April 24, 1934. M. A. ACHESON 1,956,408

ELECTRODE FOR ELECTRON DISCHARGE DEVICES

Filed March 2, 1928

Fig. 1

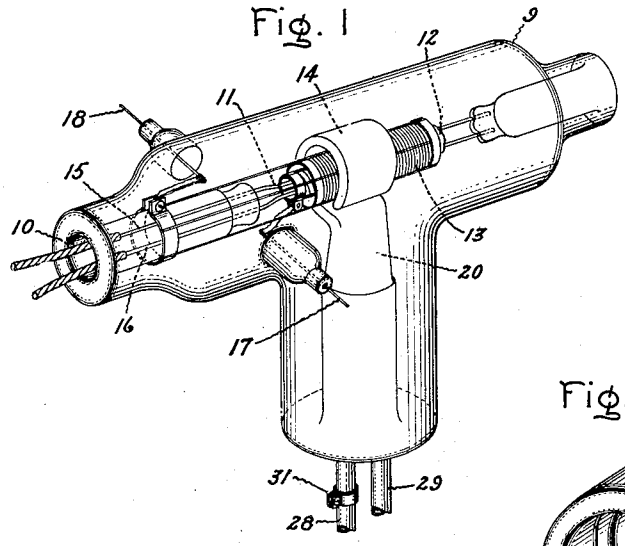


Fig. 3.

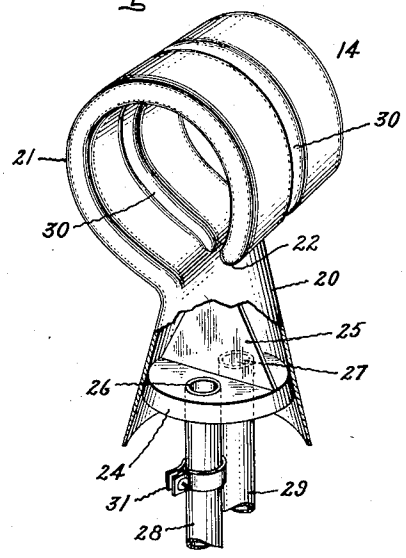
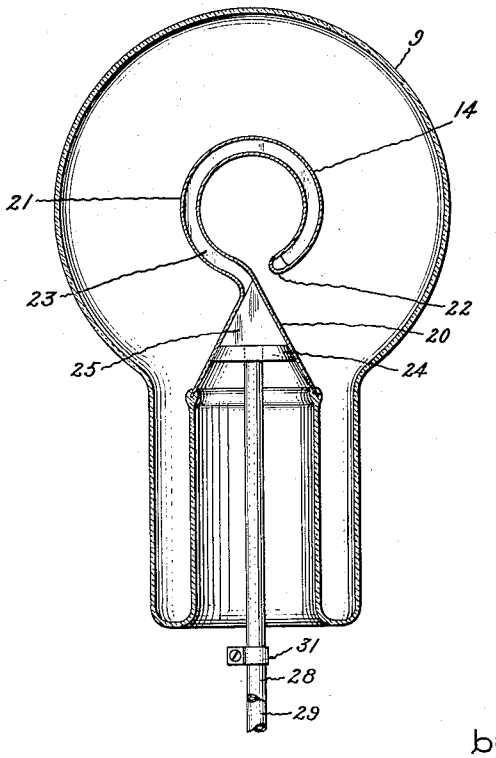


Fig. 2.



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ELECTRODE FOR ELECTRON DISCHARGE DEVICES

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8 Claims. (Cl. 250—27.5)

The present invention relates to electric discharge devices and more particularly to an anode structure capable of use in discharge devices that are capable of delivering several kilowatts of energy at frequencies above 20,000 kilocycles. To provide proper operation at the higher frequencies, it is desirable to make the electrodes in the discharge devices as small as possible to thereby decrease the inter-electrode capacity. However, delivery of a high output with small electrodes requires a high plate voltage and an anode which is capable of dissipating a large amount of power per unit area.

It is one of the objects of the present invention to provide a discharge device adapted for use in short wave radio transmission and having a small water cooled anode which is simple in construction and efficient in operation.

The novel features which I believe to be characteristic of my invention are set forth with particularity in the appended claims. The invention itself however will best be understood from reference to the following specification when considered in connection with the accompanying drawing in which Fig. 1 is a perspective view of an electric discharge device embodying the features of the present invention; Fig. 2 is a cross section on an enlarged scale of the anode and receptacle shown in Fig. 1, the remaining electrodes being omitted; while Fig. 3 is a detail perspective view, partly broken away, of a modified form of my invention.

Referring to the drawing, I have disclosed an electric discharge device comprising an evacuated receptacle 9 having an open ended reentrant stem portion 10. A cathode 11, control grid 12, screen grid 13 and anode 14 are concentrically mounted within the receptacle. Current is supplied to the cathode through leading-in wires 15 and 16 and a potential is supplied to the control and screen grids through leading-in wires 17 and 18 respectively.

Anode 14 is made from a drawn copper tube comprising a short portion 20 which is substantially circular in cross section, and a longer portion 21 which is substantially rectangular in cross section and has a closed end 22. The perimeter of the anode does not form a complete circle but is discontinuous on account of the closed end so that its shape may be likened broadly to that of a "mitten". A dividing partition 23 is placed within the portion 21 so as to extend longitudinally therethrough and divide it into two substantially equal parts which communicate with each other at the end 22 to thereby provide a circulatory path for a cooling medium. The partition is soldered or secured in any other suitable manner to the part 21 and the latter part then given one or more turns to form a hollow double-walled substantially cylindrical member having a funnel-shaped portion or extension 20 adapted to be sealed to the reentrant stem 10 and form a closure therefor.

The funnel-shaped extension 20 is divided into two chambers by means of a plug 24 having a triangular plate 25 mounted on the inner side thereof and making a close fit with the walls of the funnel-shaped extension. Plug 24 is provided with a pair of circular openings or perforations 26 and 27 on opposite sides of the plate 25 which openings are connected to pipes 28 and 29 adapted to carry a supply of a cooling medium or fluid to and from the anode 14. The cylindrical portion of the anode is divided by the central partition 23 which is in effect a continuation of the plate 25 and serves to provide serially connected paths for the cooling fluid in opposite directions through the two halves of the anode. Instead of employing a central partition, the walls of the anode may be pressed together at a central portion thereof as indicated at 30 in Fig. 3, to provide a pair of parallel, serially connected passages for the cooling fluid which flows in opposite directions through two halves of the anode.

The anode may be sealed to a reentrant portion of the glass container, as indicated in Fig. 2, and a potential applied thereto through a conductor which may be secured to the clamp 31 mounted on the pipe 28. Water entering the anode through the pipe 28 flows in one direction through one-half of the anode and then in the opposite direction through the other half of the anode and out of the anode through pipe 29. This construction permits a water cooled anode to be used which has small dimensions and maximum dissipating power. The anode has no seams or soldering exposed to the vacuum and only one seal is necessary between the anode and container therefor.

What I claim as new and desire to secure by Letters Patent of the United States, is:

1. An electric discharge device comprising a receptacle terminating in a reentrant portion, a hollow, double walled electrode mounted in the receptacle, the walls of the electrode being closed at one end but open at the other end, said electrode being sealed to and forming a closure member for said reentrant portion at the said open end, and a second electrode mounted within said hollow electrode.

2. An electric discharge device comprising a receptacle having a reentrant portion open at the inner end thereof, a hollow, double walled cylindrical anode supported upon and forming a closure for said stem, the walls of the anode being open at the end supported by said stem but closed at the end remote from said stem and a second electrode mounted within said anode.

3. An electric discharge device comprising a receptacle provided with an open-ended reentrant stem, a hollow cylindrical electrode mounted in the receptacle, said electrode being sealed to and forming a closure member for said stem and being provided with double walls, means extending through the stem for supplying a cooling medium to the electrode in contact directly with the interior of said walls, and a second electrode mounted within said cylindrical electrode.

4. An electric discharge device comprising a receptacle provided with a reentrant stem, a hollow anode sealed to and forming a closure for said reentrant portion, said anode containing passageways for a cooling fluid member, and an electrode mounted within said hollow anode.

5. An electric discharge device comprising a receptacle provided with a reentrant stem, a plurality of concentrically arranged electrodes mounted in the receptacle, said electrodes including a hollow anode surrounding the other electrodes and sealed to said reentrant portion, said anode forming a closure for one end of said reentrant stem, and being provided with serially connected passageways therethrough for a cooling fluid.

6. An anode for an electric discharge device comprising a portion of substantially circular cross section, a portion of substantially rectangular cross section and having a closed end, a dividing partition located within the rectangular portion and extending along the entire length thereof to form compartments which communicate with each other at the said closed end whereby a circulatory path for a cooling medium is provided, inlet and outlet fluid conduits connected respectively to said compartments at adjacent positions on the portion of the anode having the circular cross section.

7. An electrode comprising an elongated double-walled member open at one end to receive and discharge a cooling fluid and closed at the other end, said member containing a partition which extends along the length of the member up to a short distance from the closed end whereby the interior of the member is divided into a plurality of fluid-carrying passageways which communicate with each other solely through the space between the end of the partition and the closed end of the member, said electrode being formed as a hollow cylinder adapted to surround a cooperating electrode.

8. An electrode comprising an elongated double-walled member open at one end and closed at the other end, said member containing a partition which extends along the length of the member up to a short distance from the closed end whereby the interior of the member is divided into a plurality of passageways which communicate with each other solely through the space between the end of the partition and the closed end of the member, a fluid inlet conduit connected to one of said passageways at the open end of said member and a fluid outlet conduit connected to another of said passageways at the said open end whereby the direction of fluid flow through one passageway is opposite to the direction of flow through the adjacent passageway, said electrode being formed as a hollow cylinder adapted to surround a cooperating electrode.

MARCUS A. ACHESON.