Sept. 1, 1936. D. JOURNEAUX 2,052,831

ELECTRIC POWER RECTIFIER

Filed April 29, 1931

Fig. 1.

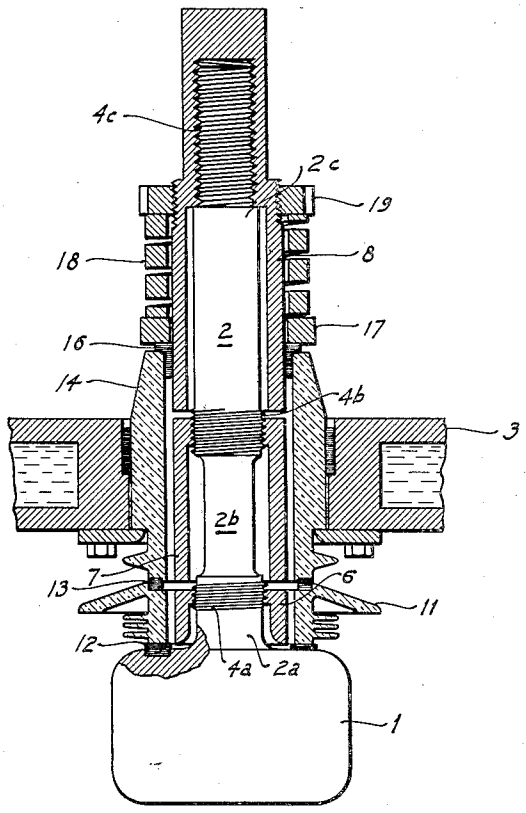
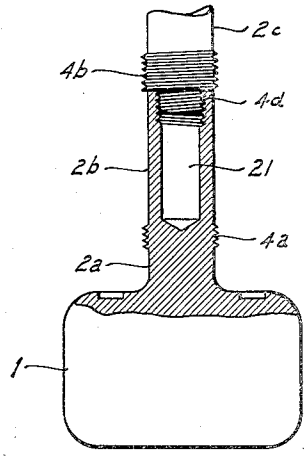


Fig. 2.



Inventor
Didier Journeaux
By [signature]
Attorney

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ELECTRIC POWER RECTIFIER

Didier Journeaux, West Collingswood, N. J., assignor, by mesne assignments, to Allis-Chalmers Manufacturing Company, Milwaukee, Wis., a corporation of Delaware

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3 Claims. (Cl. 250—27.5)

This invention relates to improvements in anode structures for electric power rectifiers of the arc type employing a metallic housing or tank retaining a suitable vapor or gas in which the arc is produced.

In an electric power rectifier of the character indicated above, the anodes must pass through the walls of the tank, from the exterior to the interior, in insulated relation therewith. The operation of a rectifier produces heat which varies in intensity dependent on the density of the current rectified. A portion of the insulator about the anode is thus exposed to the high temperature which the anode reaches at high current densities while the outer portion of the insulator is surrounded by the atmosphere at the comparatively low ambient temperatures. In addition, portions of the insulator are in contact with the wall of the tank which is cooled by the circulation of cold water through the double walls thereof.

The temperature extremes to which the insulator is therefore subject create stresses which, in addition to the compressive stresses exerted on the insulator to seal its joints with the anode in gas-tight relation, cause chipping or cracking of the insulator. Such cracking, which permits leakage of air, sealing or cooling medium into the rectifier, is injurious to the operation thereof as is well-known.

It is, therefore, among the objects of the present invention, to provide an anode construction for electric power rectifiers of the metallic vapor arc type in which the rectifying action takes place in a metal tank; in which construction the several portions are arranged in such manner that the insulator is not subject to such extremes of heat as was the case heretofore.

Another object of the invention is to provide an anode construction for an electric current rectifier of the metallic vapor arc type in which the insulator about the anode is divided into two or more sections subject to different temperature ranges.

Another object of the invention is to provide an anode construction for electric power rectifiers of the metallic vapor type in which a divided insulator arranged about the anode between the anode and the tank is so shielded from the heat conducted through the anode stem that the maximum temperatures of the insulator portion are different and are reduced.

Objects and advantages, other than those above set forth, will be apparent from the following description when read in connection with the accompanying drawing in which

Figure 1 shows a vertical sectional view of an anode construction, for an electric power rectifier of the metal tank inclosed type, embodying the present invention, and

Fig. 2 shows a modified construction of the anode stem which further reduces the transmission of heat therethrough.

Referring particularly to the drawing by characters of reference, the reference numeral 1 indicates an anode head having a stem 2 extending therefrom through an aperture in a double walled tank indicated at 3. It will be understood that the anode head 1 is within the tank 3 and that the one end of the anode stem 2 is outside of the tank 3 and is adapted to have a current supply conductor (not shown) fastened thereto. The stem 2 is divided, for purposes of convenience in this specification, into several sections 2*a*, 2*b* and 2*c* limited by the threaded portions of the stem shown at 4*a*, 4*b* and 4*c*. The section 2*b* is made with a decreased cross-section area to decrease the conduction of heat therethrough from the anode head.

A plurality of shields 6, 7 and 8 in the form of cylinders having an inwardly turned flange are screw-threaded on the threaded sections 4*a*, 4*b* and 4*c* of the stem and extend in spaced relation over the stem section 2*a*, 2*b* and 2*c* from adjacent the anode head over the entire stem.

A lower porcelain 11 surrounding the anode stem section 2*a* and its shield 6 rests on a gasket 12 in a seat formed in the anode head. The porcelain 11 provides a seat for a gasket 13 which supports an upper porcelain 14 which surrounds anode stem section 2*d* and its shield 7. The upper porcelain is spaced from and sealed against the shield 8 by a gasket 16 which is pressed down by a washer 17 under pressure. The washer 17 is under the action of a spring 18 which is compressed by a nut 19 threaded on the sleeve 8. The space between the porcelains and the stem 2 is sealed against the entrance of air or gases thereinto by the pressure exerted on washer 16 by spring 18. It is evident that sealing means other than or in addition to the gasket 16 may also be used.

The entire anode unit is supported within the aperture through the tank 3 by a flange secured thereon about the aperture therethrough or a shoulder formed therein and is sealed in gas-tight relation with the tank by a gasket or other suitable sealing means.

The insulator is thus divided into a lower portion 11 which is heated to a high temperature and an upper portion 14 which is comparatively

cool. The gaskets 12, 13 between the porcelains permit expansion and contraction of either portion without effect on the other. The temperature extremes to which the ends of the upper porcelain, in particular, are exposed are so nearly the same values as to avoid the creation of heat stresses therein. The temperatures prevailing throughout the several porcelains are maintained at a substantially uniform value throughout each entire porcelain by the shields, which are made of good heat conductive material such as copper. The temperature of each shield is substantially uniform throughout its length and equal to the temperature of the stem at the point where the shield is attached to the stem. The surfaces of the stem and of the shields are also highly polished to reduce the transfer of heat therebetween by radiation from the stem to the shields and from the shields to the insulators. Thus shield 7 prevents radiation from the stem section 2b to the porcelain 14. The amount of heat radiated from the shield 7 toward the insulator 14 is thus much less than the amount radiated from the stem if no shield were used and is uniform throughout the entire insulator. Shield 6 reduces, to a lesser degree, the heat transferred from the stem section 2a to insulator 11 and to the lower portion of insulator 14. The seal between the anode stem and the upper insulator 14 is located at 16 between the shield 6 and the insulator to reduce the temperature of the seal thereby reducing the deteriorating effect of heat thereon to a negligible value.

In the modification shown in Fig. 2, transfer of heat by conduction from the stem section 2a to the other stem sections and the shields thereabout is reduced by reducing the cross section area of the stem section 2b by making such stem section hollow. Greater rigidity with a smaller stem cross section area is thus obtained than would be possible merely by reducing the external dimensions of the stem.

Although but two embodiments of the present invention have been illustrated and described, it will be apparent to those skilled in the art that various changes and modifications may be made therein without departing from the spirit of the invention or from the scope of the appended claims.

The invention claimed is:

1. In an anode construction for electric power rectifiers of the metallic vapor arc type enclosed within a metallic tank, an anode having a head portion and a stem portion, a poorly heat conductive electric insulator arranged about the stem in spaced relation therewith and in sealing engagement with the head, a second poorly heat conductive electric insulator arranged about the stem and spaced therefrom and from the first said insulator, a plurality of shields of highly heat conductive metal with highly polished surfaces supported between said anode stem and said insulators in spaced relation therewith and with said head portion of said anode to prevent radiation of heat from the stem to said insulators, and means for pressing said insulators against each other and for pressing the first said insulator against the head of said anode.

2. In an anode construction for electric power rectifiers of the metallic vapor arc type enclosed within a metallic tank, an anode having a head portion and a stem portion, the stem being so formed as to reduce the conduction of heat therethrough from the head, a poorly heat conductive electric insulator arranged about the stem in spaced relation therewith and in sealed contact with the head, a second poorly heat conductive electric insulator arranged about the stem in spaced relation therewith and sealed against the first said insulator, a plurality of shields of highly heat conductive metal with highly polished surfaces secured on the stem of said anode and spaced between said stem and insulators and spaced from said head portion of said anode to prevent radiation of heat from the stem to said insulators, two of said shields being substantially co-extensive with said insulators, and means for pressing said insulators against each other and for pressing the first said insulator against the head of said anode.

3. In an anode construction for electric power rectifiers of the metallic vapor arcing type, an anode having a head portion and a stem portion arranged within an evacuated chamber, a poorly heat conductive electric insulator arranged about and in spaced relation with said stem portion in sealing relation with said head portion, a second poorly heat conductive electric insulator arranged about and in spaced relation with said stem portion and spaced from the first said insulator, cylinders of material having high thermal conductivity severally arranged in the space between said insulators and said stem portion and spaced therefrom having the surfaces thereof highly polished for reducing radiation of heat thereto from said stem portion and for reducing radiation of heat therefrom to said insulators and each having the end thereof remote from said anode head affixed to said stem to thereby maintain the space about each said cylinder at a substantially uniform reduced temperature throughout the length of each said cylinder.

DIDIER JOURNEAUX.