Sept. 2, 1941. S. AOKI 2,254,722

DISCHARGE DEVICE

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Fig. 1.

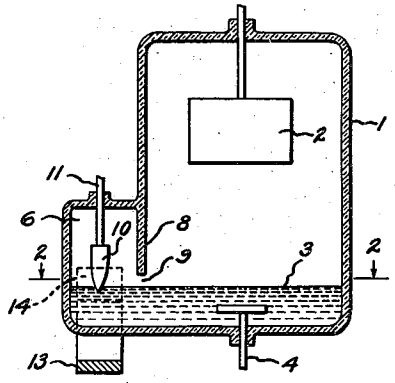
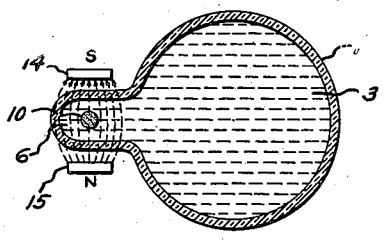


Fig. 2.



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DISCHARGE DEVICE

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3 Claims. (Cl. 250—27.5)

This invention relates to improvements in that class of intermittently conducting discharge device which utilizes a mercury cathode and a make-alive electrode of the immersion type.

It is a particular object of the invention to provide an arrangement for safe-guarding the make-alive electrode from the effects of the main discharge without thereby decreasing its effectiveness as a discharge-controlling means. This is accomplished by enclosing the electrode in a chamber which is separate from the main body of the envelope, although in communication therewith, and by employing a properly directed magnetic field to assist in transferring a cathode spot established by the electrode to the main discharge space.

The features which I desire to protect herein are pointed out with particularity in the appended claims. The invention, itself, together with further objects and advantages thereof, may best be understood by reference to the following description taken in connection with the drawing, in which Fig. 1 is a longitudinal sectional view of a discharge device suitably embodying the invention and Fig. 2 is a transverse section taken on line 2—2 of Fig. 1.

Referring particularly to Fig. 1 there is shown a discharge envelope 1, consisting, for example, of glass or an equivalent insulating material. Within the envelope there are provided an anode 2 and a pool type cathode 3. The cathode may consist of a body of mercury and is connected with an outside source of potential (not shown) by means of a lead-in conductor 4, carried through the wall of the envelope.

A device such as that illustrated is normally non-conductive, but can be caused to become conductive by the establishment of a cathode spot on the mercury surface at a time when the potential relationship between the main electrodes is favorable to the occurrence of a discharge. In this connection, it is known to employ as a means for producing a cathode spot, a make-alive electrode consisting of a body of semiconducting material partially immersed in the mercury at the cathode surface. However, the life of such electrodes tends to be undesirably short because of the destructive effects of the main discharge, to which they are ordinarily exposed.

In accordance with my present invention, this difficulty is overcome by positioning the make-alive element in an auxiliary discharge chamber. In the arrangement illustrated, such a chamber is provided by an enclosure 6 which constitutes an extension of the main body of the envelope and which projects externally of the envelope. The enclosure 6 is partially segregated from the main discharge space by the provision of a wall part 8 but is in communication with such discharge space through an opening 9 provided at the surface of the cathode 3. A make-alive electrode comprising a body of high resistance material such, for example, as boron carbide, is provided in contact with the mercury surface as indicated at 10. This electrode has a conductive connection 11, which projects through the wall of the envelope so as to permit the energization of the electrode by an appropriate control potential. In operation, the application of a positive potential to the electrode 10 tends to create a cathode spot at the intersection of the electrode and the mercury, especially when the application of such potential coincides with the application of positive potential to the main anode 2. Under these circumstances the initiation of a cathode spot makes possible the occurrence of a main discharge between the anode 2 and the cathode 3.

In view of the fact that the make-alive electrode 10 is separated from the main discharge chamber by the walls of the enclosure 6, it cannot be overheated by the main discharge current. Consequently its operating life is very much prolonged, and the likelihood of an objectionable change in its conductive characteristics is reduced. Moreover, inasmuch as the main discharge path is in no way obstructed by the presence of the electrode 10 the arc drop of the device as a whole is diminished.

In order to overcome the reluctance of the cathode spot which is established by the electrode 10 to transfer itself to that part of the cathode which is contained in the main body of the envelope, my invention further provides means for producing a magnetic field in the vicinity of the electrode 10 and in such direction with respect thereto as to facilitate the transfer of the cathode spot. Such a magnetic field may be produced, for example, by means of a magnetic yoke positioned as indicated at 13 so that its pole pieces 14 and 15 are in close proximity to the lateral walls of the enclosure 6. With the arrangement illustrated the magnetic flux is in a direction parallel to the cathode surface and transverse to the direction in which it is desired to cause the cathode spot to move. Under these circumstances, if the polarity of the magnetic field is as indicated, motion of the cathode spot toward the main discharge enclosure will be as-

sisted in accordance with the known laws of electromagnetic action, inasmuch as the direction of flow of the current by which the cathode spot is supplied is in a direction generally perpendicular to the cathode surface.

While I have described the invention in connection with a particular embodiment thereof, it will be understood that numerous modifications may be made by those skilled in the art without departing from the invention. I, therefore, aim in the appended claims to cover all such equivalent variations as come within the true scope of the foregoing disclosure.

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

1. In an intermittently conducting discharge device having an anode and a pool-type cathode, the combination which includes a main discharge chamber containing said anode and cathode, an auxiliary chamber separate from the main chamber but communicating therewith at the cathode surface, a make-alive electrode contained within said auxiliary chamber and in operative relation to the cathode material therein, and means for producing a magnetic field in the vicinity of the said make-alive electrode and in such relation thereto as to assist in transferring a cathode spot formed by the electrode within the auxiliary chamber to the main discharge chamber.

2. In an intermittently conducting discharge device having an anode and a pool-type cathode, the combination which includes an envelope defining a main discharge chamber for the said anode and cathode, means defining an auxiliary discharge chamber external to the main body of the envelope but communicating therewith at the cathode surface, a make-alive electrode of the immersion type contained within the said auxiliary chamber and in contact with cathode material therein, and means for producing a magnetic field parallel to the cathode surface in the vicinity of the make-alive electrode and in such direction with respect thereto as to assist in transferring a cathode spot formed by the electrode to the main discharge chamber.

3. In an intermittently conducting discharge device having an anode and a pool-type cathode, the combination which includes an envelope defining a main discharge chamber enclosing said anode and a portion of said cathode, an auxiliary discharge chamber materially smaller than the main chamber and formed as an outward extension of the body of the envelope, said auxiliary chamber containing a portion of the cathode and being in communication with the main discharge chamber at the cathode surface, a make-alive electrode of the immersion type within the said auxiliary chamber and in contact with the cathode material therein, and a magnetic structure externally embracing the said auxiliary chamber so as to produce therein a magnetic field parallel to the cathode surface and in such relation to the said make-alive electrode as to assist in transferring a cathode spot formed thereby to the portion of the cathode surface within the main discharge chamber.

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