Feb. 14, 1939. G. DOBKE 2,147,484

POOL TYPE DISCHARGE DEVICE

Filed Feb. 24, 1937

Fig. 1.

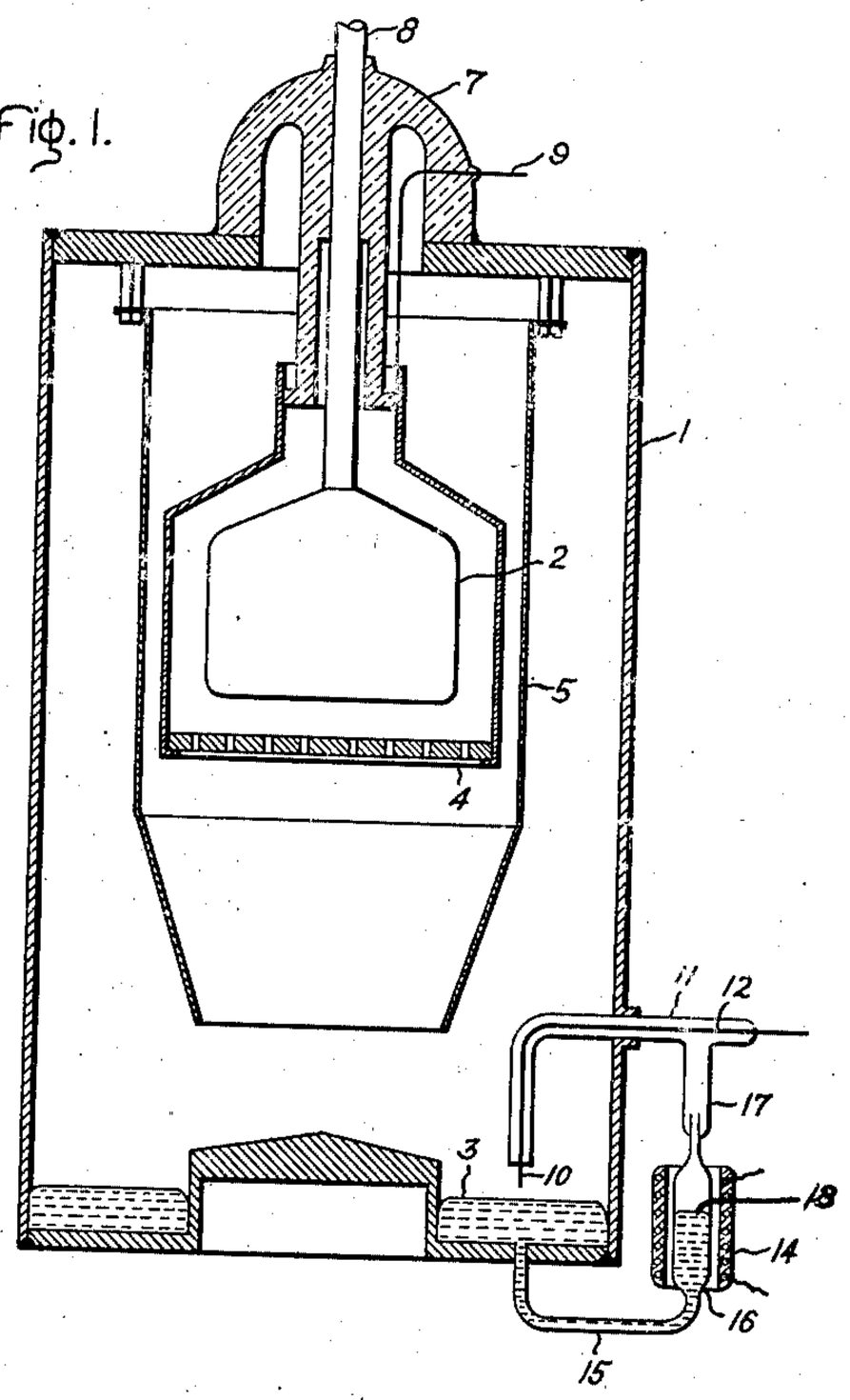


Fig. 2.

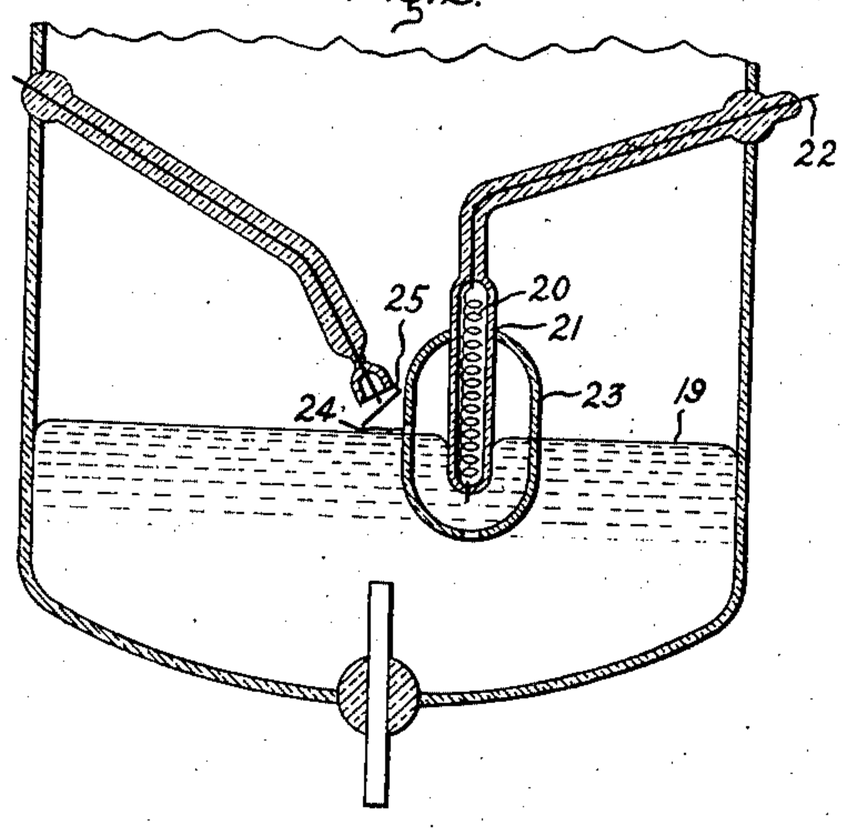
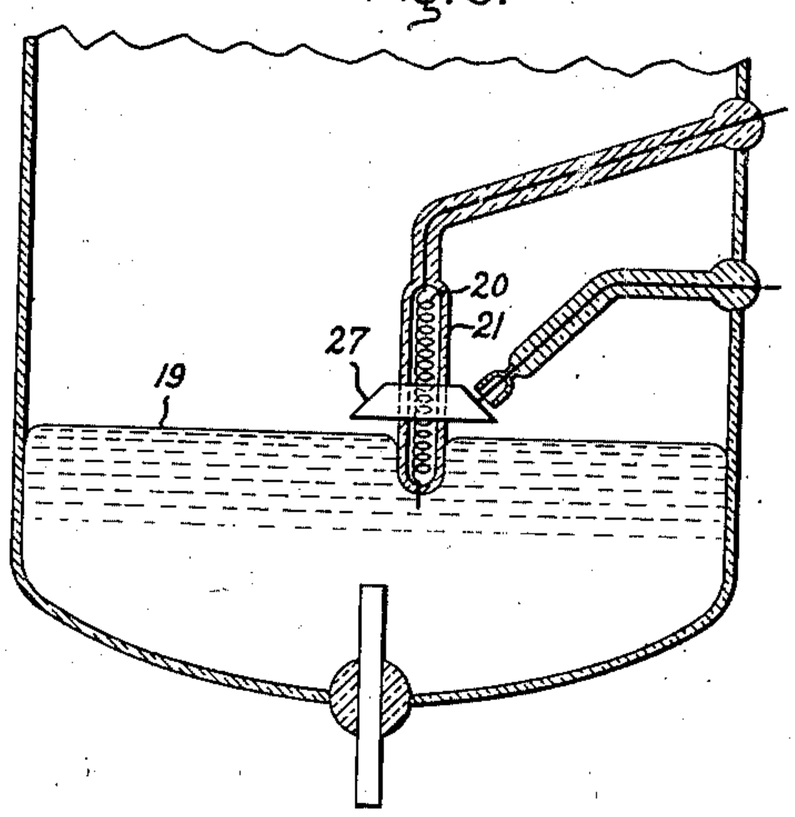


Fig. 3.



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POOL TYPE DISCHARGE DEVICE

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4 Claims. (Cl. 250—27.5)

The present invention relates to discharge devices, and more particularly to an improved ignition means for such devices.

The invention is especially concerned with pool-type discharge devices which are adapted to become wholly non-conductive during at least a portion of each voltage cycle. One object hereof is to provide means for effectively and reliably controlling the restarting of such devices at desired intervals of time. An important feature of the invention consists in the combination of an ignition electrode positioned in non-contiguous proximity to the cathode surface, and means effective during the operation of the device to produce a copious supply of vaporized ionizable material in the region between the ignition electrode and the cathode surface.

The particular features desired to be protected herein are pointed out with particularity in the appended claims. The invention itself, however, may best be understood by reference to the following description taken in connection with the accompanying drawing, in which Fig. 1 represents in longitudinal section a discharge device suitably embodying the invention; Fig. 2 is a fragmentary section of a modified discharge device embodying an alternative form of the invention, and Fig. 3 is a similar view showing still another possible modification.

Referring particularly to Fig. 1 there is shown an enclosing envelope comprising a sealed metal container 1. This container encloses an anode 2 and a pool-type cathode 3, for example, of mercury. In connection with the anode there is provided a grid 4 and a protective shield comprising a metal cylinder 5 surrounding the grid and anode. The anode 2 is supported and insulated from the envelope by means of a suitable insulator shown in the present case as a glass body 7 through which the anode lead-in connection 8 is sealed. A lead-in connection 9 for the grid 4 may also be sealed through the glass body 7 in the manner indicated.

Discharge devices of the type illustrated are conventionally used in rectifier or inverted circuits and when so used are adapted to become wholly non-conductive during that portion of the voltage cycle in which the anode 2 is negative with respect to the cathode 3. In order that the discharge may be resumed at the beginning of each positive half cycle, it is necessary to provide in connection with the cathode a suitable ignition means. Such means should be capable of operating reliably through the application of a control voltage of relatively low potential.

In Fig. 1 there is shown a particular ignition device constructed in accordance with the principles of the present invention. As illustrated this comprises an ignition electrode 10 positioned in non-contiguous proximity to the cathode surface; that is, arranged close to but out of contact with the cathode material. The ignition electrode 10 may comprise a metal wire for example, of tungsten arranged within the bore of a hollow tube 11, preferably of insulating material. The internal diameter of this tube should be sufficiently great so that a free space will be provided around the lead-in connection 12.

In order to facilitate the initiation of an arc when a positive potential is impressed between the electrode 10 and the cathode 3, means is provided for generating in the region between the electrode and the cathode surface a copious supply of ionizable vapor, preferably vaporized cathode material.

In the particular arrangement shown this means comprises a tube 15 in communication with the main body of cathode material and also connecting with a chamber 16 arranged outside the discharge envelope. In connection with the chamber 16 there is provided a heating means 14, suitably an electrical resistance heater, surrounding the chamber. This heater may be energized either by the current passing through the discharge device, or by means entirely independent of the main discharge. In either case the heat which it produces will cause substantial vaporization of the cathode material contained in the chamber 16 and will cause the vapor thereby produced to be forced through an outlet tube 17, the tube 11 and around the ignition electrode 10. The high vapor density thus created in the vicinity of the ignition electrode will permit a discharge to take place between it and the cathode surface at a relatively low potential on the order of a few volts. Consequently, whenever the anode 2 is positive with respect to the cathode 3, the discharge device as a whole may be rendered conductive by impressing a positive potential of the desired magnitude on the ignition electrode 10. In order to prevent the initial cathode spot from being formed on the surface of the mercury at 18 instead of at 3, a construction may be provided in the tubular connection 17.

In Fig. 2 I have shown a somewhat modified form of the invention comprising a vapor generating device in contact with the main surface of the cathode material (designated by the numeral 19). In this case the vapor generating device includes an electrical resistance heater 20

enclosed within an insulating sheath 21 and provided with current by means of a lead-in connection 22. A return circuit for the heating current is provided through the cathode material 19. In order to project the vaporized cathode material into the desired space a container 23 having an opening 24 at the surface of the cathode is arranged to surround the heater.

In operation, vapor issuing from the opening 24 produces a high vapor density in the vicinity of a starting electrode comprising a thin plate or disk 25 supported adjacent to the opening. Under these conditions the act of impressing a positive potential on the starting electrode 25 will cause a cathode spot to develop approximately in the opening 24. However, the further action of the issuing vapor will cause the cathode spot to be forced away from the container 23 and will thereby prevent its destruction by the action of the spot. I prefer to make the container 23 of a material such as glass which is a poor conductor of heat, or to form the container with double walls in order that very little heating energy will be required to produce vaporization of the cathode material.

The arrangement of Fig. 3 employs a heating device similar to that described in connection with Fig. 2. In this case, however, the ignition electrode comprises a plate-like portion 27 arranged at the lower end of the heater sheath 21 and positioned approximately parallel to the cathode surface. With this arrangement vaporization of the cathode material will take place in the vicinity of the ignition electrode. Due to the confined space provided between the plate-like portion 27 and the cathode surface, the cathode spot will be driven away from the ignition device by the action of the mercury vapor as soon as an arc is initiated. In this way the ignition device as a whole will be protected from the destructive effects of the cathode spot.

While I have shown particular embodiments of my invention, it will be understood by those skilled in the art that many modifications may be made without departing from the invention, and I aim by the appended claims to cover all such modifications as fall within the true spirit and scope of the invention.

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

1. In an electric discharge device, an anode, a pool-type cathode and an ignition device, said ignition device including the combination of an ignition electrode in non-contiguous proximity to the cathode surface, a container enclosing a quantity of cathode material and having an opening adjacent the region between the ignition electrode and the cathode surface, and a heater continuously effective through the operation of the discharge device to vaporize cathode material within the container.

2. An electric discharge device including the combination of an anode, a pool-type cathode, an ignition electrode positioned above and out of contact with the cathode surface, said electrode being operable intermittently to create an auxiliary discharge to the cathode thereby to initiate a main discharge between the anode and cathode, and means including an electrical resistance heater in heat-exchanging relation with the cathode material for continuously supplying such material in vapor form to the space between the cathode surface and the ignition electrode so as to facilitate the functioning of the latter, said resistance heater having its conductive parts completely insulatingly separated from the discharge space.

3. An electric discharge device including an anode, a pool-type cathode, an ignition electrode positioned above and out of contact with the cathode surface, said electrode being operable intermittently to produce an auxiliary discharge to the cathode thereby to initiate a main discharge between the cathode and anode, means including an electrical resistance heater in heat-exchanging relation with the cathode material for continuously supplying such material in vaporized form to the space between the cathode surface and the ignition electrode so as to facilitate the functioning of the latter, and an electrically completely separating insulating wall shielding the conducting parts of the heater from direct contact with the discharge space.

4. An electric discharge device including the combination of an anode, a mercury pool cathode, an ignition electrode comprising a plate-like portion extending approximately parallel to the cathode surface and closely adjacent thereto so that the cathode spot is prevented from lodging under the electrode, and means including a resistance heater for maintaining a supply of vaporized mercury in the space between the cathode surface and the ignition electrode during the entire period of operation of the discharge device, said heater comprising a portion contacting the cathode surface in a region underlying the plate-like portion of the ignition electrode.

GÜNTHER DOBKE.