

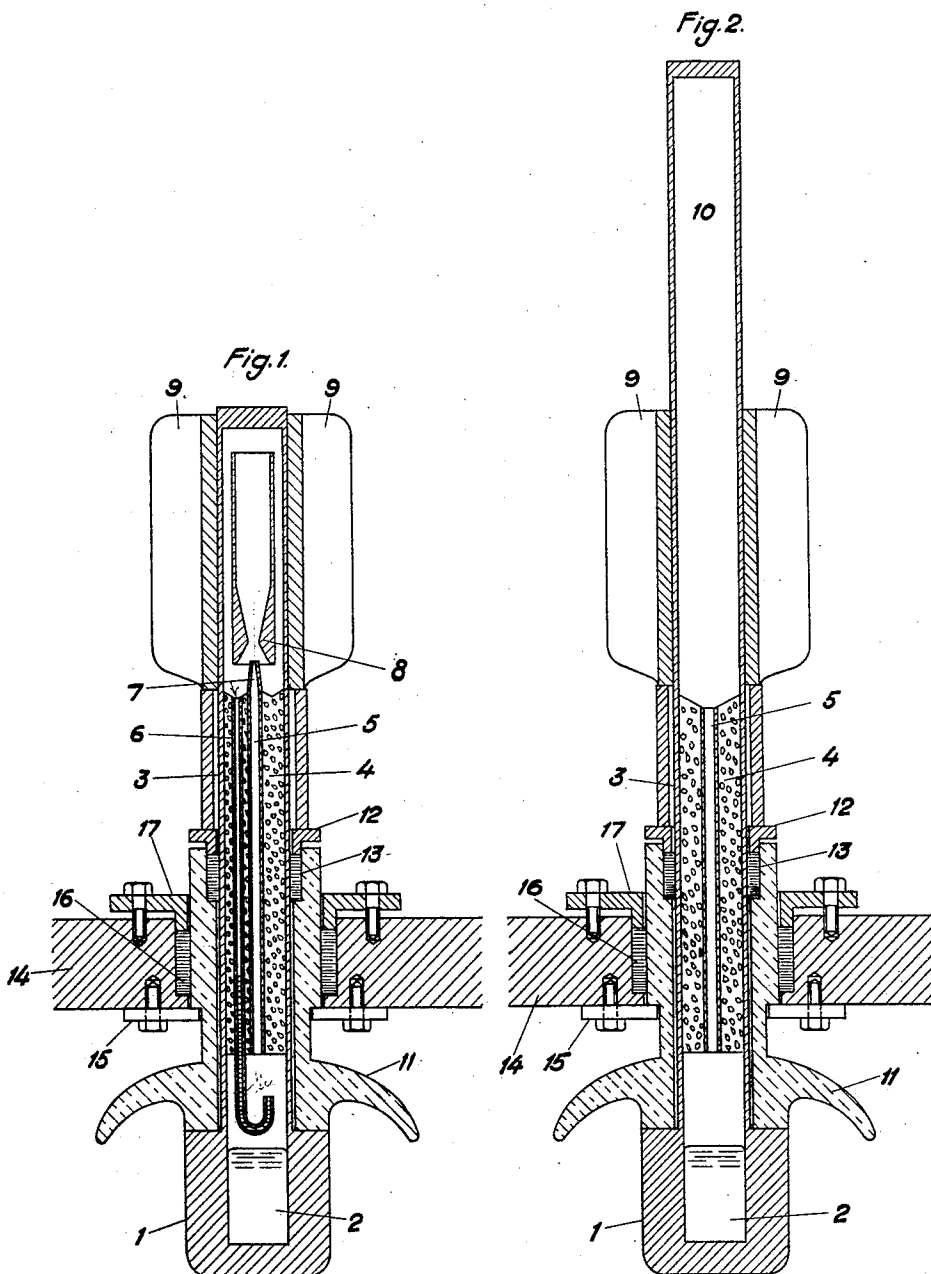
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U. LAMM

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COOLING DEVICE FOR ANODES IN METAL VAPOR RECTIFIERS

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Inventor.
Uno Lamm
per *Wm. Ballantyne*
Attorney.

UNITED STATES PATENT OFFICE

UNO LAMM, OF LUDVIKA, SWEDEN, ASSIGNOR TO ALLMANNA SVENSKA ELEKTRISKA
AKTIEBOLAGET, OF VASTERAS, SWEDEN, A CORPORATION OF SWEDEN

COOLING DEVICE FOR ANODES IN METAL VAPOR RECTIFIERS

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In electric current rectifiers containing metal vapor, for instance, mercury vapor, as a conducting medium, it has been found to be of importance to keep the anodes at a substantially constant, not too low temperature. As the energy dissipated at the anodes is substantially proportional to the current and thus highly variable, it is necessary to cool the anodes by some means which is readily adaptable to said varying conditions. It has already been proposed to use mercury, which is vaporized inside the anode and then again cooled to condensation. The arrangements previously used for this purpose have, however, not been very efficient. Generally the mercury vapor has been condensed again inside the rectifier receptacle, cooling tubes containing another circulating liquid being introduced into the lower portion of the anodes for effecting the condensation. Where in some cases the mercury vapor has been led outside the receptacle to be condensed there, there has been a great risk of the packings around the anodes being damaged by the hot mercury vapor.

According to the present invention, the passage between the interior of the anode proper and the condensing device, which is situated outside the receptacle wall, is heat insulated against the packing in said wall, so that the latter is protected against undue heating.

For keeping the ebullition point of the mercury or other cooling liquid having a high such point as nearly constant as possible, it is advisable to enclose a permanent gas or gas mixture in the interior of the anode so as to keep the total pressure therein approximately constant. Such a gas has a certain tendency to prevent the access of the mercury vapor to the cooling surfaces intended to effect the condensation. In order to overcome such tendency certain steps are taken according to the present invention, as will be hereinafter described.

Two different forms of the invention are illustrated in the accompanying drawing in Figs. 1 and 2, each of which shows an anode with cooling device in a vertical section.

In both figures, 1 represents an anode

for a metal vapor rectifier, consisting for instance of pure iron, and 11 is an insulator therefor, inserted in the upper wall 14 of the rectifier receptacle where it is held in place by a split ring 15 and surrounded by a packing 16 with a flange 17 so as to form a vacuum tight joint. A plurality of such anodes are generally combined in one receptacle. The anode is hollow, and its interior space is filled to a certain height with a cooling liquid 2, for instance mercury. The anode carries a tubular extension 3, preferably integral therewith, and extending upwards through the insulation 11 and through a packing 13 with compression flange 12, adapted to form a vacuum tight joint between the tube 3 and insulator 11. The packings 16 and 13 preferably contain mercury as principal sealing substance.

In order to protect the insulator 11 as well as the packings inside and outside it against undue heating from the mercury vapor, the latter is led through a preferably central tube 5 surrounded by heat insulating material 4.

A portion of the tube 3 above the insulator and packings carries cooling ribs 9 for effecting the condensation of the mercury vapor. If this cooling portion of the tube is at the very top thereof and no particular steps are taken, the heavy mercury vapor has a tendency to displace the permanent gas enclosed, which is generally lighter, towards the top of the tube where it forms a cushion acting to prevent access of the vapor to the cooling portion. The low diffusion speed of the mercury vapor which is a consequence of its high specific gravity further aggravates this phenomenon. In order to overcome it, the central tube 5 for the rising mercury vapor in Fig. 1 ends in a nozzle 7 forming together with a surrounding appropriately shaped tube 8 a jet apparatus which will make the vapor carry forth the gas in the upper end of the tube 3 and cause it to circulate upwards through the tube 8 and downwards through the annular space between said tube and the tube 3. This annular space, being most adjacent to the cooling ribs 9, forms the condensing chamber,

from which the mercury flows down into the anode through the pipe 6. The latter is bent upwards at its lower end to form a liquid seal for preventing the rising vapor from passing through said pipe.

In Fig. 2, the same result is achieved in another way. The tube 3 is here extended above the cooling ribs 9 to form a particular chamber in which the gas displaced by the vapor may collect without disturbing the condensation. This arrangement is simpler than that shown in Fig. 1 but necessitates a greater total height of the anodes. The condensate may in this case flow back through the tube 5.

As the arrangements described make the cooling action practically independent of the physical properties of the enclosed gas, the latter may be chosen exclusively with respect to its chemical properties so as to attack the cooling liquid and the walls of the anode and tubes in the smallest possible degree. In using mercury as a cooling liquid, the gas may preferably consist of an inert gas or hydrogen.

I claim as my invention:

1. A mercury vapor rectifier comprising a vapor-containing receptacle, at least one hollow anode traversing the upper wall of said receptacle, a vacuum-tight packing surrounding each of said anodes, a liquid having a high ebullition point inside said anodes adapted to be vaporized at the lower end and condensed at the upper end of said anodes, and a heat insulating lining inside said anodes adjacent to said surrounding packing.

2. A mercury vapor rectifier comprising a metallic vapor-containing receptacle, a hollow anode traversing the upper wall of said receptacle, an insulator bushing surrounding said anode, vacuum-tight packings between said anode and insulator and between said insulator and wall, a liquid having a high ebullition point inside said anode adapted to be vaporized at the lower end and condensed at the upper end of said anode, and a heat insulating lining inside said anode adjacent to the packing between the anode and insulator.

3. A mercury vapor rectifier comprising a vapor-containing receptacle, a hollow anode having an entirely closed inner space traversing the upper wall of said receptacle, cooling means surrounding said anode outside said receptacle, a liquid having a high ebullition point and a substantial amount of gas both enclosed in said anode, and means inside said anode for guiding the current of vapor of said liquid to pass closely adjacent to the wall portion of the anode surrounded by said cooling means.

4. A mercury vapor rectifier comprising a vapor-containing receptacle, a hollow anode having an entirely closed inner space traversing the upper wall of said receptacle, cooling

means surrounding said anode outside said receptacle, a liquid having a high ebullition point and a gas enclosed in said anode, a central rising tube for the vapor of said liquid, a nozzle forming the upper termination of said tube and a tube surrounding said nozzle to form a jet apparatus in which the gas and vapor are mixed before reaching said cooling means.

5. A mercury vapor rectifier comprising a vapor-containing receptacle, a hollow anode having an entirely closed inner space traversing the upper wall of said receptacle, cooling means surrounding said anode outside said receptacle, a liquid having a high ebullition point and a gas inert with respect to said liquid both enclosed in said anode, and means inside said anode for guiding the current of vapor of said liquid to pass closely adjacent to the wall portion of the anode surrounded by said cooling means.

In testimony whereof I have signed my name to this specification.

UNO LAMM.