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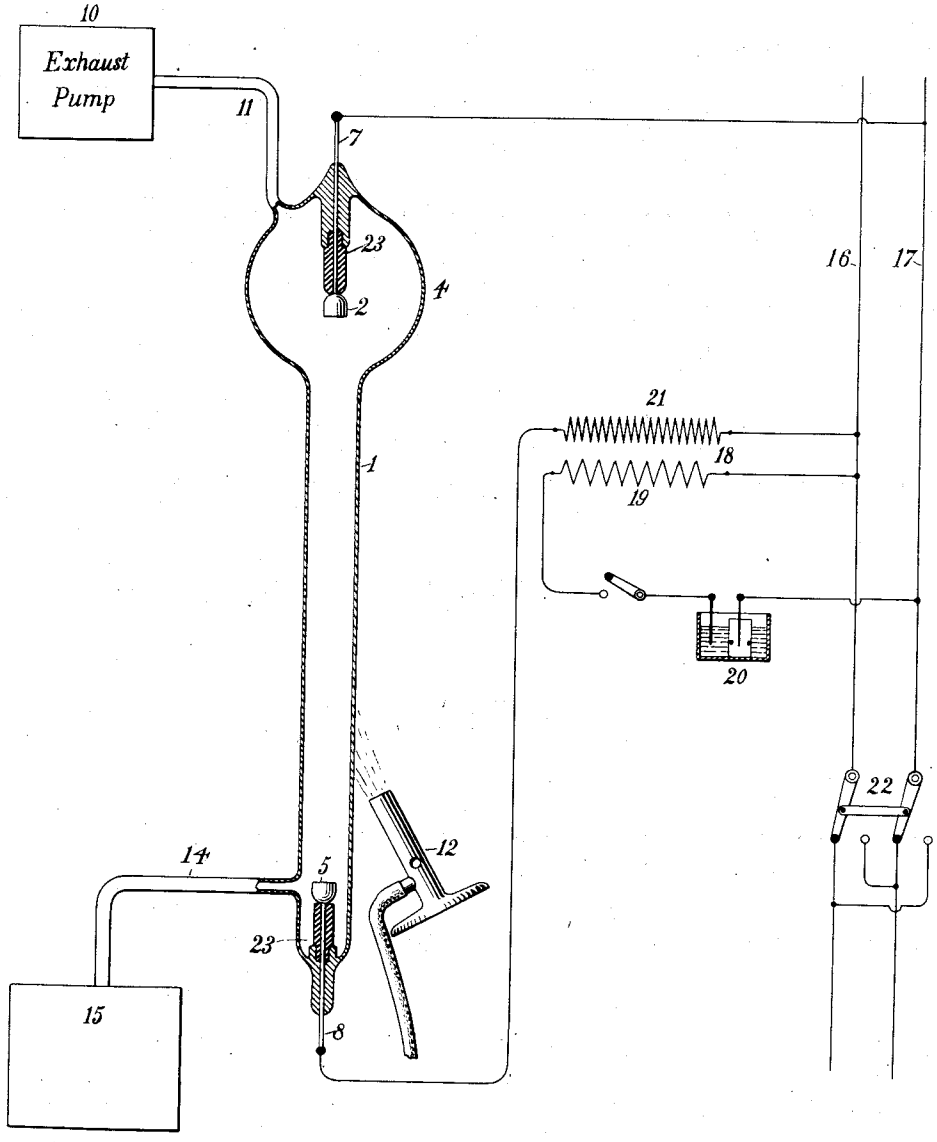
P. C. HEWITT.

METHOD OF MANUFACTURING VAPOR OR GAS LAMPS.

(Application filed Apr. 5, 1900. Renewed May 2, 1901.)

(No Model.)



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UNITED STATES PATENT OFFICE.

PETER COOPER HEWITT, OF NEW YORK, N. Y., ASSIGNOR TO PETER COOPER HEWITT, TRUSTEE, OF SAME PLACE.

METHOD OF MANUFACTURING VAPOR OR GAS LAMPS.

SPECIFICATION forming part of Letters Patent No. 682,699, dated September 17, 1901.

Application filed April 5, 1900. Renewed May 2, 1901. Serial No. 58,510. (No model.)

To all whom it may concern:

Be it known that I, PETER COOPER HEWITT, a citizen of the United States, and a resident of New York, in the county of New York and State of New York, have invented certain new and useful Improvements in Methods of Manufacturing Vapor or Gas Lamps, of which the following is a specification.

My invention relates to the class of electric-lighting apparatus in which an electric light is produced by the action of electric currents upon a vapor or gas.

The object of the invention is to provide an electric lamp having a gas of the proper density and characteristics for producing light conveniently and efficiently by the action of electric currents.

Prior to my invention it had been proposed to produce within a so-called "vacuum-tube" electric light by means of electric charges, and in some instances it has been proposed to pass electric currents through tubes containing a vapor or gas. None of these devices, so far as I am aware, were capable of being operated in a commercial manner. Among other defects may be mentioned the fact that they would not receive current in such manner as to be self-regulating in any commercial degree. Moreover, their resistances were not controllable in such manner as required for commercial use.

My invention aims to produce a lamp which may be used upon commercial circuits with convenience and which shall be highly efficient and durable.

In the manufacture of my lamp it is essential that the containing-chamber shall be freed from deleterious gases and substances and caused when finished to have a suitable quantity of gas or gases at the proper densities. These results I accomplish by manufacturing the lamp in a manner which will be more particularly described in connection with the accompanying drawing, which illustrates diagrammatically the lamp and the circuits and apparatus for manufacturing it.

Referring to the drawing, 1 represents the lamp-chamber, consisting in this instance of a tube which may, if desired, contain a slight enlargement 4 at one end. It is provided with two electrodes 2 and 5, suitably located within the chamber, and leading-in wires 7 and 8 connect with these electrodes, respectively

The lamp is during the process of manufacturing connected with a suitable exhaust-pump 10 by means of a pipe 11. The lamp structure is exhausted by means of the pump 10, and I usually heat it during the process of exhaustion—as, for instance, by the flame of a Bunsen burner 12 or in any other convenient manner. Previous to placing the lamp upon the pump it may be thoroughly washed with alkalies and acids to remove the impurities. When the atmosphere has been pumped out from the structure, a quantity of gas of the same kind as that which it is desired to use in the completed lamp may be let into the lamp either through exhaust-tube 11, or, if more convenient, through a tube 14, which is here shown as connected with the lower end of the lamp and as leading from a suitable reservoir 15, containing the gas. The exhaust-pump 10 is operated to pump out the gas thus admitted, and the washing by means of this gas is continued as long as may be necessary.

In order to heat the electrodes within the lamp as well as the whole lamp structure, it may be connected with a suitable source of electric currents 16 17, and for the purpose of applying a higher difference of potential to the lamp than that with which it is intended to ultimately operate it a transformer 18 may be employed, having its primary coil 19 suitably connected with the source 16 and 17, and, if desired, through an interrupter 20 of any convenient character, while the secondary coil 21 is connected in the circuit leading to the lamp. The higher difference of potential thus impressed upon the terminals of the lamp acts upon the vapor within the lamp, at first causing it to be slightly luminous. By means of a reversing-switch 22 the connections of the circuits may be reversed, so as to render the electrodes 2 and 5 alternately cathodes and anodes. I have found that the cathode will become highly heated by the action of these currents, and thus throw off occluded gases and be subjected to such chemical reactions and changes as might otherwise occur in the lamp after

it is completed. By thus treating the lamp the impurities and such materials as would exercise a deleterious effect upon the lamp may be removed. When the lamp has thus been sufficiently treated, an excess of the gas with which it is to be operated is admitted to the chamber or created in it, and while the terminals of the lamp are subjected to the currents of higher electromotive force and also of the electromotive force with which it is designed to be operated, the excess of gas is pumped out until a point is reached where the gas becomes sufficiently conductive to receive considerable currents and to become highly luminous. When the proper conditions are reached, the action of the lamp is very noticeable and the amount of light yielded is vastly greater than that produced by the action of the higher-potential current. In some cases it may be desired to operate the lamp with currents of considerable quantity repeatedly before finally sealing off the lamp. By noting the operation of the lamp and the quantity of current received it may be readily determined when the lamp is charged with a gas of the proper density, and the lamp is then sealed off and completed. The densities required on the part of the gases differ with different gases used, and the electromotive force and quantity of current received by the lamp are dependent in a measure upon the length and cross-section of the gas path within the lamp, as well as upon the kind of gas employed, and also upon the kind of electrodes. By following the instructions herein given, however, the rules for governing each different gas, as well as the dimensions of the lamp structure, may be readily determined, and the proper point of time at which to seal off the lamp is indicated in the manner referred to. I have obtained excellent results from such gases as nitrogen.

The tendency of the electric current during the operation of the lamp is to pass to the farthest portions of the electrodes, and I therefore usually construct the lamps so that the portions of the electrodes 2 and 5 which are nearest to each other are the only exposed portions thereof, protecting the more remote portions by the covering of insulated material—such, for instance, as sleeves 23, of porcelain or other substance—which will not be acted upon by electric current, fitting tightly over the leading-in wires. The shapes of the electrodes may be variously modified. I have found, for instance, that a somewhat conical face serves well for the anode and a concave face for the cathode; but these shapes may be variously modified. The electrodes are made of suitable material—such, for instance, as iron, platinum, &c.

It will of course be understood that instead of admitting an excess of gas and then withdrawing it for the purpose of producing the required density a higher degree of exhaustion may be obtained and then the gas admitted gradually until the proper condition is reached.

In certain other applications filed by me April 5, 1900, Serial Nos. 11,605, 11,606, and 11,607, I have described a lamp of the general character of that described and claimed herein and its method of operation and process of manufacture.

The invention claimed is—

1. The hereinbefore-described process of manufacturing lamps having a gas path, which consists in heating the containing-chamber, exhausting the gaseous contents therefrom, washing the chamber with a gas of the same character as that with which it is to be provided, subjecting the interior of the chamber and the electrodes to the action of electric currents, creating within the chamber such a density as will permit the gas to receive currents of considerable quantity under the influence of moderate electromotive force, and then sealing off the lamp.

2. In the process of manufacturing lamps having gas or vapor serving as a path for the current between the electrodes, the method of cleansing the lamp which consists in electrically heating the electrodes and washing the lamp by a gas or vapor of the same character as that which is to constitute the gas or vapor path when the lamp is complete.

3. The process of producing within a gas electric lamp the required density of gas which consists in first thoroughly cleansing the lamp from deleterious materials and then providing within the lamp an excess of the gas, gradually reducing the density of the same, and applying an electromotive force of moderate potential and superposing alternating or intermittent currents of higher potential to the terminals of the lamp until such a density is attained that currents having the lower potential will traverse the lamp, and thereafter sealing off the inclosing chamber of the lamp.

4. The method of producing within a gas electric lamp the density of the gas required for operating the lamp under the influence of moderate electromotive force, which consists in thoroughly cleansing the lamp, applying to the terminals of the lamp an electromotive force of higher voltage than that with which the lamp is intended to operate and applying a difference of potential approximately the same as that with which the lamp is designed to operate, gradually changing the density of the gas within the containing-chamber until currents traverse the lamp under the influence of the lower electromotive force, substantially as described.

Signed at New York, in the county of New York and State of New York, this 27th day of March, A. D. 1900.

PETER COOPER HEWITT.

Witnesses:

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