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COOLING DEVICE FOR VAPOR ELECTRIC APPARATUS.

APPLICATION FILED APR. 27, 1912.

1,110,601.

Patented Sept. 15, 1914.

2 SHEETS—SHEET 1.

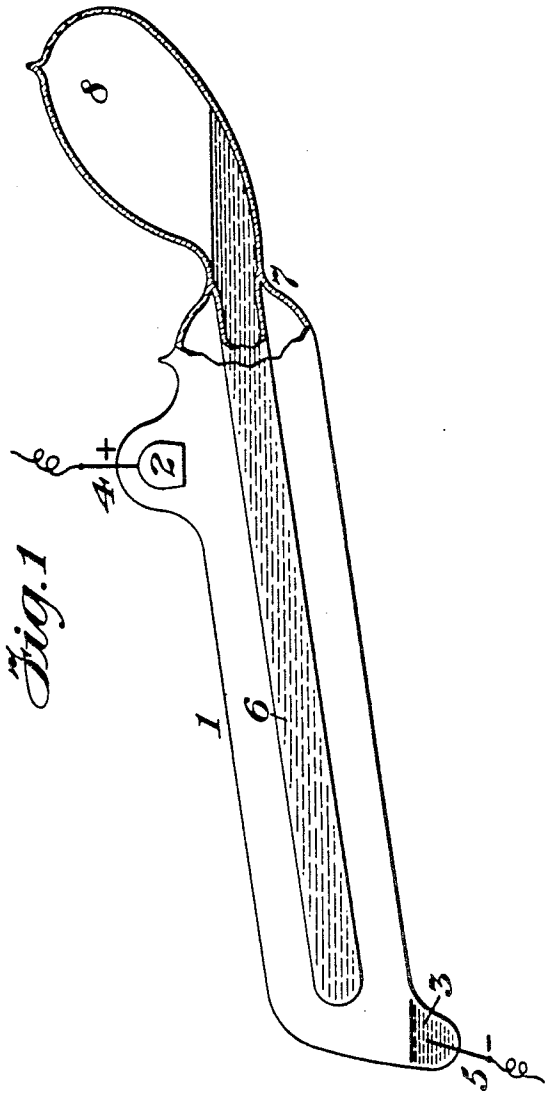


Fig. 1

WITNESSES

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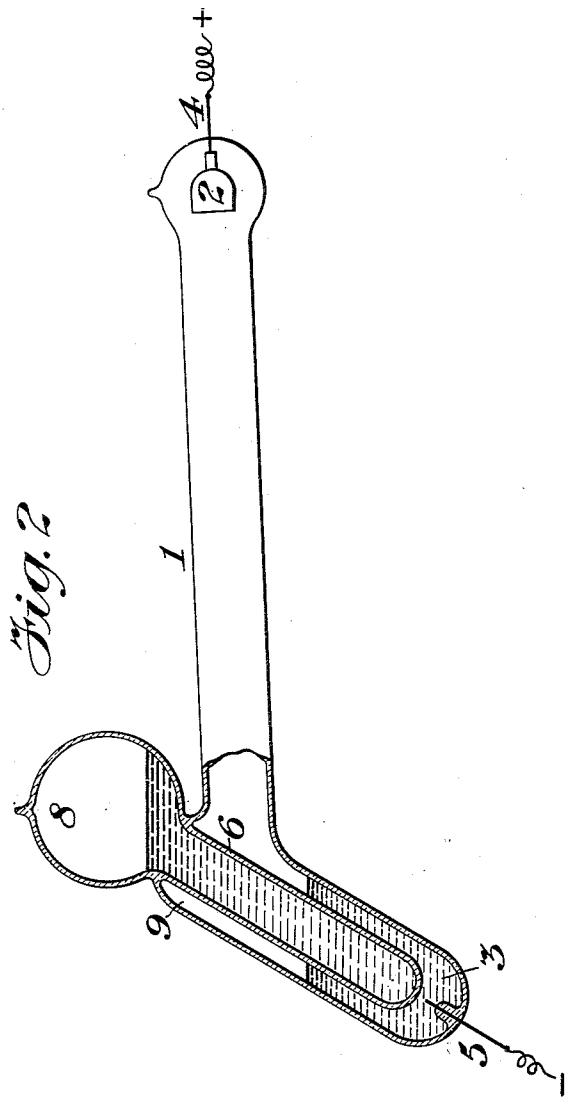
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2 SHEETS—SHEET 2.

Fig. 2



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COOLING DEVICE FOR VAPOR ELECTRIC APPARATUS.

1,110,601. Specification of Letters Patent. Patented Sept. 15, 1914.

Original application filed March 28, 1904, Serial No. 200,284. Divided and this application filed April 27, 1912. Serial No. 693,564.

To all whom it may concern:

Be it known that I, PERCY H. THOMAS, a citizen of the United States, and resident of Upper Montclair, county of Essex, State of New Jersey, have invented certain new and useful Improvements in Cooling Devices for Vapor Electric Apparatus, of which the following is a specification.

In the operation of gas or vapor electric apparatus it is often desirable to produce a local cooling of some portions of the apparatus for various purposes. It may be desired, for example, to run the disintegrating negative electrode in apparatus of this class comparatively cool so as to keep down the development of vapor from the electrode to comparatively low limits. Moreover, either in combination with such means for cooling the negative electrode, or independently thereof, it may be desired to produce local cooling in the vapor bath whereby an excess of vapor in the light-giving portion of the apparatus is prevented. This latter function of cooling means applied to a vapor apparatus may become especially valuable in vapor lamps wherein a mixture of gases or vapors is employed, one or more being condensable and the other or others being comparatively non-condensable. In such cases a portion of the apparatus may be cooled so as to keep down the excess of condensable vapor, but in practice, where such cooling is done at a portion of the apparatus remote from the light-giving portion of any excess of condensable gas which has escaped from the cooling means into the light-giving portion will gradually accumulate and by reason of the high temperature of this portion of the apparatus may not be readily condensed. Under such circumstances a return path may be provided for the excess of vapor, but this is found to be somewhat cumbersome, and it is generally preferred that other means for condensing the vapor should be employed, such, for example, as means for local artificial condensation. The local condensation might be accomplished by using a water or other cooling jacket outside the tube. This, however, would be open to the objection of the additional weight and bulk of the apparatus, while it is also true that a portion of the light-energy would be absorbed in passing through the walls of the jacket and the fluid therein.

It is a part of the present invention to secure the benefits of artificial cooling without the disadvantage due to a return tube or an external water jacket, at the same time providing ready means for dissipating the heat accumulated in the gas path in a simple and convenient manner.

A still further object of the invention is that of insuring that every portion of the light-giving vapor should be able to deliver up its heat by reason of the fact that an intimate contact is provided between the vapor and the cooling means.

I accomplish these results by providing in the interior of the chamber of the apparatus, throughout the whole or a portion of the light-giving path, an inner tube sealed off from the main vacuum chamber and containing a suitable heat conducting fluid, such as alcohol, ether, water, or other suitable material. When an apparatus is constructed embodying the features above described and in the manner herein illustrated, the cooling means may be maintained at a constant temperature regardless of atmospheric variations.

By employing within the inner tube a liquid having a definite boiling point and determining the gas pressure upon its surface and by providing an independent condensing chamber for the cooling liquid, I may bring about a condition in which, upon the starting of the apparatus, heat will accumulate in the liquid until it reaches its boiling point, above which no elevation of temperature can take place until the liquid is entirely vaporized. Owing, however, to the presence of the special condensing chamber above referred to, the vapor from the cooling liquid is cooled and condensed and then drains back to replenish the supply of liquid.

In the accompanying drawings, Figure 1 shows an apparatus in which the cooling means are applied internally along the greater portion of the vapor column; and Fig. 2 shows a similar apparatus in which the negative electrode itself as well as a portion of the vapor is subjected to the influence of the cooling means.

Referring to the first figure of the drawings, 1 is a container of glass or other suitable material and 2 and 3 are, respectively, the positive and negative electrodes of the apparatus, the same being connected with lead-wires, 4 and 5. In this instance the negative electrode 3 may be assumed to be of mercury and the positive electrode 2 of iron or other suitable solid material. Through the major portion of the container is run a tube, 6, which is sealed off from the container 1 at the point 7. This tube 6 is provided with a condensing chamber, 8, and is partially filled with alcohol, ether, water, or some other suitable material. The liquid in the tube 6 will have a definite boiling point depending upon the gas pressure upon its surface, which pressure can be predetermined before sealing off the condensing chamber 8.

The vapor developed in the operation of the apparatus, considered as a whole, will, under the conditions described, be mercury vapor, but we may assume that some other gas or vapor, such as nitrogen, or carbonic acid gas, is introduced in definite quantity into the container 1 so as to affect in a desirable manner the total spectrum given out by the apparatus when current is passed through it. Under these conditions, it is generally desirable to cut down the amount of mercury vapor in the light-giving portion of the apparatus, owing to the tendency of such vapors to be developed in excess. The liquid containing tube 6 serves this purpose, while by reason of its location it does not notably absorb the light-energy of the apparatus, whereby the efficiency of the same is maintained practically undiminished. The liquid in the tube 6 having been brought to a state of boiling, the vapors arising from it ascend in the chamber 8 and are there condensed and fall back again to replenish the liquid.

Manifestly, the cooling means thus described are independent of atmospheric conditions or variations. By properly proportioning the parts, the excess of mercury vapor can be kept down to appropriate limits so that the apparatus as a whole will produce a predetermined spectrum. The same would apply to other condensable vapors besides mercury vapor, and the conditions would not be essentially altered by substituting for the nitrogen or carbonic acid gas any other suitable gas whose spectrum contained the desirable rays. Practically the whole of the vapor in the light-giving portion of the tube is subjected in the form of apparatus illustrated in Fig. 1 to the effects of the cooling means.

In Fig. 2, the container is again shown at 1, the positive electrode at 2, the negative electrode at 3, and the lead-wires at 4 and 5. Here, however, the tube 6 does not extend through the greater portion of the light-giving column but is sealed into the extension, 9, of the receptacle containing the negative electrode 3. The conditions in other respects are substantially the same as those already described. It is to be noted, however, that the tube then enters the mercury electrode itself and that by so doing it exposes the latter to cooling influences and also constricts the surface of mercury which is exposed to evaporation. The mercury vapor, however, as soon as it is liberated, is at once exposed to the influence of cooling means and thereby the tendency to excessive development of vapor is prevented. Under these conditions the mercury electrode might run comparatively cool, a condition which under some circumstances is desirable.

This application is a division of my application filed March 28th, 1904, Serial Number 200,284, and a companion to my application filed June 14th, 1904, Serial Number 212,475, which also is a division of my application of March 28th, 1904.

I claim as my invention:—

1. In a vapor electric lamp characterized by an exhausted container and suitable electrodes, one being a vaporizable cathode, the method of operation which consists in providing supplemental cooling surface for cooling the cathode as distinguished from the surface of the container and providing an intermediate medium or heat conductor for transferring heat from the cathode to the supplemental surface.

2. In a vacuum vapor electric apparatus adapted to produce light, the method of controlling the spectrum of emitted light, which consists in passing electric current through the apparatus by the production of vapor therein, adding a permanent gas adapted in character to supplement the spectrum of the vapor, but insufficient in quantity to balance the total quantity of vapor naturally produced and removing the natural excess of vapor by maintaining the general region wherein the vapor is produced at a temperature below the normal temperature and corresponding to the pressure of the vapor when not in excess.

3. In a vapor electric apparatus, the combination with a vaporizable electrode adapted to develop under natural conditions an excess of condensable gas or vapor, and a relatively non-condensable gas or vapor, of means for preventing the development of an excess of condensable gas or vapor, such means consisting of a cooling device entering the vaporizable electrode, and permitting the natural temperature in the light giving portion.

4. In a vapor electric apparatus, the combination with a disintegrating electrode capable of developing under natural conditions an excess of condensable gas or vapor,

and a relatively non-condensable gas or vapor, of means for condensing the excess immediately upon the liberation of the condensable gas or vapor, such means consisting of a cooling device in close proximity to the surface of the said electrode.

5. In a vapor electric apparatus, the combination with a disintegrating electrode capable of developing under natural conditions an excess of condensable gas or vapor and a relatively non-condensable gas or vapor, of means for condensing the excess immediately upon the liberation of the condensable gas or vapor, such means consisting of a tube in intimate relation with the condensable gas or vapor, and containing a suitable liquid.

6. In a vapor electric lamp characterized by an exhausted container, a suitable anode and a suitable cathode therein, the method of operation which consists in providing supplemental cooling surface for cooling the cathode as distinguished from the surface of the container and providing an intermediate medium or heat conductor for transferring heat from the cathode to the supplemental surface.

Signed at New York in the county of New York and State of New York this 26th day of April A. D. 1912.

PERCY H. THOMAS.

Witnesses:
WM. H. CAPEL,
THOS. H. BROWN.