No. 750,554. PATENTED JAN. 26, 1904.

H. N. POTTER.

BALLAST DEVICE FOR VAPOR LAMPS.

APPLICATION FILED OCT. 19, 1901.

NO MODEL. 2 SHEETS—SHEET 1.

Fig. 1

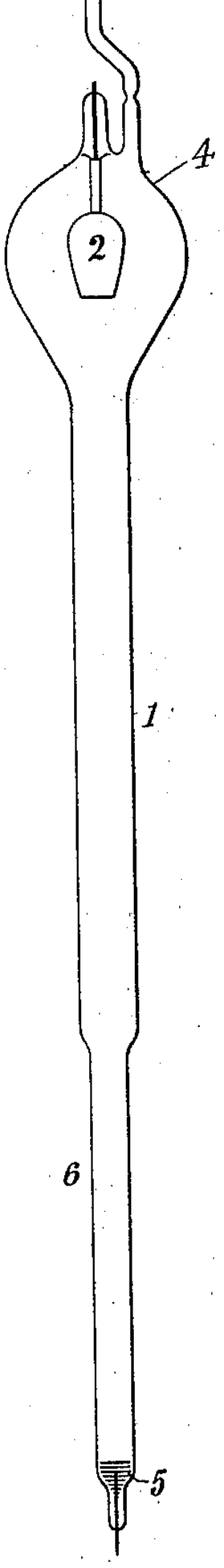


Fig. 2

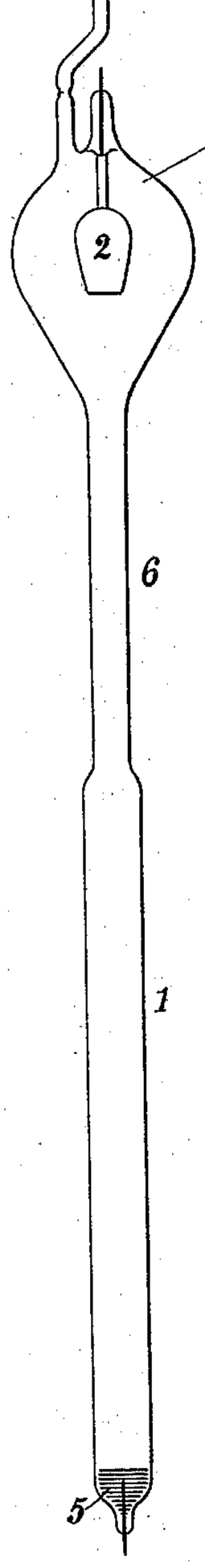


Fig. 3

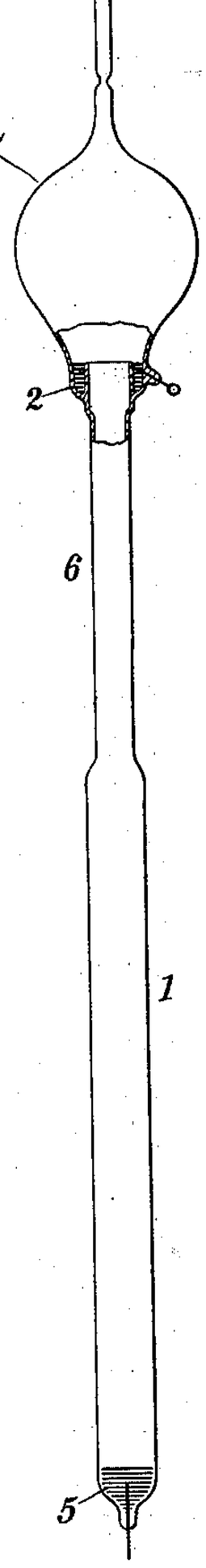


Fig. 4

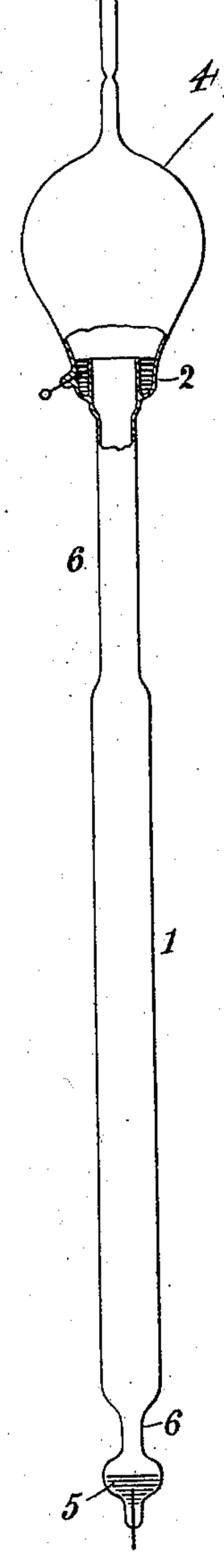


Fig. 5

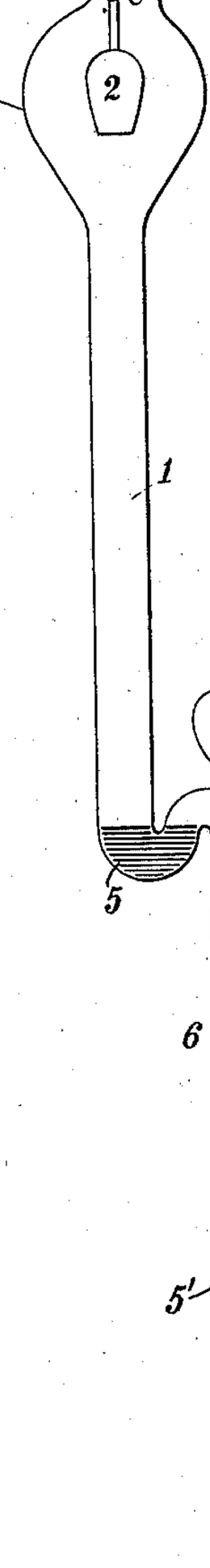
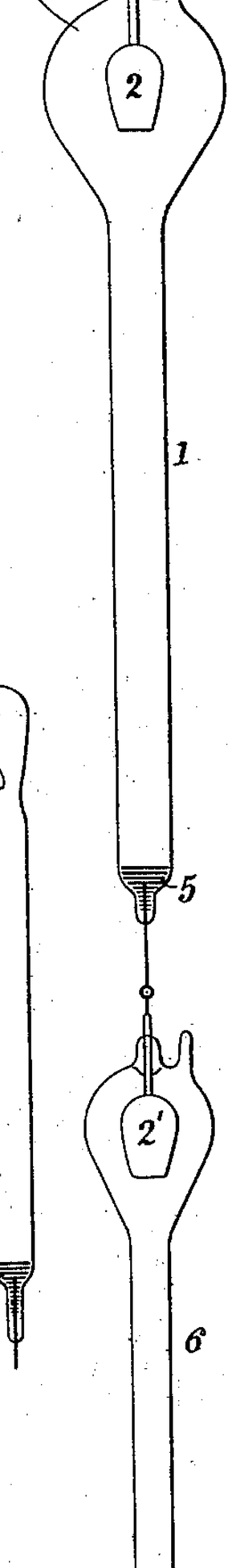


Fig. 6



Inventor

Henry Noel Potter

Witnesses:

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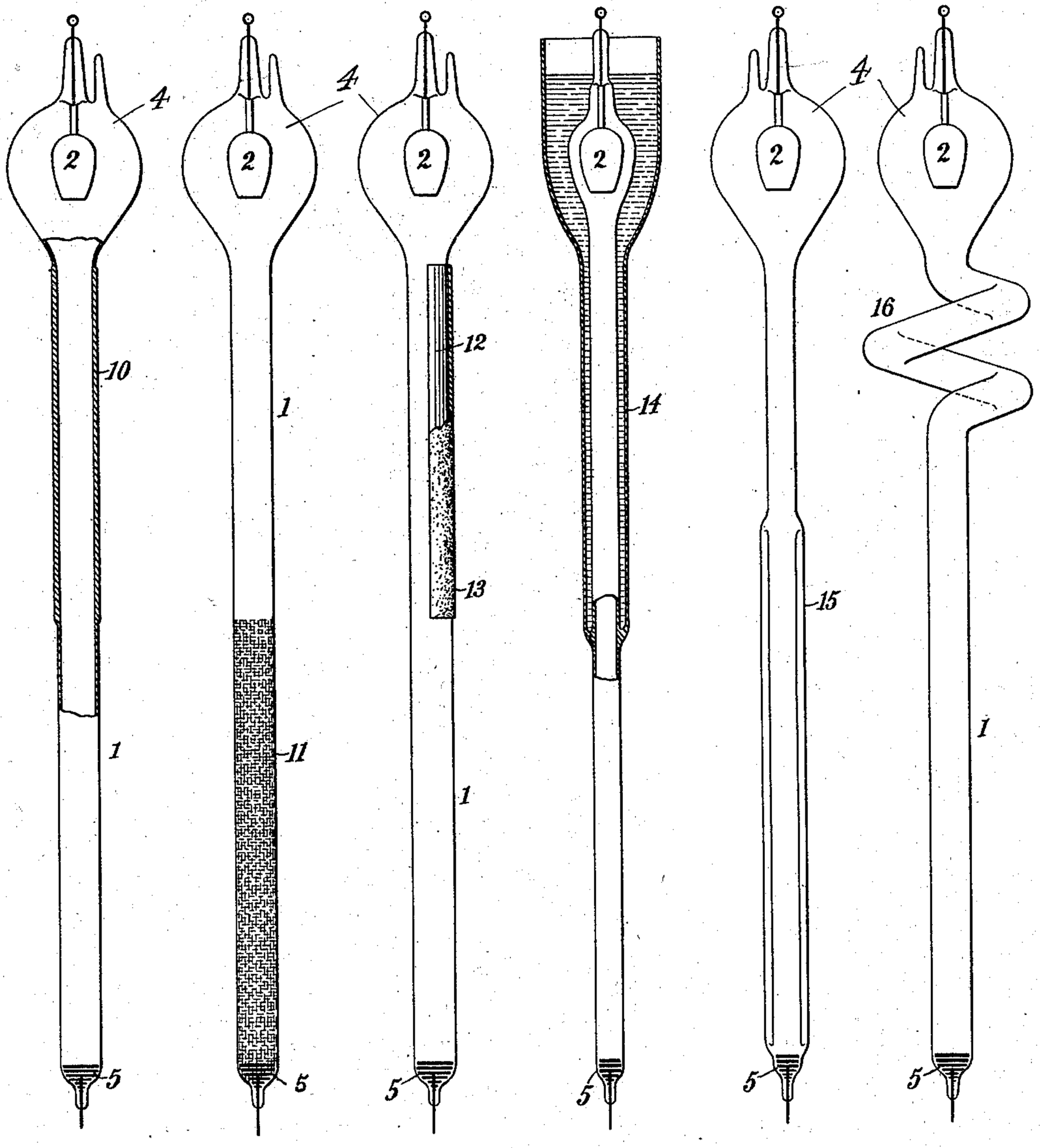
NO MODEL. 2 SHEETS—SHEET 2.

Fig. 7 Fig. 8 Fig. 9 Fig. 10 Fig. 11 Fig. 12



Witnesses:
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No. 750,554. Patented January 26, 1904.

UNITED STATES PATENT OFFICE.

HENRY NOEL POTTER, OF NEW ROCHELLE, NEW YORK, ASSIGNOR, BY MESNE ASSIGNMENTS, TO COOPER HEWITT ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

BALLAST DEVICE FOR VAPOR-LAMPS.

SPECIFICATION forming part of Letters Patent No. 750,554, dated January 26, 1904.

Application filed October 19, 1901. Serial No. 79,203. (No model.)

To all whom it may concern:

Be it known that I, HENRY NOEL POTTER, a citizen of the United States, and a resident of New Rochelle, in the county of Westchester and State of New York, have invented certain new and useful Improvements in Ballast Devices for Vapor-Lamps, of which the following is a specification.

In determining the laws of operation of gas or vapor electric lamps of the Hewitt type it is found that the points of maximum efficiency and maximum self-regulation do not coincide upon the characteristic curve. To facilitate the regulation of these lamps upon constant-potential circuits, they are commonly run at something below their highest efficiency, the local regulation being effected by means of a series resistance, involving a still further sacrifice of efficiency in the apparatus as a whole by reason of the loss of energy in heat at the series resistance. I have found that all or a portion of the series resistance can be dispensed with and a portion of the corrective resistance utilized as a luminous source by substituting for the discarded portion a series resistance giving not only heat but light and in addition thereto having a high positive temperature coefficient. I may provide such a series resistance by connecting up with a tube constituting (with its inclosed gas or vapor and the electrodes therefor) the Hewitt amp proper a vapor or gas containing tube of the same general character as the main lamp-tube, but of a diameter such that the inclosed gas or vapor path within it shall run at a point of its characteristic curve, where with increase of current it will show a large increase of voltage drop across its terminals. The selected tube may be an independent tube in series with the main Hewitt lamp, or it may be formed in one piece with the lamp-tube by lessening the diameter of the latter along one or more portions of its length. The two tubes thus arranged and subjected to the same current occupy different regions of their characteristic curves, and the smaller tube having greater current density and being hotter than the larger may under the proper conditions be in a region where its temperature coefficient is relatively high, for which reason it can exercise a corrective influence on the operation of the aggregated parts. In other words, making a tube run hotter throughout a portion of its length tends to shove that portion of the gas or vapor inclosed within the hotter part into the corrective region of its characteristic.

As has been pointed out, one of the practical effects of including a tube of relatively small diameter in series with a Hewitt lamp proper is that the smaller tube becomes hotter than the lamp itself. The gas or vapor included in the smaller tube may, according to the determined laws of operation of such gas or vapor apparatus, be operating in a region where its tendency to correct the effects of current fluctuations in the circuit will be relatively great. Under such conditions the part of the gas or vapor circuit having the smaller diameter or cross-section may perform a part or all of the functions of a corrective or ballast resistance in series with the lamp. Inasmuch as one of the practical effects of operating the circuit in this way is that of producing an increased temperature in the narrowed portion of the circuit I may produce similar results by using other means or methods for producing local differences of temperature in a Hewitt lamp-tube, even though such a tube may retain a substantially uniform diameter for the main operative portion, care being taken, so far as possible, to adopt a method which shall cause little interference with the light emission from any part of the tube. Such means or methods may be adopted either singly or in combination with each other. Suitable methods might be, for example, to make the glass wall thicker throughout a portion of its length, to jacket it with a second larger tube, or to make it of glass having a higher coefficient of absorption. In certain cases colored glass would be suitable. Part of the tube may be silvered on one side and the silvering backed by asbestos. In that case the silvering would serve as a reflector and at the same time as an absorbent

of heat. By varying the amount of surface thus covered a greater or smaller corrective effect can be obtained. A small portion of a Hewitt tube might be formed into a coil which would become heated in excess of the straight portion of the tube. Inversely, corrective effects may be secured by cooling a selected portion of a hot running tube to improve the efficiency. This may be effected in a variety of ways, as by jacketing a portion of the tube with a liquid or with a gas of high heat-conducting capacity, such as hydrogen.

I have illustrated my invention in the accompanying drawings, in which—

Figure 1 is an elevation of a Hewitt lamp having one iron and one mercury electrode and showing a reduced portion at one end to assist in the regulation. Fig. 2 is an elevation of a lamp supplied with similar electrodes, the reduced portion of the lamp being shown, however, near the opposite end of the lamp. Figs. 3 and 4 are elevations of Hewitt lamps having two mercury electrodes, the reduced or regulating portion in Fig. 3 being shown near one end of the lamp and in Fig. 4 at both ends of the vapor-path of the lamp. Fig. 5 shows the reduced or regulating portion of the lamp as being mechanically in one structure and electrically in series therewith. Fig. 6 shows the regulating-tube in series with the lamp and as mechanically an independent tube. Fig. 7 illustrates the above-described structure in which a thickened wall occupies a portion of the length of the tube. Fig. 8 shows a part of the tube as consisting of a different kind of glass from the main portion thereof. Fig. 9 shows a tube provided with a heating and reflecting jacket along a portion of its length. Fig. 10 shows a part of the lamp covered with a water-jacket for cooling purposes. Fig. 11 shows a hydrogen-jacket designed for the same purpose; and Fig. 12 shows a tube having a coil formed in one part of it, the same being adapted to become heated in excess of the main part of the tube.

Referring more particularly to the drawings, 1 is a tube of glass or other transparent material constituting a container for a suitable gas or vapor—such, for instance, as mercury-vapor. Electrodes 2 and 5, the former of iron and the latter of mercury, are shown in Fig. 1 at the opposite ends of the conducting gas or vapor path. In Figs. 3 and 4 both electrodes are of mercury, as shown. In each of these figures of the drawings I show at 6 one or more reduced tubes forming parts or continuations of the main lamp-tube 1. I also show a cooling or condensation chamber 4 near the anode, the function of which is well understood by those familiar with this type of lamp. By properly proportioning the connected tubes in relation to each other and to the current with which they are to be operated I can utilize the corrective qualities of the tube of smaller diameter for counteracting either wholly or in part the tendency to an excess of current-flow in the main lamp-tube. For example, by connecting in series a tube one inch in diameter and a tube 1.5 in diameter and operating them at 4.5 amperes I can secure approximate self-regulation for the entire apparatus, the regulating medium or that portion of it represented by the smaller tube being itself luminous, and thus contributing to the total luminosity of the lamp.

Instead of uniting the regulating-tube with the main lamp-tube I may separate it therefrom, as shown in Fig. 6, and in that case the gas or vapor inclosed within the regulating-tube may or may not be of the same density as that in the main lamp-tube.

In Fig. 5 the smaller tube 6 is electrically in series with the main lamp-tube 1 and is mechanically connected thereto, as shown.

In Fig. 7 the corrective portion of the lamp is shown at 10, where, as appears from the drawing, the walls of the tube are thicker, and hence calculated to retain more heat than the lower and thinner part of the lamp or container.

In Fig. 8 the numeral 11 marks the corrective portion of the tube, the same being formed of colored glass or other glass less permeable to radiant energy than the upper portion of the tube.

In Fig. 9 a part of the tube 1 is shown as being covered with silvering 12, the latter being itself covered by a jacket 13, of asbestos. The silvering serves for absorbing heat and reflecting light.

In Fig. 10 the part 14 is intended to illustrate a water-jacket containing water for cooling the upper portion of the lamp.

Fig. 11 shows a jacket 15 containing hydrogen for cooling purposes, this jacket being arranged to surround a portion only of the lamp-tube 1.

I show in Fig. 12 a coil 16, formed in the lamp-tube and intended to occupy some definite portion—say one-third of the length of the tube. Through the conduction, convection, or radiation of the heat acting upon the several portions of the coil by reason of the proximity of said portions to each other the coil 16 becomes heated in excess of the rest of the tube and acts as a corrective factor in the operation of the apparatus.

In Fig. 5 I have designated the lower electrode of the subordinate portion of the tube by the character 5′ and in Fig. 6 the electrodes of the independent ballast-tube by the characters 2′ and 5′.

In practice it is found that lamps made as described in the foregoing specification have efficiencies in excess of anything as yet accomplished with tubes of a single diameter and uniform heat-dissipating capacity.

I claim as my invention—

1. The combination in an electric circuit, of a conducting gas or vapor path in series with

a second conducting gas or vapor path of inferior light-producing but better current-regulating power.

2. The combination in an electric circuit, of a gas or vapor electric lamp consisting of a container and a gas or vapor path within the same operating below its point of maximum self-regulation, and a container and a similar gas or vapor path in series with the first, operating at a point nearer its point of maximum self-regulation.

3. In an electric circuit, a container and a gas or vapor path inclosed within the same, in combination with a regulating device therefor consisting of a gas or vapor path in series therewith and operating at a different point of its characteristic.

4. A lamp consisting of electrodes, a gas or vapor path, an inclosing chamber therefor, of generally uniform diameter, the said portion of uniform diameter constituting the luminous portion of the lamp, a cooling or condensing chamber, and a portion of smaller diameter between the said cooling or condensing chamber and the main luminous portion of the lamp.

5. In an electric circuit, a gas or vapor constituting a path for an electric current, the said gas or vapor being inclosed in a container having different degrees of heat-radiating capacity throughout different portions of its length, the dimensions of the main portion of the container being selected for light-giving purposes, and those of the other portion or portions being selected for both light-giving and self-regulating purposes.

6. The combination with a gas or vapor electric lamp, of a gas or vapor of the same general character in series therewith, the said gas or vapor having a high positive temperature coefficient.

7. A lamp consisting of electrodes, a gas or vapor path between the same, an inclosing chamber therefor of uniform diameter, the said portion of uniform diameter constituting the main luminous portion of the lamp, and a portion of smaller diameter interposed between the electrodes.

Signed at New York, in the county of New York and State of New York, this 17th day of October, A. D. 1901.

HENRY NOEL POTTER.

Witnesses:
GEORGE H. STOCKBRIDGE,
WM. H. CAPEL.