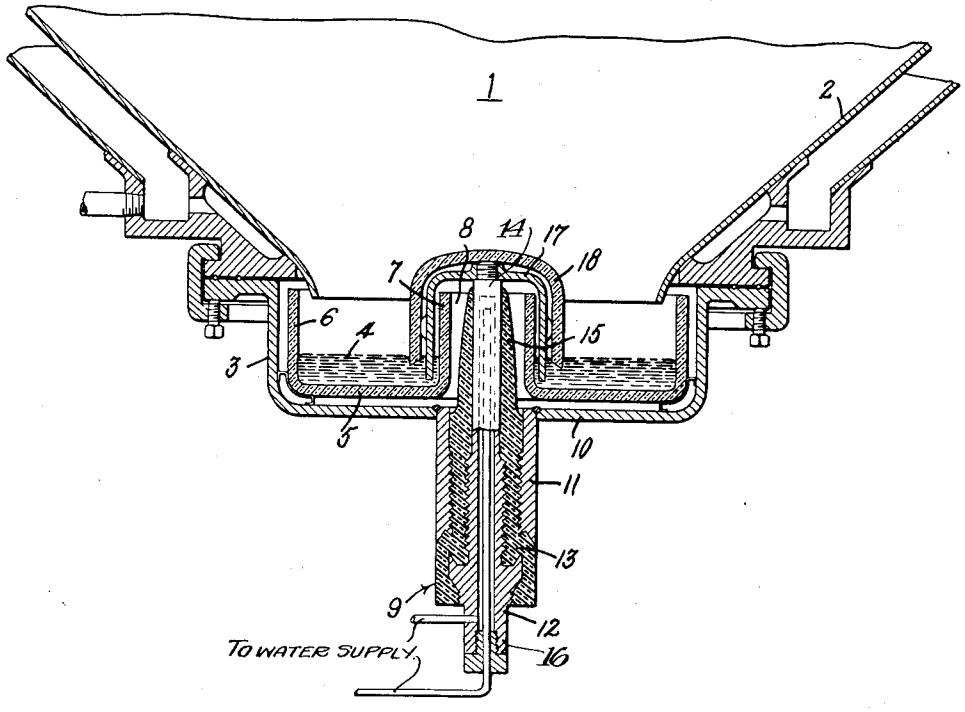
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CATHODE STRUCTURE FOR MERCURY ARC DEVICES

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CATHODE STRUCTURE FOR MERCURY ARC DEVICES

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My invention relates to cathode structures for arc discharge devices having liquid cathodes, particularly to sealing means for the cathodes of metal tank mercury arc rectifiers and the like, and its object is to provide an improved cathode structure and seal for such devices.

In the use of power mercury arc rectifiers of the metal tank type it is usual to insulate the cathode from the tank, this being accomplished for example by the provision of large diameter ring-shaped insulators of porcelain interposed between the lower edge of the tank and the cup-shaped or other member in which the liquid cathode is contained.

Since the porcelain insulator thus utilized as part of the cathode seal has not proved altogether satisfactory in certain instances by reason of the fragility of the porcelain material and the severe temperature conditions to which it is subjected it has been suggested to replace porcelain for this purpose with other sealing materials, particularly materials which have been found highly suitable for sealing the anodes of mercury arc rectifiers. A material used extensively for the latter purpose consists of a mixture of mica and lead borate.

Difficulties are encountered, however, in the manufacture of insulating rings from this latter material of the large diameter hitherto usual when the rings were composed of porcelain, due to the dimensions of the presses required for forming such rings from the mica and lead borate compound.

In accordance with my invention these difficulties are obviated by the provision of a cathode structure so arranged that a cathode seal of small diameter, for example of the type well known in anode seals, and utilizing the above mentioned mica and lead borate or other suitable sealing compound is made possible and large diameter insulating members for the cathode structure are rendered unnecessary.

In carrying my invention into effect I provide an improved cathode structure comprising a metal cathode-supporting member detachably connected directly to the lower edge of the evacuated tank, a small diameter cathode seal including the sealing compound and welded to the metal member, an annular member of insulating material surrounding a portion of the seal and containing the mercury cathode, and metallic connecting means between the mercury and the current conductive member of the seal.

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

Referring to the drawing, the single figure thereof is a cross-sectional view of a mercury arc rectifier in which my invention has been embodied.

In the figure the numeral 1 illustrates a mercury arc rectifier comprising an evacuated tank or receptacle 2 to the lower edge of which a metal cathode-supporting member or cup 3 is detachably connected but not insulated therefrom. Since the large diameter porcelain ring commonly interposed between the metal cup 3 and the tank 2 is not required, a metal to metal clamp joint such as illustrated in the figure may be provided which may be of any desired diameter and which will withstand considerable heating without injury.

In order to insulate the mercury cathode 4 from the rectifier tank 2, the mercury is contained in a high temperature insulating member or dish 5 of annular channel form having vertical outer and inner walls 6, 7 respectively, the inner walls 7 defining an aperture 8 disposed centrally of the cathode dish or annular member 5.

To insulate the mercury cathode 4 from the rectifier tank a cathode seal 9 of relatively small diameter is provided connected to the lower wall 10 of cathode cup 3 centrally thereof and extending downwardly a substantial distance therefrom. The seal 9 comprises a downwardly extending main body including a metal shell 11 welded at its upper edge to lower wall 10 of cup 3, a conductive core member 12, and a body 13 of vitreous material, preferably a mixture of mica and lead borate, molded between the members 11 and 12. Protection of the core member 12 from possible contact with mercury is insured by extending this member 12 above the cathode dish or channel member 5 and by covering the upwardly extending portion 14 of the core member 12 with an upwardly extending portion 15 of the body of vitreous material 13.

In order to conduct current from the mercury pool 4 to an outside circuit (not shown) connected to the lower extremity 16 of the seal core member 12 I provide an inverted cup-shaped metallic member 17 in contact with the upper extremity of core member 12 and extending downwardly over and outside of the inner vertical walls 7 of cathode dish 5. The edge of inverted cup 17 dips below the upper surface of mercury cathode 4. The cup 17 is protected from the arc by a cup-shaped insulator 18 such as high temperature porcelain mounted thereupon.

I have found it preferable to provide no cooling means for the cup-shaped metal cathode-supporting member 3 for the reason that if this member were cooled it would tend to fill with mercury, thus necessitating a larger supply of mercury in the rectifier. When this member 3 is uncooled no particular tendency exists for the mercury to collect outside the porcelain dish 5 and any mercury which is splashed outside of the dish evaporates slowly. If desired the conductive core member 12 of seal 9 may be made hollow and arranged for water cooling, as shown for example in the figure, the necessity for such cooling of the member 12 depending on the size of the apparatus.

It will be observed that in accordance with my invention current is conducted from the liquid cathode 4 to the outside circuit through a conductive means as core member 12 which passes through this liquid cathode centrally thereof, and that a small diameter cathode seal 9 projects downwardly a substantial distance from the rectifier tank and is disposed centrally of the cathode-supporting or tank closure member 3. It will be observed further that the cathode structure herein described in accordance with my invention comprises a seal for the liquid cathode which is of the same type heretofore found eminently practicable when employed for the sealing of the anodes of mercury rectifiers. Since in this type of seal the vitreous body interposed between core and shell is of relatively small diameter, no difficulty is encountered in providing adequate presses for forming the seal.

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

1. In an electric discharge device having an evacuated metallic tank and a mercury cathode, a cathode structure including a metallic member connected to and closing said tank, a cathode container of insulating material mounted within said metallic member and having an aperture formed therein, and a cathode seal including a conductive core and a metallic sleeve concentric therewith connected to said metallic closure member, said seal including a body of vitreous material molded between said core and sleeve, said seal extending a substantial distance below said metallic closure member, said conductive core being connected to said mercury cathode through said aperture and out of contact with the walls of said aperture, said body of vitreous material having a portion extending a substantial distance upwardly between the conductive core and the walls of said aperture to prevent contact of said core with mercury in said metallic member.

2. In an electric discharge device including an evacuated metal receptacle, a mercury cathode, a cathode container of insulating material having a central aperture the walls of which extend above the level of the mercury in said container, a metallic member connected in gas tight relation with said receptacle and enclosing said cathode container, a cathode seal connected to said metallic member, said seal including a conductive core and a body of vitreous material to insulate said core from said metallic member, said seal having a portion extending above said mercury cathode, the main body of said seal extending a substantial distance below said mercury cathode, said portion of the seal which extends above the mercury cathode including a body of vitreous material between the core and the walls of said aperture to prevent contact of the core with mercury in said metallic member, and means in contact with the surface of said mercury cathode to connect electrically said conductive core to said cathode.

3. In an electric discharge device including an evacuated metal receptacle, a metallic member connected to said receptacle, a member of insulating material disposed within said metallic member, a mercury cathode disposed in said insulating member, said insulating member having a central aperture the walls of which extend above the level of the mercury in said insulating member, a cathode seal connected to said metallic member and having a main body portion extending downwardly a substantial distance from said metallic member, said seal having a current conducting core member projecting through said member of insulating material, said seal including a vitreous body having a first portion to insulate said core from said metallic member and a second portion extending upwardly from said first portion a substantial distance between the core and the walls of said aperture to prevent contact of the core with mercury in said metallic member, and means to connect the upper surface of said mercury cathode to said core member.

4. In an electric discharge device including an evacuated receptacle, a metallic member connected to said receptacle, a member of insulating material disposed within said metallic member, a mercury cathode disposed in said insulating member, said insulating member having a central aperture the walls of which extend above the level of the mercury in said insulating member, a cathode seal connected to said metallic member and having a main body portion extending downwardly a substantial distance from said metallic member, said seal having a current conducting core member projecting through said member of insulating material, said seal including a body of insulating material having a portion extending upwardly of said metallic member between the core and the walls of said aperture to prevent contact of said core with mercury in said metallic member, metallic means to connect the upper surface of said mercury cathode to said core member, and insulating means adjacent said metallic means to protect said metallic means from the arc in said device.

5. In an electric discharge device including an evacuated metal receptacle, a cup-shaped metallic member connected in gas-tight relation to said receptacle, an annular channel member of insulating material disposed within said cup-shaped member, a mercury cathode disposed in said channel member, said channel member having a central aperture the walls of which extend above the level of the mercury in said channel member, a cathode seal including a shell connected at its upper edge to the lower wall of said cup-shaped member and a conductive core insulated from said shell, said shell and core extending downwardly a substantial distance from said wall of the cup-shaped member, said seal including a body of insulating material having a portion extending upwardly of said shell between the core and the walls of said aperture to prevent contact of the core with mercury in said cup-shaped metallic member, and means including an inverted cup-shaped metallic member to connect the surface of said mercury cathode to said conducting core member.

6. In an electric discharge device including an evacuated metal receptacle, a cup-shaped metallic member connected in gas-tight relation to said

receptacle, an annular member of insulating material disposed within said cup-shaped member and having a central aperture, a mercury cathode disposed in said member of insulating material, said central aperture having walls extending above the level of the mercury in said annular member, a cathode seal connected to said cup-shaped member, said seal including a conductive core and a body of vitreous material surrounding said core, said seal having a main body portion extending downwardly a substantial distance from said cup-shaped member, said core and said vitreous body having portions projecting upwardly from said main body portion, the upwardly extending portion of the vitreous body being between said core and the walls of said aperture to prevent contact of the core with mercury in the cup-shaped metallic member, and an inverted cup-shaped metallic member mounted outside said inner walls of said annular member to connect said core to said cathode.

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