Oct. 20, 1931. M. CRÉMER 1,828,645

ELECTRICAL APPARATUS

Filed Aug. 2, 1927

Fig. 1.

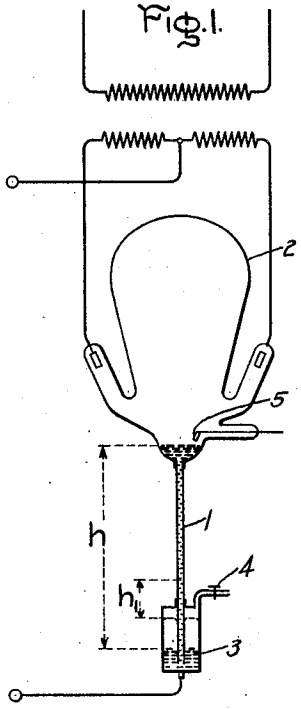


Fig. 2.

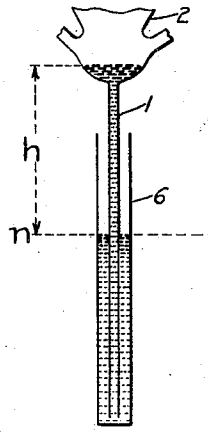


Fig. 3.

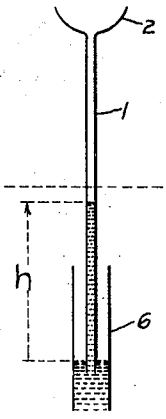


Fig. 4.

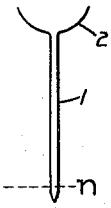


Fig. 6.

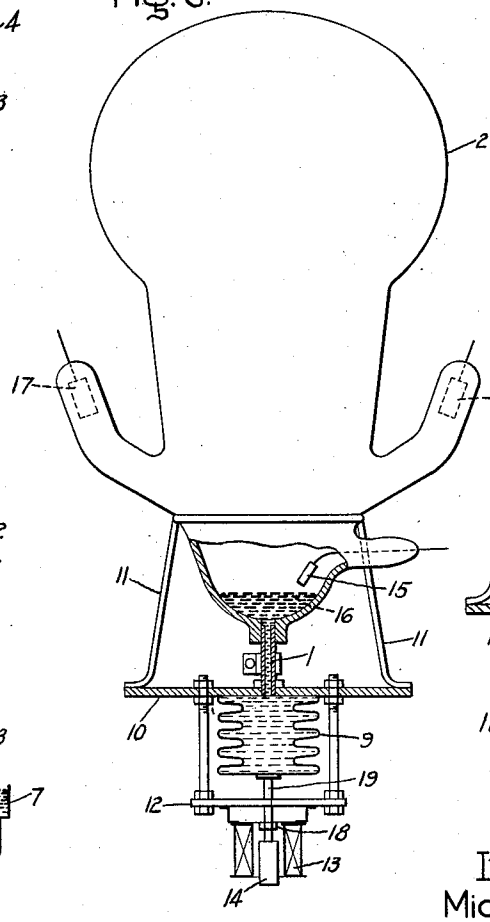


Fig. 5.

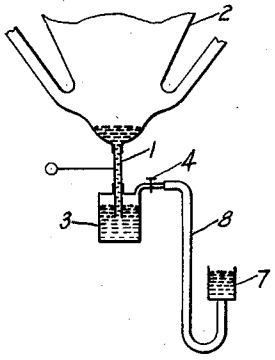
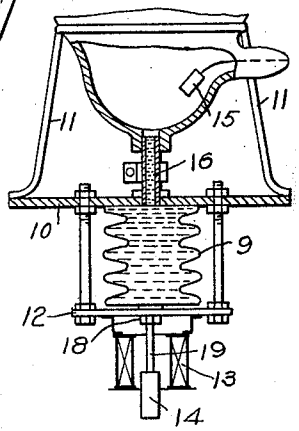


Fig. 7.



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His Attorney.

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UNITED STATES PATENT OFFICE

MICHEL CRÉMER, OF PARIS, FRANCE, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK

ELECTRICAL APPARATUS

Application filed August 2, 1927, Serial No. 210,184, and in France December 30, 1926.

My invention relates to electrical apparatus, such as a vapor electric device provided with an electrode of liquid metal, and has for its principal object the provision of an improved construction which greatly facilitates the transportation and operation of such apparatus.

The invention will be described as applied to mercury arc rectifiers, but it will be apparent that it may be readily applied to other devices such as vapor electric circuit breakers, arc lamps, oscillators, and the like.

It is known that mercury arc rectifiers capable of transmitting large currents comprise considerable quantities of mercury which render their transportation difficult, especially if they are provided with an evacuated receptacle of glass. Another difficulty encountered in connection with mercury arc rectifiers is the provision of a satisfactory and simple means for starting the arc through which the current of the rectifier is transmitted. In accordance with my invention, these difficulties are avoided by the provision of means for withdrawing the liquid metal electrode from the evacuated receptacle during transportation and for moving the liquid metal electrode so as to complete and interrupt a circuit whereby starting of the main arc is effected.

My invention will be better understood from the following description when considered in connection with the accompanying drawings and its scope will be pointed out in the appended claims.

Referring to the drawings, Fig. 1 relates to a mercury arc rectifier provided with means for moving the level of the mercury cathode with respect to the other electrodes of the apparatus; Figs. 2 to 5 show a modified arrangement whereby the same result is effected; and Figs. 6 and 7 relate to a further modification in the means for controlling the level of the mercury cathode.

In accordance with the invention, the cathodic lead 1 sealed into the lower part of the rectifier 2 shown in Fig. 1 is a tube preferably made of a good electrical and thermal conducting metal. At the lower end of this tube there is located a reservoir 3 filled in part with mercury, so that the whole represents a device similar to a barometer. If the cock 4 is open, the height h of the mercury column is evidently equal to about 760 mm. but I can reduce the required length of the tube 1 by establishing a partial vacuum in the interior of the reservoir 3.

The level of the mercury being thus suitably regulated, the arc of the rectifier is readily started by increasing the pressure in the interior of the reservoir 3 until the mercury comes into contact with an ignition anode 5. It then suffices to reestablish the original pressure to effect the breaking of the current and to establish the lighting arc. Various means which may be employed to vary the level of the mercury cathode will be described hereinafter.

If the pressure in the reservoir 3 is decreased until all the mercury has been drawn into the tube 1 and the column of mercury is equal to h_1 for example, the cock 4 may be closed and the rectifier can be transported without danger to its fragile parts. After the final installation, the normal column of mercury is reestablished by opening the valve 4.

I can employ another method to completely evacuate the mercury from the rectifier during its transportation. During the manufacture the bulb 2, represented in part in Fig. 2, is provided provisionally with a very long tube 1 of glass, surrounded by a reservoir 6. The rectifier is evacuated, the column h being equal to the normal barometrical column. This operation being terminated, I lower the reservoir 6 in such a manner that the mercury in the tube 1 is below the level n n, see Fig. 3. At this moment the tube is sealed below this level as is shown in Fig. 4, and the rectifier no longer contains mercury. It can then be transported and installed, after which it suffices to plunge the extremity of the tube 1 into a reservoir 3 similar to that of Fig. 1 and to break the point of the seal.

The variations in pressure in the reservoir 3 can be obtained by any suitable device. I can for example employ for this purpose a cylinder with a movable piston actuated by

an electromagnet which is fed when I desire to effect starting of the arc; in place of a piston, I can use the arrangement shown in Fig. 5, in which I use a short metal tube 1 connected to a tight reservoir 3 in the interior of which the partial vacuum is regulated by the movable reservoir 7 connected to the reservoir 3 by the intermedium of a flexible tube 8. It goes without saying that the reservoir 3 can be omitted and that the flexible tube 8 can be directly arranged on tube 1.

Fig. 6 relates to an improved arrangement based on the use of an elastic corrugated bellows 9. These bellows, known on the market under the name of "sylphon bellows" and formed of a suitable metal, capable of standing high interior and exterior pressures, are absolutely tight, being made of one piece without joints and soldering. and are very elastic in the longitudinal direction.

In Fig. 6 the plate 10 represents the support of the rectifier connected to its bulb 2 by a metal tube 1, of copper for example, sealed into the glass; the bulb itself is supported by the feet 11. The flexible bellows 9 having several circuar corrugations is filled with mercury, as is also the tube 1 and the lower part of the vessel.

The support 12 fixed at a certain distance from the plate 10 carries a coil 13 acting on its core 14, which being attracted can compress the bellows 9 and produce in this manner the regulation of the level of the mercury in the interior of the rectifier.

In order to produce the lighting of the arc the coil 13 is energized; the core 14 rises and pushes back the mercury through the tube 1 until it arrives in contact with the lighting electrode 15. The coil 13 is then de-energized and the bellows 9 expands thus lighting the arc between the cathode 16 and the anodes 17. It goes without saying that the mechanical control and the arrangement of the parts can be made altogether differently.

To transport the rectifier, it suffices to lengthen the bellows 9 so as to suck in all the mercury by the tube 1. This can be obtained for example by means of the nutscrew 18 which is screwed on the rod 19 until it bears against the support 12 and by drawing the rod 19 downwardly. This is clearly illustrated in Fig. 7. In this manner I cause the lowering of the level of the mercury until it is preferably located in the interior of tube 1 the section of which is relatively small. Under these conditions the oscillations of the mercury due to shocks in the course of the transportation are not to be feared.

It is to be noted that the corrugations of the bellows 9 represent small wings capable of notably activating the cooling of the cathode.

In place of controlling the mercury level by the intermedium of the hollow cathode conductor, I can, it is well understood, use a special tube establishing a connection with the auxiliary reservoir.

On the other hand, instead of applying the invention to rectifiers of glass, I can use the arrangements described above, or their modifications, in rectifiers or similar devices having a metallic container.

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

1. An electrical device comprising an evacuated vessel, a solid electrode mounted within said vessel, a hollow electrically conductive member, an elastic receptacle connected with said vessel by means of said hollow electrically conductive member, a liquid electrode extending between said vessel and said receptacle, means for applying to a wall of said vessel a pressure which may be varied to control the spacing between said electrodes, and means for locking said elastic receptacle in such a position that said liquid electrode is withdrawn from said vessel.

2. An electrical device comprising an evacuated vessel, a solid electrode mounted within said vessel, an elastic receptacle connected with said vessel, a liquid electrode extending between said vessel and said receptacle, electroresponsive means for applying to the exterior surface of said receptacle a pressure which may be varied, and adjustable means for limiting the movement of said elastic receptacle.

3. A vapor electric device comprising an evacuated vessel, a corrugated bellows, a tubular member of relatively small cross-section connecting said bellows to said vessel, a liquid electrode extending between said vessel and said bellows through said tubular member, a portion of said liquid electrode lying within said vessel during operation of said device, and means operative to lengthen said bellows to withdraw said portion of said liquid electrode from said vessel.

In witness whereof, I have hereunto set my hand this 11th day of July, 1927.

MICHEL CRÉMER.