Aug. 8, 1939 W. E. BAHLS 2,169,015

AUXILIARY ELECTRODE

Filed Feb. 20, 1937

Fig. 1.

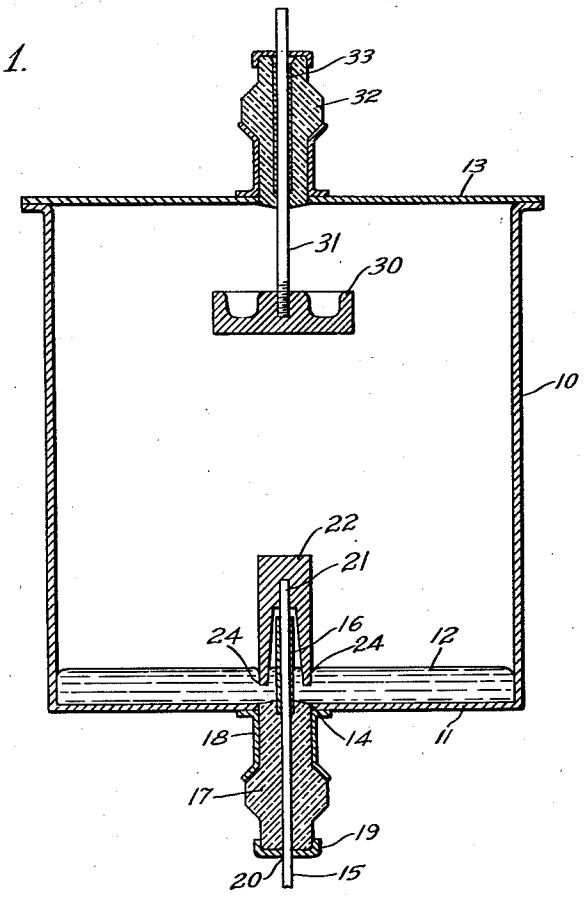


Fig. 2.

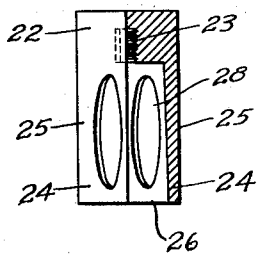
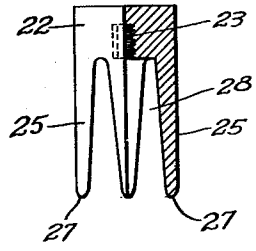


Fig. 3.



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AUXILIARY ELECTRODE

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7 Claims. (Cl. 250—27.5)

My invention relates to auxiliary electrodes for discharge devices and especially to the type of auxiliary electrode that makes contact with a liquid electrode.

An object of my invention is to provide an auxiliary electrode that will effectively contact the liquid cathode of a discharge device.

Another object of my invention is to reduce the maximum peak current required to initiate an arc.

Another object of my invention is to locate the lead-in for the auxiliary electrode where it will not interfere with the normal functioning of the discharge device and its necessary equipment, as, for example, the cooling jacket.

Other objects and advantages will become apparent from the following description and drawing in which:

Figure 1 is a view, principally in cross section, of a discharge device incorporating my invention; and,

Figs. 2 and 3 are views, partly in elevation and partly in cross section of modified forms of the auxiliary electrode.

My invention deals with a solution of the perplexing problem of the lead-in construction in a metal tube of an auxiliary electrode of the type designated as a make-alive in which a high resistance or semi-conductive material, such as boron-carbide, carborundum and various compositions of boron, silicon, carbon, etc., have a contact with a metallic liquid electrode such as mercury. In prior devices, the auxiliary electrode was, in general, brought through the anode or the metal casing adjacent the anode or on the side of the metal casing. In the former construction, a double insulation problem was presented as the anode must be insulated from the container which is at cathode potential and then practically the same amount of insulation must again be used to insulate the anode from the auxiliary electrode. In the case where the auxiliary electrode was brought in on the side of the casing, the connections therefrom prevented the utilization of a simple and easily removable cooling jacket around the metal casing.

In accordance with my invention, I bring the auxiliary electrode directly through the bottom of the casing and liquid electrode and provide a multiple point or broad area contact with the mercury.

In Fig. 1, I have disclosed a preferred embodiment of my invention in which the metal casing has its side walls 10 and bottom plate 11 supporting a metallic liquid 12, such as mercury, as a cathode. A cover portion 13 is welded or copper sweated to the top of the sides 10. The bottom portion 11 of the casing has an opening 14 through which extends a connection or lead-in 15 for the auxiliary electrode. Insulation means 16, such as a quartz tube, surrounds the upper portion of the lead-in and prevents it from making contact directly with the mercury. An insulator 17, preferably of porcelain, fits in the opening 14 of the casing and also closely surrounds the lead-in 15 extending therethrough. A metal tubular portion extension 18 preferably of a material of an alloy of 24% to 30% nickel, 5% to 25% cobalt, less than 1% manganese and the remainder iron or principally iron, is welded or copper sweated to the bottom 11 and is sealed vacuum-tight to the porcelain insulator 17, preferably by means of boro-silicate glass. A cap 19 may be secured to the outer end of the insulator 17 and the opening 20 therein for the passage of the connection 15 therethrough may be likewise sealed with glass. If desired, the connection may terminate at a closed cap and an exterior connection made to the exterior part of this cap. On the inner end 21 of the lead-in 15 is attached the auxiliary electrode proper 22. This connection between the two may be made in any desired way as by the screw-threaded connections 23 disclosed in Figs. 2 and 3. This auxiliary electrode is of a high resistance or semi-conducting material such as the boron carbide material, previously mentioned. This auxiliary electrode 22 is preferably of an inverted cap-shape with the rim 24 extending downward to make a wide contact area with the mercury.

The specific form of this auxiliary electrode may take various shapes and two preferred types of these shapes are disclosed in Figs. 2 and 3. I prefer to have openings 28 between the extensions 25 from the main body or top part 22 of the electrode for the purpose of permitting escape of any vapor from the surface of the mercury enclosed by the auxiliary electrode. In Fig. 2, the end of the extensions 25 have a connecting rim 26. In Fig. 3, on the other hand, the extensions 25 terminate in prongs or tips 27. The openings 28 in Fig. 2 may take the form of ovals, as illustrated, or any other desired form.

In these various forms illustrated, the cross-sectional area sticking into the mercury is less than that of similar electrodes of the prior art with the result that the current will be constricted in the electrode producing higher gradients for a given total current and thus easier starting.

A decided advantage of the multiple contacts,

illustrated in these figures, is to reduce the maximum peak current required to initiate an arc. With the single point initiation of the arc, as in the prior art, the peak current required may vary from cycle to cycle by as much, or more, than ten to one. With two points of initiation, the probability that both would require a high peak current at the same time is very low. Accordingly, the maximum peak current, at which one of the extensions making contact with the mercury will always initiate an arc, is greatly reduced. This advantage is important because it is the high peak currents occasionally required by the single contact of the prior art that causes damage, especially to the cathode of the auxiliary firing tube.

At the upper portion of the metal casing, I have illustrated an anode **30** with a lead-in or conductor **31** extending through an insulator **32** and sealed therein by means of glass or glaze **33** with an assembly similar to the lead-in construction of the auxiliary lead-in construction previously described.

It will be noted that by this construction the sides **10** of the discharge tube are free to receive an easily assembled and easily removed cooling jacket without any interference from electrode leads.

Although I have described a particular type of lead-in construction in regard to the insulator **17** and tubular extension **18** and metal cap **19**, yet other types of seals through metallic casings such as I have described in my copending application Serial No. 106,798, filed October 21, 1936, for Vacuum tight insulated lead-in constructions, may be utilized.

While I have disclosed certain embodiments of my invention, yet many changes in the shape, arrangement and number of elements may be made without departing from my invention. Accordingly, I desire only such limitations on the following claims as are necessitated by the prior art.

I claim as my invention:

1. In a discharge device, a liquid electrode and an auxiliary electrode comprising a body having a plurality of prongs, the ends of which make a plurality of separate contacts with said liquid electrode.

2. In a discharge device, a liquid electrode and an auxiliary electrode comprising a high resistance body having a plurality of prongs, the ends of which make a plurality of separate contacts with said liquid electrode.

3. In a discharge device, a liquid electrode and an auxiliary electrode in contact therewith, said contact being through a plurality of high resistance paths which are separated from each other by gaps.

4. A discharge device having a liquid electrode and an auxiliary electrode in fixed contact therewith, said auxiliary electrode having a connection extending through and insulated from said liquid electrode, the contacts of said auxiliary electrode with said liquid being spaced at several points, at least, radially about said connection.

5. A discharge device comprising a casing having an anode at one end thereof, a liquid cathode at the other and an auxiliary electrode structure comprising a lead-in extending through said liquid, insulation means between said lead-in and said liquid and covering all points thereof between the upper and lower boundaries of said liquid and a high resistance material on said lead-in extending into contact with said liquid cathode on a plurality of sides of said lead-in.

6. A discharge device comprising a metal casing, a metallic liquid in said casing, an anode extending through said casing and insulated therefrom, and an auxiliary electrode having a connection extending through and insulated from said metal casing and metallic liquid at all points of said connection below the upper surface of said liquid, said auxiliary electrode having a high resistance material in the form of an inverted cap in contact with said metallic liquid.

7. A discharge device comprising a metal casing, a metallic liquid in said casing, an anode extending through said casing and insulated therefrom, and an auxiliary electrode having a connection extending through and insulated from said metal casing and metallic liquid at all points of said connection below the upper surface of said liquid, said auxiliary electrode having a high resistance material in the form of a perforated inverted cap in contact with said metallic liquid.

WALTER E. BAHLS.