April 12, 1949. M. GARBUNY 2,466,843

CONTROL DEVICE

Filed July 9, 1946

Fig. 1.

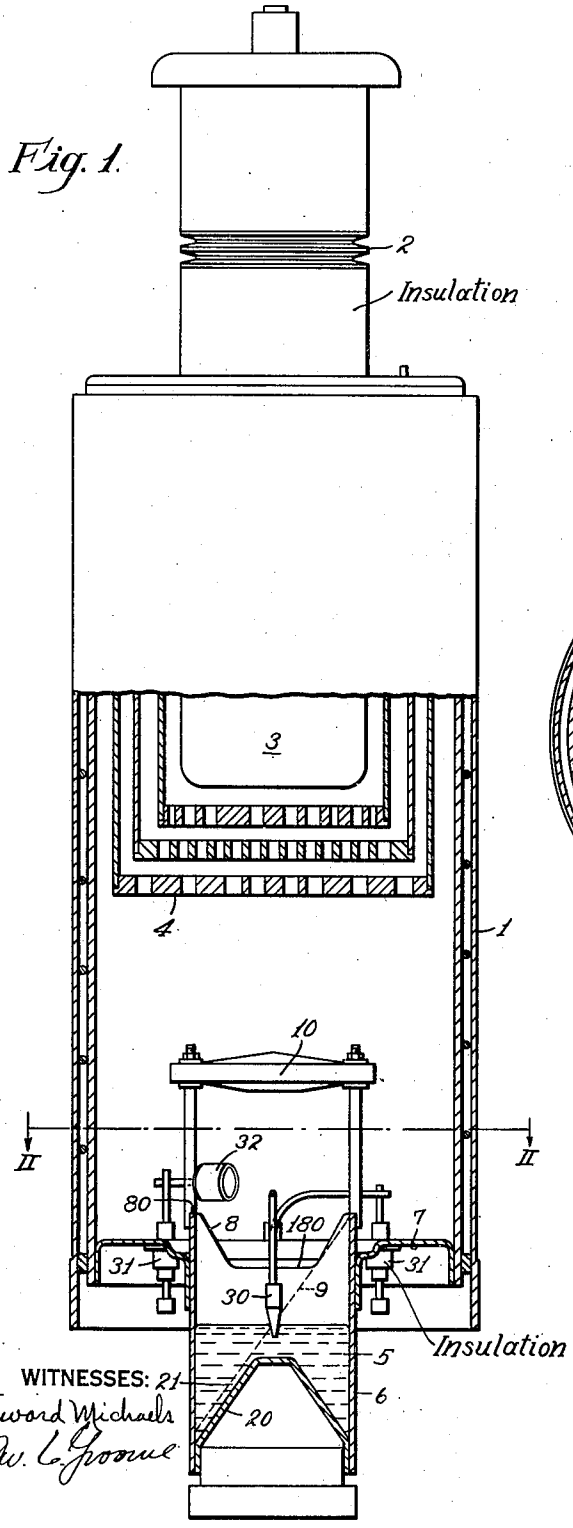
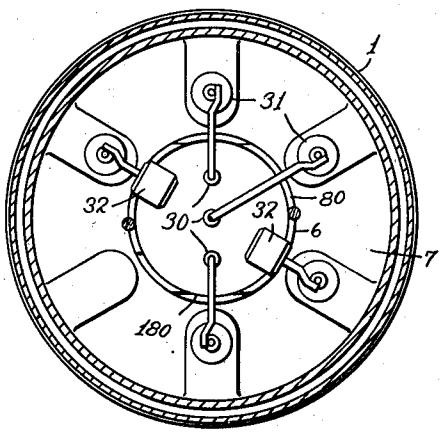


Fig. 2.



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CONTROL DEVICE

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15 Claims. (Cl. 250—27.5)

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My invention relates to a vapor-electric device and particularly to a cathode arrangement for a vapor-electric converter to be monuted on movable platforms such as ships.

In the operation of vapor-electric devices on moving platforms such as is provided in ocean-going vessels, the cathode material is subjected to the movements of the platform such as the roll and pitch of the ship. Consequently, the cathode constructions such as used in normal converters are totally unsuitable for sea-going converters as the movement of the platform would cause the migration of the liquid mercury into undesirable positions in the converter envelope.

Various forms of cathode containers have been provided to eliminate the undesirable migration of the cathode material. However, these devices which have been heretofore designed provide restricted arc paths which eventually results in burning and eventual destruction of the cathode container because of contact with the heat of the arc stream. According to my invention, I provide a cathode container having the maximum opening to the arc stream and still having sufficient restraint to prevent migration of the cathode material because of the motion of the platform on which the converter is mounted.

Because of the movement of the platform, it is necessary to provide a relatively large quantity of cathode material. As the large quantity of cathode material increases the possibility of migration of the cathode material, it is desirable to provide a cathode having the minimum output of liquid cathode material. Accordingly, I have provided a cathode dish with a re-entrant bottom which displaces the major portion of the volume of the cathode material while still leaving sufficient material to keep the cathode surface in normal position regardless of the movement, such as roll and pitch, of the platform on which the converter is mounted.

I have accomplished this by providing a substantially cylindrical cathode dish having a lip portion extending upwardly inside the envelope of the converter container and having the upper surface of the cathode dish contoured to the movement of the platform. For instance, for a converter mounted on shipboard for which the maximum roll may be 60° from vertical, the lateral sides of the cathode dish extend to a point such that inclination of the cathode material at an angle of 60° will still be retained within the cathode dish. However, since the pitch of the vessel is much less than the roll, the forward contour may be reduced to as much as 15% variation from vertical. As a consequence, the top edge or retaining edge of the cathode dish is consequently contoured to the pitch and roll of the platform on which the converter is mounted. This reduces the constriction at the top of the cathode dish and permits ready access of the arc stream to the surface of the cathode material.

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In order to eliminate the large quantity of mercury present in the deep cylindrical dish, the bottom of the converter cathode is provided with a re-entrant or dished-in portion which substantially displaces all of the central portion of the cathode, the inside surface of the dished-in portion being contoured to be covered by the cathode material at both maximum pitch and roll of the platform on which the converter is mounted. This contouring produces a minimum amount of cathode material in a container having the minimum restriction to the arc string, thus reducing the tendency to burn by the proximity to the arc and further reducing migration of the cathode material into undesired portions of the converter.

It is accordingly an object of my invention to provide a cathode construction having the minimum amount of cathode material therein.

It is a further object of my invention to provide a cathode construction for preventing migration of cathode material because of movement of the converter.

Other objects and advantages of my invention will be apparent from the following detailed description taken in conjunction with the accompanying drawing, in which:

Figure 1 is a view in elevation, partially in section, of a converter according to my invention; and

Fig. 2 is a sectional view taken in the direction of the arrows along line II—II showing the electrode arrangements in the cathode.

In the illustrated embodiment of my invention, a converter assembly comprising an outside envelope or container 1 is provided with an insulator 2 adjacent the top for supporting an anode 3 in insulated spaced relation in the envelope 1, the anode 3 being surrounded by one or more anode shields 4 as may be desired. The cathode 5 is provided in the bottom of the container 1 preferably being constructed of suitable vaporizable reconstructed material such as mercury, mercury amalgam, tin, or gallium. The cathode material 5 is contained in my improved cathode dish which consists of a metallic cylinder 6 welded in vacuum-tight relation to the bottom header 7 of the converter envelope. The upper

end of the cathode dish 6 is contoured to provide a retaining edge 8 according to the maximum possible pitch or roll of the platform on which the converter envelope 1 is mounted. For instance, assuming that the maximum roll or lateral angular movement of the container will be 60° from vertical, then the upper lateral edges 8 of the cathode cup 6 will be elevated so that the upper edge 80 will be above a line 9 which would be established by the mercury level when the cathode is tilted through the maximum angle of roll. Assuming that the maximum pitch will be 15°, the forward and after edges 180 will be extended to the position sufficient to retain the mercury or other cathode material when the vertical angle forward or backwards is advanced to 15°. Since the vessel obviously may take any position between these two extremes, the edge 8 then is contoured from the pitch to the roll position so that in any position the edge 8 of the cathode cup 6 provides a retaining edge for the cathode material 5. Preferably, the cathode dish 6 is set into the header 7 so that the lowest contour 180 of the cathode dish 6 is level with the lowest position of the header 7 so that any mercury or other cathode material condensed in the vessel and returning to the floor or header 7 will return through this low contour 180 to the cathode dish 6.

Preferably, a cathode shield 10, usually of graphite, but which may be of metal, is mounted directly upon the edges 80, preferably the maximum height edge of the cathode cup 6, so that direct emanation of mercury from the cathode 5 to the vicinity of an anode 3 is effectively prevented.

In order to reduce to the absolute minimum the quantity of cathode material necessary to maintain the cathode level during any operating position, the bottom end 20 of the cathode cup 6 is dished—or contoured to displace the maximum quantity of cathode material. This dished-in surface is so related to the pitch and roll of the platform that during either maximum pitch or roll, a film 21 of cathode material sufficient to absorb the heat of the cathode spot is maintained above the metallic surface of the cathode dish 20. This displacement of the cathode material not only reduces the cost of the cathode material but eliminates excessive weight which would otherwise be present and eliminates the strains produced by the motion of heavy masses of cathode material.

Because of the movement of the platform on which the converter is mounted, the level of the mercury surface is constantly changing. For this reason, the ignitors or make-alive electrodes may have their immersion changed so that there is a possibility of failure of ignition of the arc during some position of the cathode material. In order to eliminate this possibility, I have provided a plurality of make-alive electrodes 30, preferably three, mounted in a direction transverse to the maximum displacement of the cathode material. These make-alive electrodes 30 are rigidly mounted on insulated lead-in bushings 31 mounted in the header 7 or bottom of the converter envelope and positioned in spaced relation with a middle or inmost ignitor 30 placed in the center of the cathode surface. In addition to the make-alive electrodes, suitable auxiliary anodes or holding electrodes 32 may be provided for maintaining the cathode spot from the instant of its initiation to the interval when the main arc may pick up between the anode 3 and cathode 5.

In the operation of the device according to my invention, the make-alive electrodes 30 will be periodically energized as is necessary or desirable to produce the desired arc current and the cathode spot will be maintained as is necessary to insure the pick up of the arc between the main anode 3 and cathode 5. Because of the contour of the top 8 of the cathode dish or cup 6, the mercury will also be maintained at a substantially constant level in the center portion of the cathode container. However, if any unexpected motion should reflect or displace the cathode material from the centermost portion of the converter cathode, at least one of the remaining make-alive electrodes 30 will always be in position to initiate a cathode spot at the beginning of any desired current carrying interval.

While for purposes of illustration, I have shown and described a specific embodiment of my invention, it will be apparent that changes and modifications can be made therein without departing from the true spirit of my invention or the scope of the appended claims.

I claim as my invention:

1. In a vapor electric device for use on a moving platform subject to different degrees of inclination in different directions, a cathode comprising a substantially cylindrical cup open to the inside of the device, the top edge of said cup being contoured to conform to the degree of inclination of said platform and a liquid cathode material in said cup.

2. A cathode construction for a vapor electric device subject to inclination of varying amounts in different directions comprising a cathode cup, a quantity of a liquid cathode material in said cup, the top edge of said cup being elevated different amounts to provide the minimum retaining edge for the cathode liquid at the various angles of inclination.

3. A vapor electric device for use on shipboard comprising a container, an anode mounted in said container, a cathode cooperating with said anode, said cathode comprising a deep cup set into the bottom of said container, the laterial edges of said cup being elevated to retain the cathode material at the maximum roll of the ship, the leading and after edges of said cup being reduced in height to retain the cathode material at maximum pitch of the ship.

4. A vapor electric device for use on shipboard comprising a container, an anode mounted in said container, a cathode cooperating with said anode, said cathode comprising a deep cup set into the bottom of said container, the lateral edges of said cup being elevated above the bottom of the container to retain the cathode material at the maximum roll of the ship, the leading and after edges of said cup being flush with the bottom of the container to retain the cathode material at maximum pitch of the ship, the cathode material having a normal level below the lowermost edge of the top of the cup.

5. A vapor electric device for use on shipboard comprising a container, an anode mounted in said container, a cathode cooperating with said anode, said cathode comprising a deep cup set into the bottom of said container, the lateral edges of said cup being elevated to retain the cathode material at the maximum roll of the ship, the leading and after edges of said cup being flush with the bottom of the container to retain the cathode material at maximum pitch of the ship, a reentrant bottom in said cup, said reentrant bottom being

shaped to be substantially evenly covered by cathode material at maximum roll of said ship.

6. A vapor electric device for use on shipboard comprising a container, an anode mounted in said container, a cathode cooperating with said anode, said cathode comprising a deep cup set into the bottom of said container, the lateral edges of said cup being high enough to retain the cathode material at the maximum roll of the ship, the leading and after edges of said cup being flush with the bottom of the container, a plurality of make-alive electrodes for cooperating with the surface of said cathode, one of said make-alive electrodes being substantially in the center of the cathode surface.

7. In a vapor-electric device for use on a moving platform capable of having a predetermined lateral angular motion and a predetermined longitudinal angular motion, a cathode comprising a substantially cylindrical cathode dish open to the inside of the device, a liquid cathode material in said cathode dish, the lateral edges of said cathode dish being elevated above the cathode liquid to provide a retaining edge for the liquid when the platform has moved through its lateral angular motion.

8. A cathode construction for a vapor electric device subject to inclination of varying amounts in different directions comprising a cathode cup, a quantity of a liquid cathode material in said cup, the top edge of said cup being of different heights in the different directions to provide the minimum retaining edge at the various angles of inclination.

9. A vapor electric device for use on shipboard comprising a container, an anode mounted in insulated relation in said container, a pool-type cathode cooperating with said anode, a deep cup set into the bottom of said container for retaining the cathode pool, said cup being subject to angular inclinations corresponding to the pitch and roll of the ship, the lateral edges of said cup being elevated to retain the cathode material in the cup at the maximum lateral inclination thereof and the forward and after edges of said cup being elevated to retain the cathode material therein at maximum forward and reverse inclination.

10. A vapor electric device for use on shipboard comprising a container, an anode mounted in insulated relation in said container, a pool-type cathode cooperating with said anode, a deep cup set into the bottom of said container for retaining the cathode pool, said cup being subject to angular inclinations corresponding to the pitch and roll of the ship, the lateral edges of said cup being high enough to retain the cathode material in the cup at the maximum lateral inclination thereof and the forward and after edges of said cup being high enough to retain the cathode material therein at maximum forward and reverse inclination, the lowermost edge of said cup being substantially flush with the bottom of said container.

11. A vapor electric device for use on shipboard comprising a container, an anode mounted in insulated relation in said container, a pool-type cathode cooperating with said anode, a deep cup set into the bottom of said container for retaining the cathode pool, said cup being

subject to angular inclinations corresponding to the pitch and roll of the ship, the lateral edges of said cup being high enough to retain the cathode material in the cup at the maximum lateral inclination thereof and the forward and after edges of said cup being high enough to retain the cathode material therein at maximum forward and reverse inclination, a reentrant bottom in said cup, said reentrant bottom having a slope with respect to the side of the cup substantially equal to the maximum permissible lateral inclination of the cup.

12. A vapor electric device for use in shipboard comprising a container, an anode mounted in insulated relation in said container, a pool-type cathode cooperating with said anode, a deep cup set into the bottom of said container for retaining the cathode pool, said cup being subject to angular inclinations corresponding to the pitch and roll of the ship, the lateral edges of said cup being high enough to retain the cathode material in the cup at the maximum lateral inclination thereof and the forward and after edges of said cup being high enough to retain the cathode material therein at maximum forward and reverse inclination, a plurality of make-alive electrodes cooperating with said cathode, one of said make-alive electrodes being substantially in the center of the cathode surface.

13. A vapor-electric device comprising a container, an anode secured in insulated relation in said container, a cathode dish of less diameter than the container, a pool of cathode liquid in said dish, the top of said dish being elevated various amounts in various directions so that the device may be inclined various amounts in various directions without spilling the cathode liquid.

14. A vapor-electric device comprising a container, an anode secured in insulated relation in said container, a cathode dish of less diameter than the container, a pool of cathode liquid in said dish, the top of said dish being elevated various amounts in various directions so that the device may be inclined various amounts in various directions without spilling the cathode liquid, the lowermost portion of the edge of the dish being flush with the bottom of the container.

15. A vapor-electric device comprising an evacuated container, an anode in spaced insulated relation in said container, a pool-type cathode in said container, said cathode pool being retained in a relatively narrow and deep cathode dish, the top edge of said dish being of different heights in various portions so that the device may be inclined various amounts in various directions without spilling the cathode material.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
2,249,485	Miles	July 15, 1941
2,308,378	Marshall	Jan. 12, 1943
2,367,987	White	July 23, 1945