Sept. 24, 1929. F. B. VON KLEIST 1,729,463

RECTIFIER TANK

Filed Aug. 3, 1927

Fig. 1.

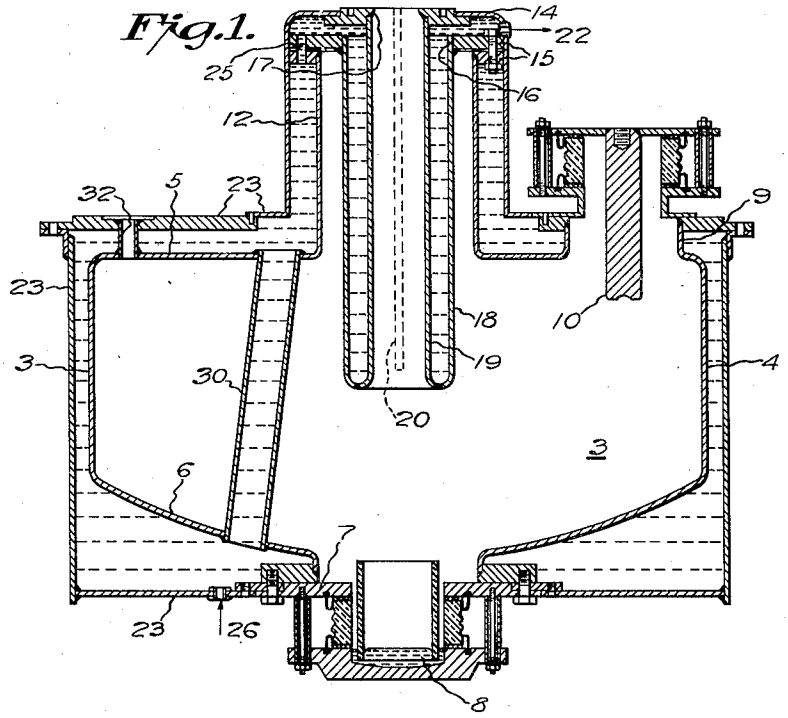
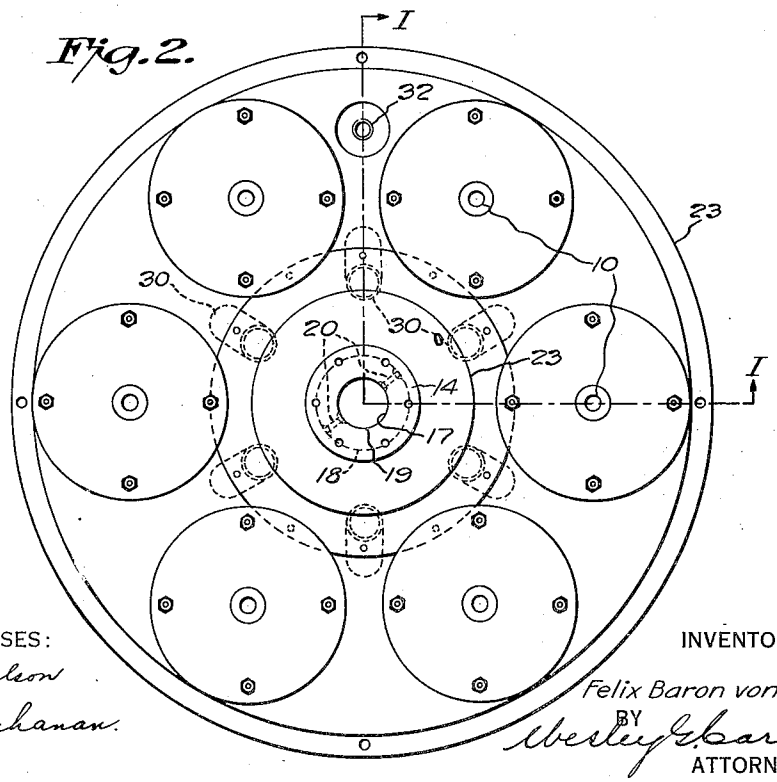


Fig. 2.



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UNITED STATES PATENT OFFICE

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RECTIFIER TANK

Application filed August 3, 1927, Serial No. 210,282, and in Germany October 23, 1926.

My invention relates to metal tanks for mercury-vapor rectifiers, and it has particular relation to a combind cooling and bracing means therefor.

In the operation of metal-tank mercury-arc rectifiers, it has been shown that there is a very definite relation between the vapor pressure or, what amounts to the same thing, the temperature, and the frequency of occurrence of back-firing.

An object of my invention is to provide new and improved means for cooling the internal space of the rectifier and, in particular, the space, between the cathode and the anodes, which is traversed by the arc.

Another difficulty which has been encountered in modern rectifiers of large size has arisen from the extremely massive construction which is necessary to make the structure self-supporting against pressures, either the external air pressure when the tank is evacuated, or the internal pressures which are commonly utilized for testing purposes. As the tanks must be vacuum-tight, a particularly rigid construction is necessary in order to prevent the various joints from working loose. The foregoing considerations have resulted in a design embodying tanks having top and bottom plates of very great thickness, thereby greatly increasing the cost and the weight of the apparatus.

In addition to the cooling operation mentioned above, therefore, an improved feature of my invention is the provision of internal braces or struts directly connecting the top and bottom plates of a large rectifier tank, whereby sheet metal of relatively small thickness may be utilized for these parts. By reason of the very high temperatures of the arc stream which plays over the surfaces of these strut members, it is necessary to cool the same in order to prevent them from being softened, and the cooling thereby performs the double function of making possible the utilization of the struts and of reducing the internal vapor temperatures of the rectifier and thereby reducing back-firing thereof.

With the foregoing and other objects in view, my invention consists of the apparatus and combinations hereinafter described, claimed and illustrated in the accompanying drawing, wherein

Fig. 1 is a vertical sectional view of a metal-tank rectifier embodying my invention, and

Fig. 2 is a top plan view of the tank shown in Fig. 1.

My invention is embodied in a mercury-arc rectifier comprising an iron tank 3 having a cylindrical side wall 4 and top and bottom walls 5 and 6, respectively. The bottom wall is provided with a central depending projection 7 to which is insulatingly attached a mercury cathode member 8. The top wall is provided with a plurality of upwardly extending projections 9 for receiving the several anodes 10 which are insulatingly supported thereby and project therethrough in a circle surrounding the cathode and disposed near the outer periphery of the top plate 5.

In the form of embodiment of the invention shown in the drawing, the top plate is also provided with a tall central projection 12 which rises therefrom to provide a condensing chamber which is closed by a double-top construction 14 and 15, the lower top member 15 being provided with an opening 16 which is somewhat larger than the opening 17, which is provided in the upper top member 14. Depending from the two openings 16 and 17 are two concentric tubes 18 and 19, respectively, which are joined together at their bottoms and which are welded to the respective top members 15 and 14 to provide a vacuum-tight construction. Separators may be provided for the tubes, as indicated in dotted lines at 20, so that a cooling fluid may enter the space between the tubes at one side between the two top members 14 and 15 pass downwardly under the separators 20, and thence upwardly, to be expelled from the top of the tubes by means of an outlet opening, as indicated at 22. The top plate member 14 is closed, in the usual manner, by means of a cap piece which carries a starting anode of usual construction (not shown).

A water jacket 23 is provided around the tank, surrounding the bottom, side and top walls thereof, as well as the condensing cham-

ber 12. The lower top member 15 of the condenser chamber is perforated, as indicated at 25, to permit the cooling fluid to pass up into the space which communicates with the cooling tubes 18 and 19 which extend downwardly through the condensing chamber. Water enters the lower portion of the jacket 23 by means of an inlet opening 26.

An important feature of my invention is the provision of a plurality of cooling tubes 30 which extend through, and are welded into, perforations in the top and bottom plates 5 and 6 of the tank. It will be observed that the cooling tubes 30 traverse the interior space of the rectifier tank, so that the arc stream plays thereover as it passes between the cathode and the anodes. The tops of the tubes 30 are disposed inside of the circle of anodes, while the bottoms of the tubes are disposed outside of the cathode.

The top plate 5 of the tank is also provided with a vertical tubular member 32 for connecting pumping equipment (not shown) whereby the tank may be exhausted.

In operation, water is admitted into the water jacket 23 at any convenient point, as at a bottom inlet opening 26, and it circulates in the jacket 23 surrounding the tank, and also through the tubular braces 30, to cool the tank and the internal space thereof, finally passing out through the depending condensing-chamber cooler tubes 18 and 19, to the outlet 22 as hereinabove described.

While I have illustrated my invention in a preferred embodiment, I do not wish to be limited thereto but I desire that the appended claims shall be given the broadest construction consistent with their language and the prior art.

I claim as my invention:

1. A metal rectifier tank comprising top and bottom plates joined by a cylindrical wall member, a water jacket surrounding said tank, a central projection depending from said bottom plate adapted to receive an insulatingly attached mercury-cathode member, a plurality of projections rising from the top plate adapted to receive insulatingly attached anode members, an evacuating opening in said tank, and a plurality of tubular braces extending through the interior space of said tank and joining said top and bottom plates, said tubular braces being open at their tops and bottoms to be traversed by the water in said water jacket.

2. A metal rectifier tank comprising top and bottom plates joined by a cylindrical wall member, a central projection depending from said bottom plates adapted to receive an insulatingly attached mercury cathode member, a plurality of projections rising from the top plate adapted to receive insulatingly attached anode members, an evacuating opening in said tank, and a plurality of tubular braces extending through the interior space of said tank and joining said top and bottom plates, said tubular braces being open at their tops and bottoms.

3. An evacuated metal-tank mercury-vapor space-current discharge device comprising top and bottom plates joined by a cylindrical wall member, a water jacket surrounding said tank, a central projection depending from said bottom plate, an insulatingly attached mercury-cathode member secured thereto, a plurality of projections rising from the top plate, a plurality of insulatingly attached anode members secured thereto, and a plurality of tubular braces extending through the interior space of said tank and joining said top and bottom plates, said tubular braces being open at their tops and bottoms to be traversed by the water in said water jacket.

4. An evacuated metal-tank mercury-vapor space-current discharge device comprising top and bottom plates joined by a cylindrical wall member, a central projection depending from said bottom plate, an insulatingly attached mercury-cathode member secured thereto, a plurality of projections rising from the top plate, a plurality of insulatingly attached anode members secured thereto, and a plurality of tubular braces extending through the interior space of said tank and joining said top and bottom plates, said tubular braces being open at their tops and bottoms.

5. An evacuated metal-tank vapor rectifier comprising a vaporizable reconstructing cathode member disposed centrally in the bottom thereof, a plurality of anode members disposed around the top thereof near the outer periphery, and cooling means comprising a plurality of tubes extending through, and welded into, openings in both the top and the bottom of the metal tank, the bottoms of the tubes being outside of the cathode and the tops of the tubes being inside of the circle of anodes, said tubes conducting a cooling medium therethrough.

In testimony whereof, I have hereunto subscribed my name this seventh day of July, 1927.

FELIX BARON VON KLEIST.