

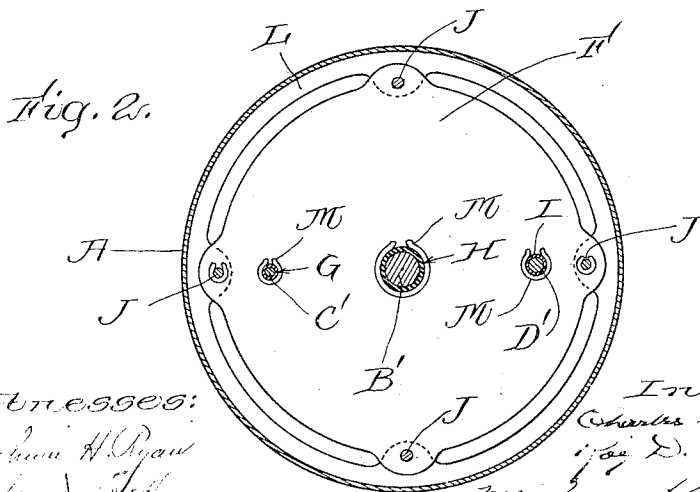
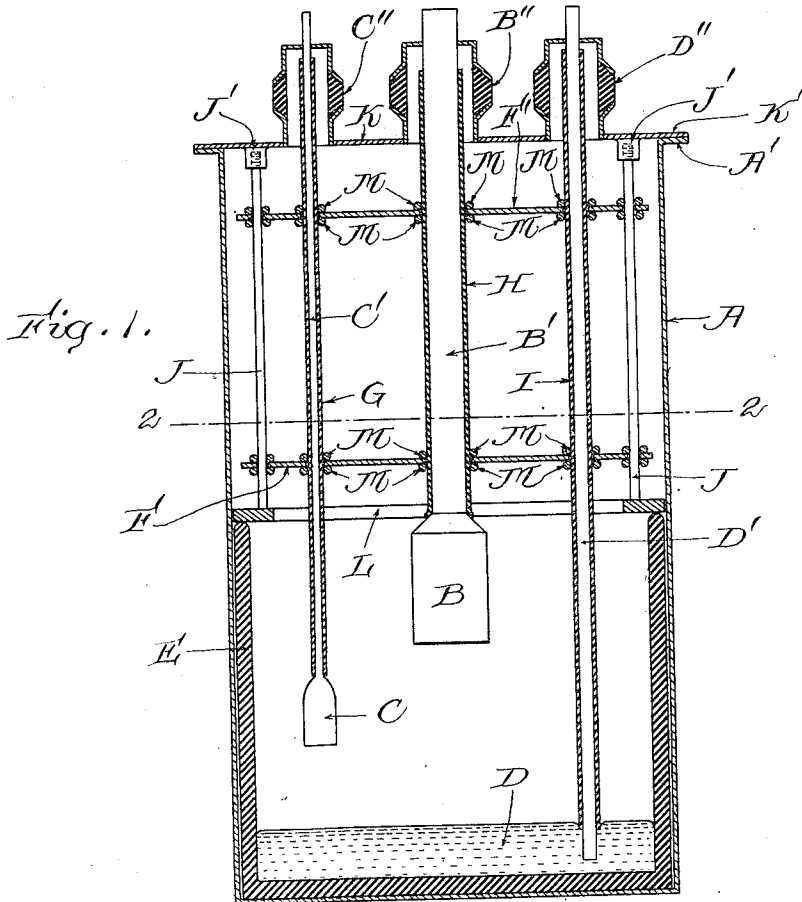
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VAPOR ELECTRIC APPARATUS.

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1,046,082.



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# UNITED STATES PATENT OFFICE.

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## VAPOR ELECTRIC APPARATUS.

1,046,082.

Specification of Letters Patent.

Patented Dec. 3, 1912.

Application filed June 30, 1910. Serial No. 569,696.

*To all whom it may concern:*

Be it known that we, CHARLES A. KRAUS and ROY D. MAILEY, both citizens of the United States, and residents, respectively, of Newton Highlands and Lynn, in the counties of Middlesex and Essex and State of Massachusetts, have invented new and useful Improvements in Vapor Electric Apparatus, of which the following is a specification.

Our invention relates to the construction of vapor electric apparatus and is particularly applicable to apparatus of this character wherein a closed metal container is employed with electrode leads of considerable length, current-carrying capacity, and consequently weight, which are led through the walls of the container and secured therein by hermetically closed insulating joints.

The object of these improvements is to provide suitable apparatus within the container for the electrode leads so as to relieve the joints of the stresses due to the weight of the electrodes and their leads, to the accidents of handling, transportation and the agitations of operation.

We illustrate our improvements as applied to a mercury vapor rectifier which is a typical example of vapor electric apparatus. The rectifier to which we show our improvements as applied consists of a closed metal container which includes one or more main anodes properly designed to carry out the rectification of an alternating current, together with one or more auxiliary anodes of which the function is to maintain the rectifier at all times in proper operative condition, and a mercury cathode. A rectifier of the character indicated is adapted to form part of a distributing system such as described in an application for United States Letters Patent Serial No. 514,907, filed on or about August 27, 1909.

The leads which join the various electrodes with other essential parts of the distributing system pass upward through the container through the upper wall thereof from which they are insulated and to which they are secured, by means of gas-tight insulating joints, preferably such as are described in patent applications Serial Nos. 514,858 and 514,859 filed on or about August 27th, 1909. In a structure such as indicated, the electrode leads are of considerable length since they pass through the greater part of

the height of the container in which the mercury vaporized by the arc is condensed. In rectifiers of this general character which possess small current-carrying capacity, the joints which support the electrode leads may be made amply strong to resist ordinary and accidental stresses, but as the capacity of the rectifier is increased the size of the container and of the electrodes and leads is also necessarily increased, and as the weight of the electrodes and leads under fixed conditions of length increases substantially as the square of the diameter, while the holding surface of the joint increases approximately only as the diameter and as capacity of the instrument is increased, the effective holding surface of the joint relatively diminishes. But further, increase in the capacity of the rectifier in practice requires an increase in the length of electrode leads since the dimensions of the condensing chamber must be increased to provide for sufficient condensation of vaporized mercury. As a result, the stresses on the joints are greatly increased on account of the increased leverage of the massive electrodes on lever arms of increased length, and ultimately the normal or accidental stresses on such joints must reach dangerous proportions. Any fracture of a joint results in the impairment both of their insulating and gas-excluding efficiency. Rupture of such joints would naturally occur in conditions of exceptional mechanical stress such as arise from overloads of the apparatus or from mechanical shock which is almost inevitable in the course of commercial use and transportation.

Our improvements herein described consist of a support or system of supports which, under all reasonably expected conditions of use and transportation, will keep the stresses upon the gas-tight insulating joints within safe limits, and our improvements result in considerable economy of manufacture and make possible the construction and use of large rectifiers which otherwise could not be employed because of the difficulties referred to. The supports should be applied as near to the electrodes as is feasible. Electrode leads of considerable length are under such conditions advantageous rather than disadvantageous, since the more flexible the lead, the smaller will be the stress on the joint for a given displacement.

ment at the point of application of the electrode lead support.

While the support of the electrodes and their leads and the protection of the joints are the chief objects of these improvements, the system of internal supports herein described may be made to serve other useful purposes, such as performing the functions of a system of baffle plates which directs and controls the flow of mercury vapor within the container or of fixing in position insulating sleeves upon the leads, holding in position an insulating cup for the mercury cathode, and in short, for supporting or securing within the container any part which may be found necessary or advantageous.

In the drawings hereto annexed, which illustrate an example of our improvements,—Figure 1 is a vertical cross section of a mercury arc rectifier; and Fig. 2 is a cross section of the same taken on the line 2—2 in Fig. 1.

Referring to Fig. 1, which represents a metal contained rectifier, A is the metal container provided with a cover K the margin of which at K' is secured and sealed to a flange A' upon the container A. B represents a main anode and B' the anode lead, C an auxiliary anode and C' its lead, D a mercury cathode contained in an insulating cup E, D' being the cathode lead. The leads B', C', D', are secured to and insulated from the cover K by means of the joints at B<sup>2</sup>, C<sup>2</sup>, and D<sup>2</sup>. Rods or tubes J, J, are secured to the inside of the cover K to which bosses J' are welded, these being provided with screw sockets into which the rods or tubes J, J, are screwed. A ring L is secured as by welding to the lower ends of the rods or tubes J, J, the length of the latter being so determined that when the cover K is in place, the ring L will bear upon and hold in place the insulating cup E. A plate F, the preferable shape of which is shown in Fig. 2, is also firmly secured to the supporting rods or tubes J, J, and is perforated so as to admit the electrode leads B', C' and D', these leads being provided respectively with sleeves of insulated material H, G and I. The perforations in the plate F are preferably of such a size as just to admit the electrode leads with their insulating sleeves. In order to support the insulating sleeves upon the electrode leads, clips M, M, are provided which may be split rings of spring material which tightly embrace the electrode leads above and below the plate F. By referring to Fig. 2 it will be observed that the metal plate F does not extend out to the walls of the container A but is spaced therefrom. This arrangement allows the circulation of mercury vapor to pass the anodes toward the upper portion of the apparatus and directs the stream of vapor toward the sides of the container, thus facilitating the condensation of

the mercury in the upper portion of the apparatus. The plate F through which the rods or tubes J, J, derive support from the container walls, is placed as far as is practicable from the joints B<sup>2</sup>, C<sup>2</sup>, D<sup>2</sup>, so that any displacement of the electrode leads which may be permitted, by reason of slight clearance in the apertures in the plate F, has no significant or practical effect upon the joints where the leads are sealed to the container.

We believe it to be desirable to supplement the plate F by a similar plate F' above it and between the plate F and the top of the container. Such an upper brace plate will contribute to some extent to the physical support of the electrode leads but will be largely functional in providing additional clips M to sustain the insulating sleeves for the electrode leads, and in providing also an additional baffle plate to arrest and control the circulation of mercury vapor in the apparatus. The function of the insulating sleeves G, H and I is to insulate the sleeves from the plates F and F' and the metallic connections to the container walls. The ring L serves not only to hold the cathode E in place and to prevent it from being displaced upward by accumulation of mercury between the cup and the walls of the container, but also is useful in affording a lower steadying support for the system of braces and plates attached by the rods or tubes J, J, to the cover of the container.

It will be observed from the foregoing description that the construction specified enables the rectifier to be manufactured and assembled economically. The cathode cup E simply slips into the bottom of the container A and all of the other functional adjuncts of the apparatus pass through or are secured to and supported by the cover K. All of these cover supported parts can conveniently be joined together before the cover K is joined to the container A; the cover is then put on the container and all its attached parts go into position and the cover may then be welded to the container, the apparatus exhausted when it will be ready for transportation and subsequent use.

What we claim and desire to secure by Letters Patent is:

1. In a vapor electric apparatus, a closed metal container, anodes and anode leads, a mercury cathode and a cup of insulating material therefor resting in the bottom of the container, and a system of supports secured internally to the container engaging the electrode leads and bearing upon the cathode cup.

2. In a vapor electric apparatus, a closed metal container, anodes and anode leads, a mercury cathode, a cup of insulating material therefor resting in the bottom of the container, and a system of internal sup-

ports suspended from the top of the container engaging the electrode leads near the lower ends thereof and bearing upon the cathode cup.

5 3. In a vapor electric apparatus, a closed metal container, electrodes and electrode leads passing through the top of the container, hermetic insulating joints securing the leads to the container, a mercury cathode and a cup therefor of insulating material resting in the bottom of the container, and a system of supports internally secured to the top of the container engaging the electrode leads near the lower ends thereof and bearing upon the cathode cup.

10 4. In a vapor electric apparatus, a closed metal container comprising a body and a cover hermetically sealed to each other, electrode leads sealed in and passing through the cover extending downward into the body of the container, a frame secured internally to the cover extending downward and provided with a brace member extending across the interior of the container engaging the electrode leads and spaced from the container walls.

15 5. In a vapor electric apparatus, the combination with electrodes and electrode leads, of a system of supports comprising brace members, insulating sleeves for the electrode leads, said leads and sleeves passing

through the brace plates, and supports for the brace members joined to the container walls.

6. In a vapor electric apparatus, the combination with electrodes and electrode leads, of a system of supports comprising brace members through which the electrode leads pass, said members extending across the interior of the apparatus spaced from the said walls thereof and secured to supports secured in turn to the walls of the container.

7. In a vapor electric apparatus, a metal container comprising a body and a cover, electrodes and electrode leads passing through and hermetically sealed to and insulated from the cover, a supporting framework secured to the under side of the cover and comprising rods and brace members, the latter perforated to engage with the electrode leads, and insulating sleeves upon the leads to insulate them from the brace members.

Signed by us at Boston, Massachusetts this twentieth day of June, 1910.

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