Our invention relates to discharge devices, and especially to discharge devices utilizing a metal casing.

An object of the invention is to prevent arc back in mercury pool discharge devices.

Another object of the invention is to provide a cooled baffle between the cathode and anode of a discharge device sufficiently restricted to prevent arc back and yet sufficiently open to permit large current flow in the discharge path.

A still further object of the invention is to provide an easily assembled metal casing for a mercury pool discharge device.

Other objects and advantages of the invention will be apparent from the following description and drawing wherein:

Fig. 1 is a view, principally in cross section, of a discharge device embodying a preferred form of our invention.

Fig. 2 is a view on line II—II of Fig. 1.

Fig. 3 is a view on lines III—III of Fig. 1.

Fig. 4 is a view on lines IV—IV of Fig. 1.

Fig. 5 is a cross-sectional view through a baffle illustrated in Fig. 1.

Fig. 6 is a bottom view on lines VI—VI of Fig. 5.

Fig. 7 is a cross-sectional view illustrating a modification of the casing on a plane similar to Fig. 4.

Fig. 8 is a cross-sectional view illustrating a modification of the baffle of Fig. 5.

Fig. 9 is a bottom view on the lines IX—IX of Fig. 8.

Fig. 10 is an enlarged detail view of the make-up structure of Fig. 1.

As stated above, one of the objects of our invention is to prevent arc back in mercury pool devices, and particularly in the type of device utilizing a metal casing. We accomplish this object by placing a water-cooled baffle intermediate the mercury pool and the cathode, and we also preferably place a second baffle to intercept all straight line paths between the mercury pool and the anode through the water-cooled baffle.

The water-cooled baffle must be sufficiently open to permit sufficient current to flow in the discharge path between the mercury pool and the anode. The water-cooled baffle provides a difference of vapor pressure around the anode, and in the space about the opening in the baffle so that there will be no danger of an arc back starting in the anode region. In addition to this general object, we have also designed a very efficient water-cooled metal casing, and one that is easily assembled in quantity.

The preferred embodiment of our invention is disclosed in Fig. 1 in which a tubular inner casing 10, preferably of stainless steel, is closed at its lower end by a dish-shaped plate 11, also of stainless or cold-rolled steel, having its downwardly turned flange 12 welded to the casing 10. The lower end of the casing 10 is bent out just beyond the edge of the lower flange 12 to an edge 13 which is welded in turn to an outer casing 14, preferably of stainless steel, to form a space 15 for the passage of a cooling fluid, such as water, between the two casings.

The upper portion of the casing 10 also has a bent-out portion at 16, which is welded to the upper end 17 of the outer casing 14. At the lower end of the casing 10 is an inlet 18 for the cooling fluid, and in the upper portion of the casing 10 is an outlet 19 for this cooling fluid.

Helical vanes or wires 20 pass around the inner casing and fill the space between the two casings in order to provide a circular path about the inner casing from the inlet 18 to the outlet 19 for the cooling fluid.

The dish-shaped member 11, in combination with the adjacent edge of the inner casing 10, provides a location for the mercury pool cathode 21. A ring 22, of quartz or molybdenum, has its periphery of one circular edge secured by any suitable fastening means 23, and the portion of the ring extending about the mercury provides a restricted portion of the mercury pool in the central portion in the bottom of the device.

The standard 24, preferably of cold-rolled steel, is attached to the bottom plate 11 and supports a baffle 25, preferably of graphite or of some other material, with a carbon or carbonized surface. The particular form of baffle we prefer is illustrated in Figs. 5 and 6, which form has a plurality of openings 27 in the underside 28. These openings pass part way through the baffle structure and then turn at an angle to opening 29 in the upper curved side 30 of the baffle.

It will be noted in Fig. 5 that there is no straight line path from the openings 27 and the underside to the opening 29 in the upper portion thereof. A shield 31, preferably molybdenum, encloses the lower portion of the standard 24 supporting the baffle 25. A pointed make-up device 32, more clearly disclosed in Fig. 10, has its tapered point inserted in the mercury. This igniting device is of high resistance material, preferably of boron carbide, which does not amalgamate with mercury.

The upper portion of this igniting device is
supported by an arm 33, which is in turn supported by a standard 34 passing through an opening in the lower plate. This standard has a cup-shaped flange 35 sealed to a ring 36 of borosilicate glass which in turn is sealed to a metal eyelet 37 preferably of cobalt-nickel-iron alloy sold under the trade name of “Kovar,” secured to the bottom plate 23, as by welding. The flange 35 is also preferably of this cobalt-nickel-iron alloy. The portion about the seal of the eyelet 37, glass 36 and conductor 34 is preferably protected by a shield 38 of metal, preferably molybdenum or cold-rolled steel. The shield 38 protects the insulating material or glass 36 during heat treatment. The slot 39 permits the shield 38 to be lowered over the make-alive structure and welded or brazed to the bottom plate.

The casing 10 preferably has two opposite openings 40 and 41, located slightly above the position of the baffle 25. These two openings 40 and 41 provide the entrance from the space between the casings for the cooling fluid to enter a water-cooled baffle, whose preferred form is illustrated in Figs. 1 and 4.

The baffle design, as disclosed in Fig. 1, is preferably wedge-shaped in cross section to extend inwardly in annular form from the inner surface of the casing 10. This baffle preferably made of two headers 42 and 43, having an annular flange 45 welded to the casing 10, and then having a dish-shaped extension 46 sloping towards one another to meet in an annular edge 47 about a central opening 48. The two edges 47 are welded together.

In Fig. 2 is disclosed the portion of the directing vanes 20 adjacent the opening 40 to the baffle 44. A semi-circular vane 45 surrounds part of the casing 10 and has a downwardly curved portion 56 to prevent the continuation of the flow of liquid about the casing and to force this liquid into the opening 40. Another semi-circular vane 51 has a curved end 52 about the opening 41 to force the cooling fluid as it leaves the baffle 44 to continue its helical path about the casing.

In the cross section of Fig. 4 is illustrated the path of the cooling fluid entering the opening 40 of the wedge-shaped baffle 44 and passing around the inner portions 53 and 54 to the exit port 41 on the other side of the casing.

A modification of this construction is illustrated in Fig. 7 where the two ports 55 and 56 are located upon one side of the casing, and the cooling medium enters the one port 55 and passes completely around the inner portion 57 of the wedge-shaped baffle and leaves at the exit port 56 to continue its curving cool path about the inner casing.

In the upper portion of the casing 10 is the anode 60, preferably of graphite or carbon, located on a shaft 61, connected to a shaft 63 of smaller diameter, forming an exterior anode connection. A dish-shaped member 64 has its bottom perforated for the shaft 63 and is welded or brazed to the broad top of the shaft 61. This member 64 is preferably of nickel-cobalt-iron alloy sold under the trade name “Kovar.” The upper edge of this member is preferably bent over and downward to seal into the edge of a cylinder of borosilicate glass 65. The other edge of this cylinder is sealed to the edge of a cylinder 62 of nickel-cobalt-iron alloy sold under the trade name “Kovar.” The space intermediate the tubular member 62 and the inner casing 10, is preferably closed by a header member 66, preferably trough-shaped, having a central annular flange 67, welded or brazed (silver or copper, or both) to the lower edge of the tubular member 62. An outer annular flange 68 is likewise welded or brazed to the inner edge of the casing 10. The outer part of the extended conductor 63 has a nut 69 upon which is screwed the air-cooled fins 70.

The device may be supported on a standard 71 having a supporting plate 72, welded to the bottom plate 11, closing the lower portion of the casing 10. If desired, the plate 72 may be spaced from the cathode plate 11, and the space intermediate the two plates connected to the inlet port 18 for cooling the plate 11, as well as the inner tubular casing 10.

In Figs. 8 and 9 we have illustrated a modification 80 of the baffle illustrated in Figs. 5 and 6. This baffle 80 has a central portion 81, supporting two practically parallel discs 82 and 83, having a plurality of openings therethrough. The openings 84 on the lower disc 82, as illustrated in the full lines in Fig. 9, are such as to form the openings 85 in the upper disc 83, as illustrated by the dotted lines in Fig. 9. There is, accordingly, no straight line path for the discharge through the baffle in these figures.

In Fig. 1 it will be noted that the combination of the water-cooled baffle 44 and the baffle 25 intercepts all straight line paths between the surface of the mercury 21 and the anode 60. The cooling effect of the water-cooled baffle 44 condenses the mercury vapor as it passes around the baffle 25 to approach the opening 40 to the anode portion of the device. The result of this cooling is that the vapor pressure in the anode chamber in the upper portion of the device is so low that no backfire will start from this region of low vapor pressure. On the other hand, the space between the two baffles is sufficiently open so that there will be no limiting effect on the amount of current in the discharge path between the cathode and the anode.

It is also to be pointed out that the form of the header 66 results in extreme simplicity of design and easiness of assembly. The shielding of the insulated envelope provides special protection for the insulation 56.

It is apparent that many modifications may be made in the preferred structure illustrated and, accordingly, we desire only such limitations to be imposed upon our invention as are necessitated by the spirit and scope of the following claims.

We claim:

1. A discharge device comprising a cylindrical metal envelope, a pool cathode therein, an anode spaced above said cathode, an annular hollow extension from the inner cylindrical wall of said envelope extending into the space between said cathode and anode, and means for passing a cooling fluid through said hollow extension.

2. A discharge device comprising a metal envelope, a pool cathode therein, an anode spaced above said cathode, a hollow casing extending in a wedge shape laterally from the side of the metal envelope and closing off all but a central opening between the cathode and anode, and means for passing a cooling fluid through said wedge-shaped casing.

3. A discharge device comprising a metal envelope, an anode in the upper portion of said envelope, a pool cathode in the lower portion of said envelope, a hollow cooled baffle having spaced walls sealed peripherally to and forming part of said envelope, said baffle closing the space between said cathode and anode except for a
A discharge device comprising a metal envelope, a pool cathode therein, an anode spaced above said cathode, an annular hollow extension from the inner cylindrical wall of said envelope extending into the space between said cathode and anode, a second envelope enclosing said first metal envelope, a port at one end of said outer envelope for a cooling fluid, means for directing said fluid around the outer surface of said inner envelope, means directing said fluid through said annular hollow extension, and an exit port for said fluid at the other end of said envelope.

A discharge device comprising an envelope having double walls with space between said walls for a cooling medium, entrance and exit pipes at remote parts of said space for maintaining a flow of cooling medium throughout said space, and a double-wall transversely disposed baffle in said envelope having a space between the walls of said baffle for flow of cooling medium therebetween, said space between the envelope walls and said space between the baffle walls being in communication one with the other.

A discharge device comprising an envelope having double walls with space between said walls for a cooling medium, entrance and exit pipes at remote parts of said space for maintaining a flow of cooling medium throughout said space, and a double-wall transversely disposed baffle in said envelope having a space between the walls of said baffle for flow of cooling medium therebetween, said spaces being divided into a continuous flow channel from the entrance to the exit pipes.

A discharge device comprising an envelope having double walls with space between said walls for a cooling medium, said space being partitioned and providing a circulatory flow passage with an entrance thereto and an exit therefrom and providing long distance of fluid travel therewith, and a double-wall transversely disposed baffle in said envelope having a space between the walls forming a flow passage through said baffle, said flow passage through the baffle being intersected in the circuit of the flow passage of the double walls of the envelope.

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