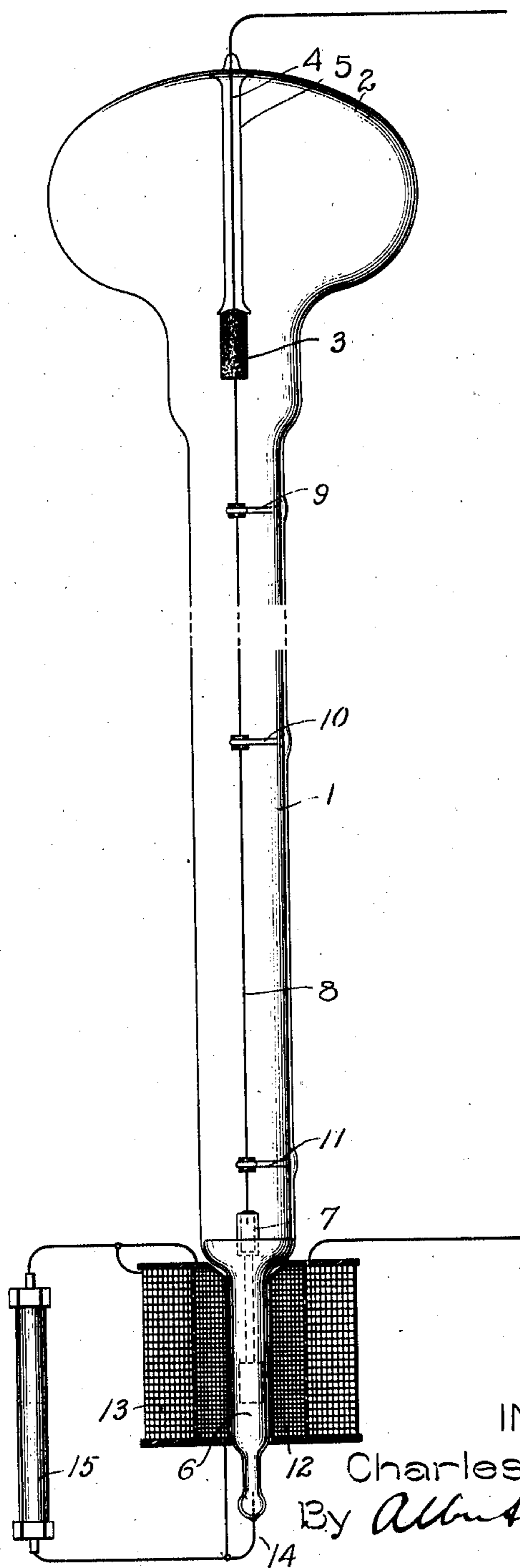


No. 850,270.

PATENTED APR. 16, 1907.

C. P. STEINMETZ.  
VAPOR ELECTRIC APPARATUS.  
APPLICATION FILED OCT. 17, 1904.



WITNESSES:

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Att'y.

# UNITED STATES PATENT OFFICE.

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## VAPOR ELECTRIC APPARATUS.

No. 850,270.

Specification of Letters Patent.

Patented April 16, 1907.

Application filed October 17, 1904. Serial No. 228,660.

### *To all whom it may concern:*

Be it known that I, CHARLES P. STEINMETZ, a citizen of the United States, residing at Schenectady, county of Schenectady, State of New York, have invented certain new and useful Improvements in Vapor Electric Apparatus, of which the following is a specification.

Mercury arc-lamps and similar apparatus when operated under conditions where they may be subjected to a relatively cold surrounding atmosphere—as, for example, when operating out of doors in winter—sometimes start with difficulty. In order to overcome this difficulty, I provide means for preheating the lamps or other apparatus, so that in cold weather they will be able to start without difficulty. This heating means I make automatic, so that it will be cut out of circuit after a moderate predetermined interval.

The features of novelty characteristic of my invention are pointed out with particularity in the appended claims. The invention itself, however, will be better understood by reference to the following description, taken in connection with the accompanying drawings, which represent my invention as applied to a mercury-vapor arc-lamp.

The mercury-lamp shown in the drawings is of a well-known type and requires but a brief description. The exhausted glass tube or envelop of the lamp is indicated at 1. This tube is surmounted by an enlargement or bulb 2, constituting a condensing-chamber. An anode 3, of artificial graphite or other suitable material, is mounted at the mouth of the upper end of the tube 1 and is supported in position by a depending wire 4, the upper end of which in the usual manner is sealed through the glass of the bulb 2 and constitutes a current-leading-in conductor. The exposed portion of this wire 4 is surrounded by a protecting glass tube 5.

The lower end of the tube 1 is contracted to form an extension 6. A body of mercury forming the cathode of the lamp fills this extension and to a slight depth spreads over the lower end of the tube 1. A float or plunger 7, of soft steel or other suitable magnetic material, is immersed in this fluid, with its upper end projecting from the surface, as indicated. This upper end is hollowed out, so as to form a cup. After the plunger has been once submerged and has come to the surface it is filled with mercury.

A filament 8, similar to the ordinary incandescent-lamp filament, is supported from the anode 3 and passing down through centering-guides 9, 10, and 11 dips at its lower end into the mercury held in the cupped upper end of the plunger 7.

A lamp such as described is ordinarily started by means of a solenoid located about the extension 6 and in series with the lamp-circuit. This solenoid when energized pulls down the plunger 7 and by thus causing an initial arc at the lower end of the filament 8 puts the lamp into normal operation in a manner well understood by those skilled in the art.

According to my present invention I provide a heating-coil located, in addition to the starting-solenoid, about the extension 6. This heating-coil is indicated at 12 and the starting-solenoid at 13. These solenoids or coils are represented one inside the other. The heating-coil may be of relatively small conductor and is preferably located next to the lamp-tube, as indicated, though, if desired, the coils may be otherwise arranged. The coils are connected in series with each other and by means of the leading-in conductor 14 with the lamp proper. The heating-coil 12 has approximately the same number of turns as the starting-coil, but is wound in the opposite direction. It is shunted by a resistance 15, the temperature-resistance coefficient of which is negative. This resistance I prefer to make of magnetite. The magnetite may be arranged in the form of a baked stick, or it may be in powdered form and compressed within a tube having suitable terminal connections. A quantity of powdered mica may be mixed with the magnetite powder, if desired. This mica, among other properties, has the advantage of preventing agglomeration of the powdered magnetite and consequent permanent variation of resistance.

When current is turned on to the lamp, the resistance of the magnetite member 15, being when cold extremely high, causes practically the entire current to pass through the heater-coil. The heater-coil and the actuating or starting coil being, as already noted, wound in opposition to each other have no resultant magnetizing effect. The heater-coil thus rapidly imparts heat to the lamp structure and takes away the undue chill, which is detrimental to the starting of the lamp. The

parts adjacent to the mercury in the lamp are thus heated up. The current traversing the filament 8 heats this filament to redness, and thus heats the upper part of the tubular member of the lamp.

The magnetite member 15 is so proportioned that its voltage—that is, the voltage at which it short-circuits—is slightly below the voltage consumed by the resistance of the heater-coil 12, about which it is shunted. Therefore for a short time and somewhere in the neighborhood of one-quarter of a minute or more the main current passes entirely through the heater-coil. By the time this period has elapsed the current, though small, which passes through the magnetite heats the latter and rapidly reduces its resistance until a condition is reached where the magnetite forms practically a short circuit about the heating-coil 12. The actuating or starting solenoid 13, then largely overpowering the counter-magnetizing effect of the heating-coil, pulls down the plunger 7, and the parts then being relieved of their chilling temperature readily starts the lamp.

The resistance of the magnetite element varies greatly in temperature and is very much higher near 0° Fahrenheit than in warm summer weather. Therefore such a magnetite element will short-circuit the heater-coil in summer-time almost instantly or within a second or so, but in winter will keep it energized for a quarter of a minute or more. The heater action of the apparatus is thus automatic, since in summer, when no such heating action is required, the heater-coil is cut out of action almost instantly, whereas in winter, when such heating action may be necessary, the heater is maintained in circuit for such a moderate time as is necessary for it to perform its function.

What I claim as new, and desire to secure by Letters Patent of the United States, is—

1. In a vapor electric apparatus, a heater traversed by current through the apparatus,

and means traversed by current through the apparatus for cutting such heater out of circuit.

2. The combination of a vapor electric apparatus, a heating-coil, and a device in shunt thereto having a negative temperature-resistance coefficient.

3. In a vapor electric apparatus, the combination of a heater-coil, an actuating or starting coil, each of which is traversed by current passing through the other, and means for practically short-circuiting the heater-coil.

4. The combination of a vapor electric apparatus, a heater, and a shunt therefor containing magnetite.

5. The combination of a vapor electric device, counter-magnetizing coils one of which is of such resistance as to serve as a heater, and means in said vapor electric device responsive to the magnetizing effect of said coils.

6. The combination of a vapor electric device, an armature associated with said device, a magnetic device having a time element, said magnetic device being in operative relation with said armature.

7. The combination of a vapor electric device, an armature therefor, coils associated with said armature, and a device for temporarily eliminating the magnetizing action of the coils.

8. The combination of a vapor electric device, an armature therefor, counter-magnetizing coils associated with said armature, one of which coils is of such resistance as to serve as a heater, and a device having a time element for practically eliminating the magnetizing action of the heater-coils.

In witness whereof I have hereunto set my hand this 15th day of October, 1904.

CHARLES P. STEINMETZ.

Witnesses:

HELEN ORFORD,  
G. C. HOLLISTER.