of Figure 3 in a further step of formation.

Figure 5 is an enlarged end view of a portion of the anode plate in Figure 4.

Figure 6 is a perspective view of one of the spacing members of Figure 2.

Figure 7 is a perspective view of a modified form of anode plate.

Tantalum is being used in discharge devices because of its ability to maintain a clean-up of the gases inside the tube. Tantalum, however, is a weak mechanical metal in comparison with the metals molybdenum, tungsten and the like.

One of the disadvantages of tantalum is that it costs approximately, at present prices, about \$85.00 per pound, so that it is desirable to utilize as little as possible of the material for a given apparatus.

It is one of the objects of my invention to provide an anode structure that will utilize a minimum of desirable but expensive material like tantalum, and yet provide a very strong rigid structure capable of maintaining its desired shape.

In Figure 1 I have illustrated a discharge device with the usual glass casing 10, having a press 11 with the standards 12 therethrough, supporting the cathode 13 and a grid 14 surrounding this cathode and supported by standards 15 and a clamp 16 from the press 11. A flexible connection 17 extends from the grid standards to a separate exterior connection 18. The cathode

standards 12 have exterior connections 19. The anode 20 is supported by the standards 21 and clamp 22 from a still different press 23. The anode has an exterior connection 24. The particular construction, however, is to be taken as purely illustrative and not as limiting the invention thereto.

It is desired to utilize tantalum for the construction of the anode. In Figure 2 I have disclosed a preferred embodiment of my invention in perspective. The two sides 25 and 26 are of tantalum inasmuch as their inner faces are mainly the active surfaces of the anode because they are closely adjacent to the grid and extended side of the M-shaped cathode illustrated in Figure 1. The end portions 27 and 28, however, are of sturdier material, preferably molybdenum.

In forming the sides 25 and 26, I take a flat piece of material and first rib the material using a V-shaped rib, starting at edge 29 and make a series of ribs 30 ending with the other edge 31 as shown in Figure 3. The series of V-shaped ribs are parallel and preferably equally spaced at frequent intervals across the sheet. The plate is then inserted in a die under an arbor press where the ribs are collapsed into the form disclosed in Figures 4 and 5.

The rib 30 now has its inner surfaces 32 and 33 in contact with each other. Because of the collapsed ribs illustrated in Figures 4 and 5, the plate is capable of withstanding mechanical pressure not possible with the open ribbed structure illustrated in Figure 3. Another advantage is that the active surface 34 facing the other electrodes is practically flat as seen in Figure 5. The structure of Figure 3 would provide sharply varying distances from the other electrodes to the flat portion 34 and then to the sloping surfaces 32 and 33. Two of these plates may be formed of the desired length and width and then be united by a U-shaped or channel member 27, preferably of molybdenum, as illustrated in Figures 2 and 6. The union of the two metals may be made by welding.

Because of the strength of the collapsed rib structure illustrated in Figure 4, the 10 mil thickness generally used with tantalum, can be reduced to 4 mils, with a great saving of material.

The collapsed rib structure of Figure 4 has a strength of probably ten times that of Figure 3, even if Figure 3 is 10 mil thickness instead of the 4 mils of Figure 4. It will be noted that my invention first contemplates a substitution of sturdier supporting channel members 27 and 28,

for the expensive tantalum, and then a decrease of thickness of the tantalum sheets utilized for the plate members.

The anode structure may, of course, take various shapes. As one illustration, a plate 35 in Figure 7 is ribbed as in Figure 3. It is then rolled into a U, as shown in Figure 7, and then inserted in a die where the ribs are collapsed into the shape disclosed in this figure. Two of these U-shaped members can be jointed together 10 by any suitable supporting members to form the anode structure. These supporting members may be attached to the inner, but preferably the outer, surface of these tantalum members. The edges 36 have the collapsed ribs therein to prevent the possibility of the material curling. The shape of the lapped edges 29 and 31 in Figure 4 also maintain the desired shape of the plates.

The spacing between the collapsed ribs depends on how strong it is desired to make the plate. With a wide plate the ribs will preferably be spaced closer together. As illustrative of desired proportions, I constructed an anode illustrated in Figure 2, with plates two inches long and one and one-half inches wide with the ribs as shown between one-sixteenth and one-eighth inch high, although nearer one-sixteenth. The channel members were three-eighths of an inch wide.

It is apparent that many modifications may be made in the preferred embodiments disclosed, without departing from the spirit and scope of the appended claims.

I claim:

1. An anode comprising two sheets of approximately 4 mil tantalum and spacing members of a sturdier metal joined to said sheets, said sheets having folds with contacting inner faces said spacing members joined at an angle to said folds.

2. An anode comprising two sheets of tantalum and spacing members of a sturdier metal joined to the lateral edges of said sheets, said sheets having folds with contacting inner faces, said folds being spaced parallel on said sheets said spacing members extending at an angle to said folds.

3. An anode for an electron discharge device including a sheet of tantalum having a plurality of folds across the outer surface thereof, the

inner surface comprising the portion of the inner faces of said folds and the portion to receive the electrons, the inner faces of said folds being in contact with each other and a metal member of sturdier material extending along a lateral surface of said tantalum at an angle to said folds, said sturdier material secured to said tantalum.

4. An anode for a discharge device, having a sheet of tantalum for an active surface, said sheet having a plurality of transverse parallel outer folds with contacting inner faces, and sturdier metal joined to said sheet at the edges of said folds.

5. An anode for an electron discharge device including a sheet of tantalum having a plurality of folds across the outer surface thereof, the inner surface comprising the portion of the inner faces of said folds and the portion to receive the electrons, the inner faces of said folds being in contact with each other and a metal member of sturdier material extending along a lateral surface of said tantalum at right angles to said folds, said sturdier material secured to said tantalum.

6. An anode for an electron discharge device comprising two spaced parallel sheets of tantalum having a plurality of transverse folds across the outer surface of each sheet and terminating at the lateral edges of the sheets, the inner surfaces of each sheet comprising the portion of the inner faces of said folds and the portion to receive the electrons, the inner faces of said folds being in contact with each other, two metal members of sturdier material each secured to two lateral edges of said tantalum sheets at right angles to said folds.

7. An anode for an electron discharge device comprising two spaced parallel sheets of approximately 4 mil tantalum having a plurality of transverse folds across the outer surface of each sheet and terminating at the lateral edges of the sheets, the inner surfaces of each sheet comprising the portion of the inner faces of said folds and the portion to receive the electrons, the inner faces of said folds being in contact with each other, two metal members of sturdier material each secured to two lateral edges of said tantalum sheets at right angles to said folds.

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