

No. 776,563.

PATENTED DEC. 6, 1904.

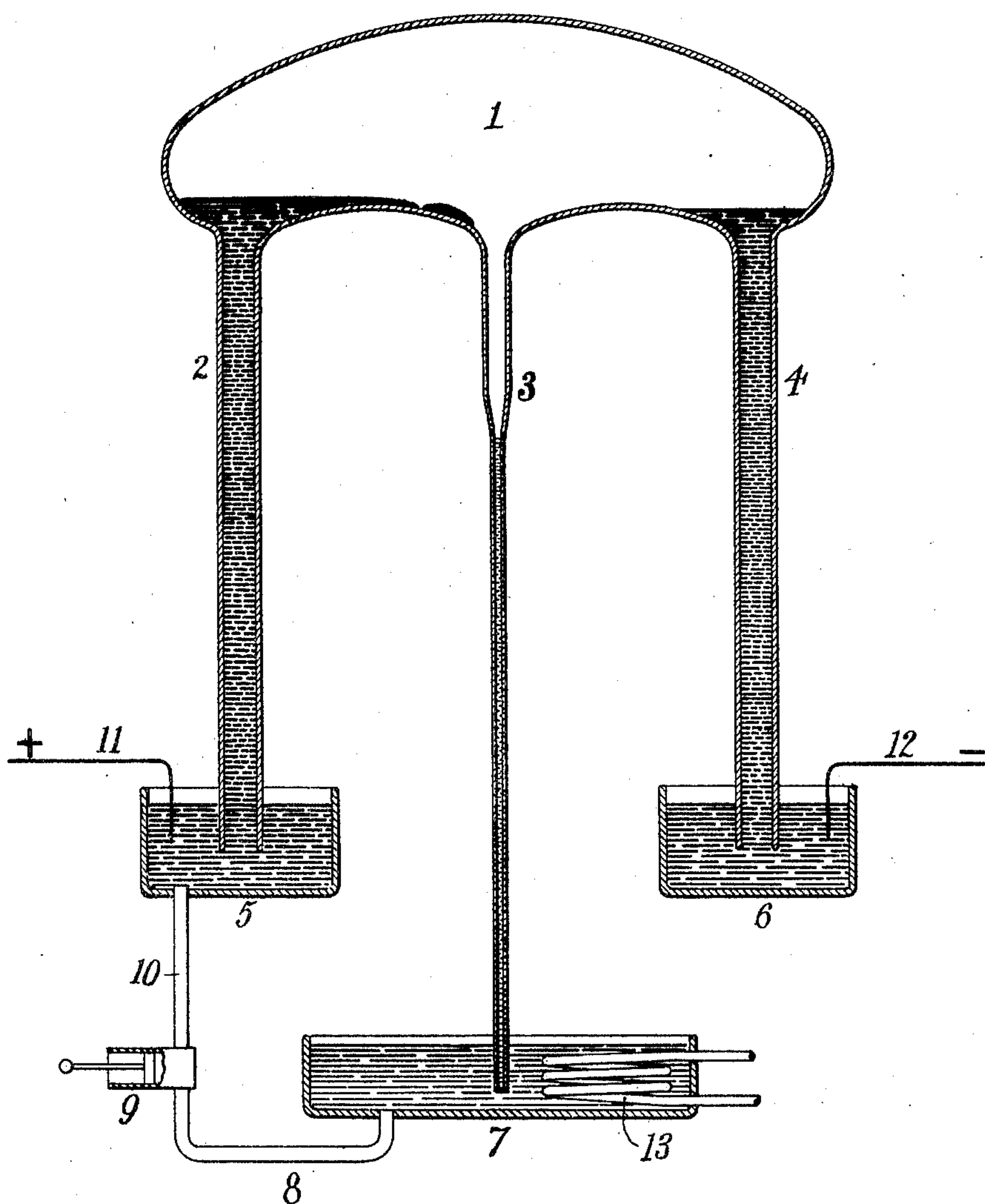
P. H. THOMAS.
CURRENT RECTIFIER.

APPLICATION FILED FEB. 4, 1903. RENEWED MAY 5, 1904.

NO MODEL.

2 SHEETS—SHEET 1.

Fig. 1.



Witnesses:

Frank S. Ober
George H. Stockbridge

Inventor

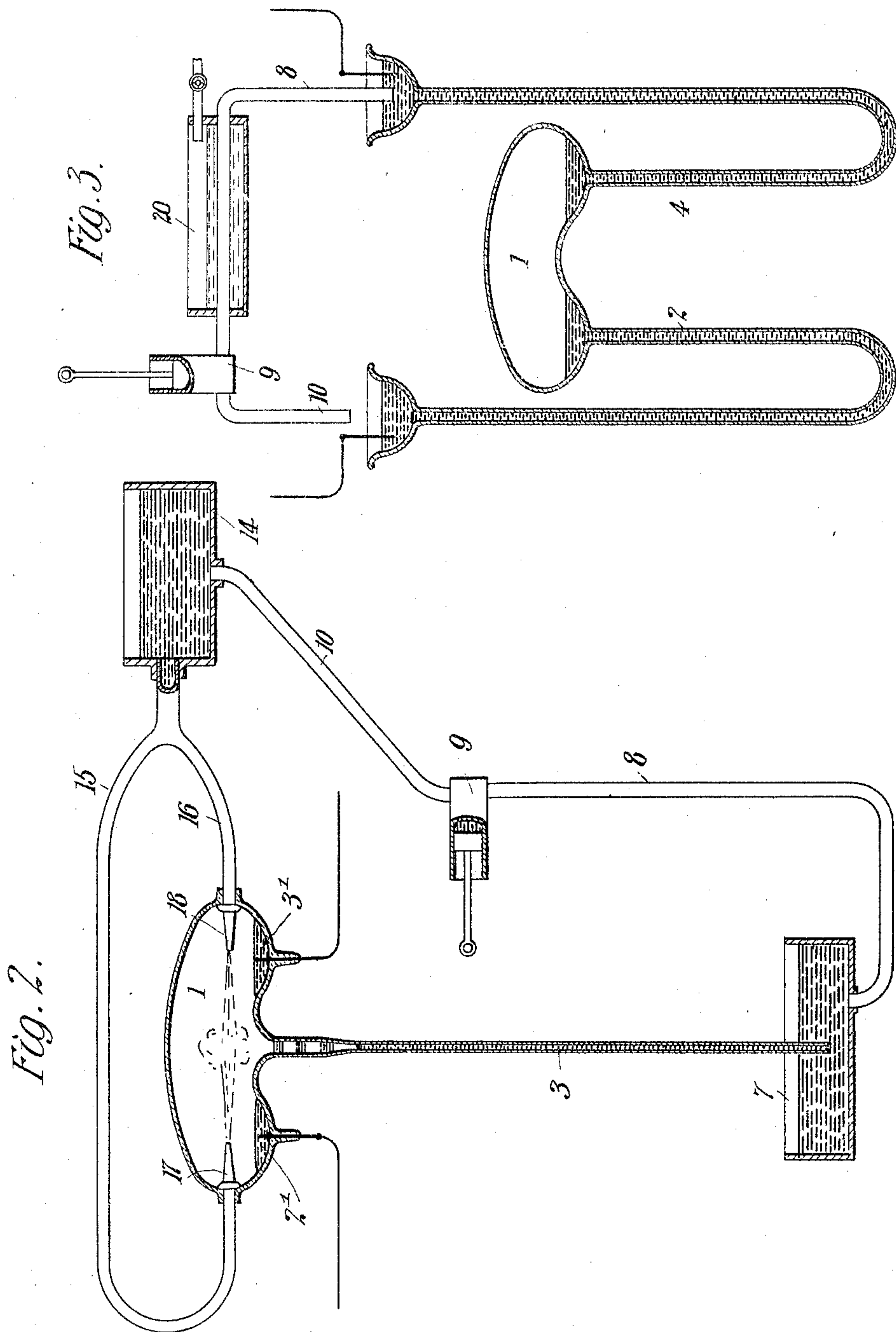
Percy H. Thomas
by *Charles A. Terry* - Atty

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2 SHEETS--SHEET 2.



Witnesses
Frank S. Ober
George H. Stockbridge

Inventor
Percy H. Thomas
 By his Attorney
Charles A. Tamm

UNITED STATES PATENT OFFICE.

PERCY H. THOMAS, OF PITTSBURG, PENNSYLVANIA, ASSIGNOR TO COOPER HEWITT ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

CURRENT-RECTIFIER.

SPECIFICATION forming part of Letters Patent No. 776,563, dated December 6, 1904.

Application filed February 4, 1903. Renewed May 5, 1904. Serial No. 206,576. (No model.)

To all whom it may concern:

Be it known that I, PERCY H. THOMAS, a citizen of the United States, and a resident of Pittsburg, county of Allegheny, State of Pennsylvania, have invented certain new and useful Improvements in Current-Rectifiers, of which the following is a specification.

My invention relates to devices for obtaining a flow of current in a given direction from alternating electromotive forces.

In its physical embodiment the device herein described consists, in general, of an inclosing chamber containing a gas or vapor and separated electrodes, one or both usually consisting of mercury. When properly constructed and operated, a current may be caused to pass in one direction only through such a device, the device opposing so great resistance to flow of current in the opposite direction as to practically prohibit such flow.

The particular subject of this invention is a novel form and construction of such a device, the object being to provide means for keeping the device cool, maintaining the proper purity and density of the gas or vapor within the chamber, and adapting it to transmit currents of large quantity.

In carrying out my invention I provide means for conducting a large amount of current into and from the device with relatively small resistance and also means for carrying away from the chamber heat generated therein and for withdrawing from the chamber any excess of vapor and maintaining the vapor in the proper condition. Among the means employed for these purposes are tubular extensions of the main body of the container, these extensions being filled wholly or partially with mercury if that be the substance of either or all of the electrodes. The lower ends of the tubes are open and are dipped into vessels containing mercury, the mercury columns inside the tubes being sustained by atmospheric pressure or, in case of need, by higher pressure, as will be explained farther on. I also provide a pump of suitable form for causing the circulation by positive means of mercury into and out of the main chamber. In this way a

circulation of the mercury within the chamber is obtained.

During the process of circulation the mercury may be cooled by artificial means, as by one or more refrigerating-coils placed at a proper point or points in the cycle, or I may accomplish the cooling effect by causing the mercury to enter or reënter the chamber in the form of spray. These two means may, if desired, be combined, or other cooling devices may be employed.

The invention will be described more particularly in connection with the accompanying drawings, in which—

Figure 1 is a vertical section showing one form of apparatus, and Figs. 2 and 3 illustrate modifications.

Referring to the first figure of the drawings, 1 represents the inclosing chamber containing a suitable gas or vapor, which for convenience will be referred to as a "mercury-vapor." This is provided with two tubular extensions 2 and 4, containing columns of mercury, which constitute, respectively, the positive and negative terminals of the device. The tubes are here represented as being filled with mercury and as terminating in vessels 5 and 6, respectively, in which vessels mercury is contained. The lower ends of the tubes 2 and 4 are open, and the mercury columns are sustained within them by atmospheric pressure. The chamber is provided with a third tube 3, which terminates in a vessel 7, also containing mercury. The vessel 7 is connected by a pipe 8 with any suitable form of pump 9, the outlet of which is connected by a pipe 10 with the bottom of the vessel 5.

In operation current is led from a conductor 11 into the mercury in the vessel 5, then passes up the mercury column contained in the tube 2, through the vapor in the chamber 1, to the column contained in the tube 4, thence to the vessel 6, and out by way of the conductor 12. Inasmuch as more or less heat will be developed in the passage of current through the device, it is found convenient to cause a more or less continuous flow of mercury upward through the tube 2 into the

chamber, from whence it flows downward through the tube 3, carrying with it more or less of the gas or vapor contained within the chamber. Such continuous flow will not only
 5 result in providing cool mercury for the positive terminal of the device, but will continually act as a pump for maintaining the requisite density and purity on the part of the vapor in the chamber. The mercury as it falls
 10 into the vessel 7 is withdrawn, preferably from the bottom of the vessel, so as to be free from air, by way of the pipe 8, through the pump 9, and returned to the vessel 5. The vessel 7 may be so constructed as to afford a
 15 considerable heat-radiating surface to the mercury, and, moreover, there may be added a cooling-pipe 13 for circulating water or other cooling fluid. The surface of the mercury in the vessel 5 is so adjusted with reference to
 20 the tube 2 that the barometric height of the column of mercury in the tube 2 will bring the top of the column at the proper point for permitting the gradual flow of mercury from the depression in the chamber at the top of
 25 the tube over into the depression in which the tube 3 terminates.

It is generally found unnecessary to cool the negative terminal, as in some instances the device operates better while the negative
 30 terminal is hot; but, if desired, a like device may be employed in connection with the negative terminal.

There will always be more or less condensation of the mercury-vapor upon the walls
 35 of the vessel, and the presence of the cold body of mercury contributes to this action, which results in keeping the vapor at its proper density.

It should be observed that the pipe 3 should
 40 be of such length that the barometric pressure will leave its upper surface at a considerable distance below the body of the vessel 1, so as to better insure the pumping action of the mercury-flow. Moreover, by virtue
 45 of such an arrangement the mercury passing into the top of the chamber 3 will at first be present in the form of drops, which will carry more or less of the vapor from the chamber 1 down through the column in the tube 3 by
 50 an action similar to that of a Sprengel pump.

I show in Fig. 2 a construction in which the tubes 2 and 4 are dispensed with and the lead-wires connected directly with the positive and negative terminals 2 and 3 in the chamber 1.
 55 The tube 3 is present, as before, and the vessel 7 is connected, through a pumping device similar to that already described, with a vessel 14. From this vessel I branch two pipes or tubes 15 and 16, which are led into opposite ends of the chamber 1 and terminate in
 60 nozzles 17 and 18, respectively, through which the mercury which is forced through these pipes by atmospheric pressure passes into the chamber in the form of finely-divided spray.

By these means not only are the terminals 65 themselves cooled, but also the conducting vapor within the chamber 1.

It may be found desirable for special purposes to maintain the conducting gas or vapor in the container at a very high pressure, in
 70 which case the atmospheric pressure exerted upon the outer terminals of the mercury columns might be insufficient to maintain the inner ends of such columns in operative relation with the conducting gas or vapor. Under such conditions an excess pressure may
 75 be applied to the outer terminals of the mercury columns, as by extending the said columns over into the other side or leg of a U-shaped tube, thus adding to the atmospheric
 80 pressure the weight of a part of the mercury column. The main thing to be obtained is that the column of conducting fluid, whatever the nature of the fluid is, may serve as a balance
 85 between the external and the internal pressures. This arrangement is illustrated in Fig. 3, where the tubes 2 and 4 are represented with extensions which return in such a manner as to form U-shaped tubes in which mercury is contained. In this case it is assumed
 90 that the conducting gas or vapor in the chamber 1 is under high pressure, and to compensate for such excessive pressure the weight of the mercury above the limit of atmospheric pressure is increased by the weight of the
 95 mercury in the outer sides of the tubes.

It will be observed that in Fig. 3 the exit-tube 3 is dispensed with and the pump is applied to the outer terminals of the tubes 2 and 4. In order to secure a good cooling effect, I may surround the tube 8 with a water-jacket 20.

Manifestly the term "extension" or "extensions" as used in this specification does not necessarily mean tubes formed in one
 105 piece with the chamber or formed on the chamber. Such extensions may be tubes secured in the walls of the chamber by any means which will prevent leakage. Obviously, also, one tube may be arranged within another so
 110 as to leave an annular space outside the inner tube, the conducting fluid forming one electrode being contained in one of the tubes and the overflow taking place in the other tube.

So far as the cooling and purifying of the
 115 vapor is concerned the liquid which is circulated need not be a conducting liquid, and it is not my intention to limit the present invention to the employment of conducting liquids only.

In a divisional application filed May 6, 1903, Serial No. 155,925, claims are made upon the apparatus described herein.

I claim as my invention—

1. The method of regulating the density and
 125 purity of the gas or vapor in the chamber of a gas or vapor electric apparatus in which one or more of the electrodes is composed wholly

or in part of a conducting fluid, which consists in circulating through the chamber a portion of the conducting fluid.

2. The method of regulating the density, 5
purity and temperature of the gas or vapor in the chamber of a gas or vapor electric apparatus having one or more of its electrodes composed wholly or in part of a conducting fluid, which consists in passing a portion of the con- 10
ducting fluid through a circuit including the chamber, and also including a portion which is exposed to the atmosphere or other heat ab-
sorbent.

3. The method of regulating the density and 15
purity of the gas or vapor in the chamber of a gas or vapor electric apparatus, which consists in circulating through the chamber a suitable liquid.

4. The method of regulating the density, 20
purity and temperature of the gas or vapor in the chamber of a gas or vapor electric apparatus, which consists in circulating through the chamber a suitable cooling liquid.

5. The method of regulating the density, 25
purity and temperature of the gas or vapor in the chamber of a gas or vapor electric apparatus, which consists in circulating through

the chamber a heat-absorbent body and withdrawing a portion of the gas or vapor.

6. The method of regulating the tempera- 30
ture of the gas or vapor in the chamber of a gas or vapor electric apparatus, which consists in circulating through the chamber a heat-absorbent body.

7. The method of regulating the density and 35
purity of the gas or vapor in the chamber of a gas or vapor electric apparatus, which consists in circulating through the chamber a suitable body and withdrawing a portion of the gas or vapor.

8. The method of operating electric appara- 40
tus comprising electrodes, an inclosing chamber, and a gas or vapor path therein, which consists in providing connections with one or more of the electrodes by barometric tubes, 45
and supplying fluid-conducting material to the electrodes through barometric pressure.

Signed at New York, in the county of New York and State of New York, this 2d day of February, A. D. 1903.

PERCY H. THOMAS.

Witnesses:

WM. H. CAPEL,

GEORGE H. STOCKTON, Jr.