No. 732,488. PATENTED JUNE 30, 1903.

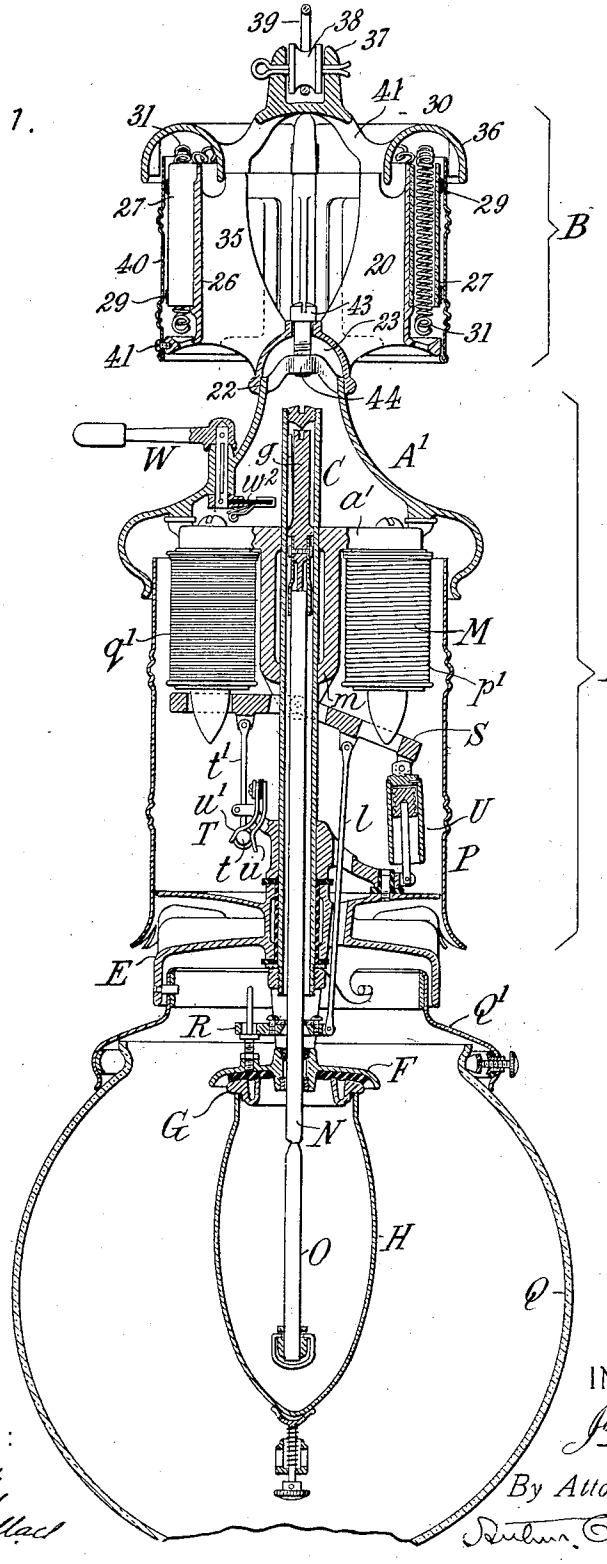
J. J. WOOD.

ELECTRIC ARC LAMP FOR CONSTANT POTENTIAL CIRCUITS.

APPLICATION FILED JUNE 14, 1902.

NO MODEL. 3 SHEETS—SHEET 1.

FIG. 1.



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Dustin & Gifford & Co

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

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NO MODEL. 3 SHEETS—SHEET 2.

FIG. 3.

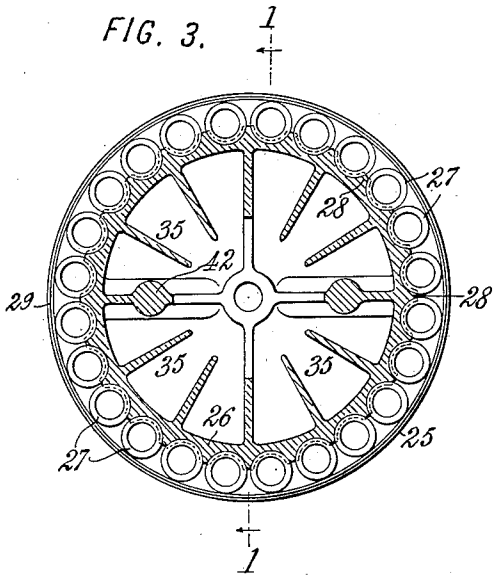


FIG. 2.

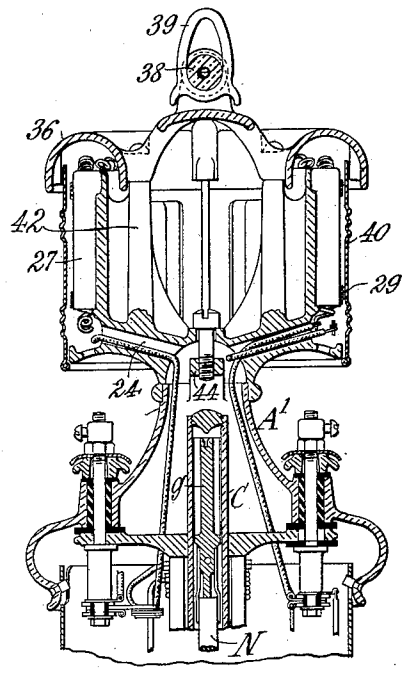


FIG. 4.

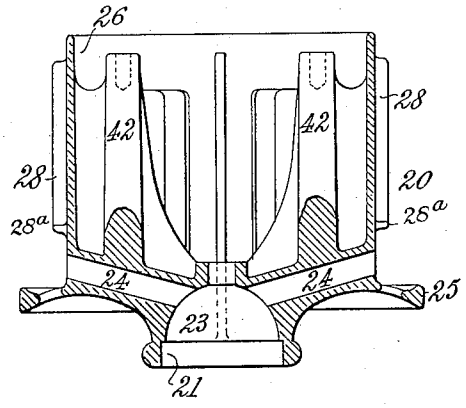


FIG. 5.

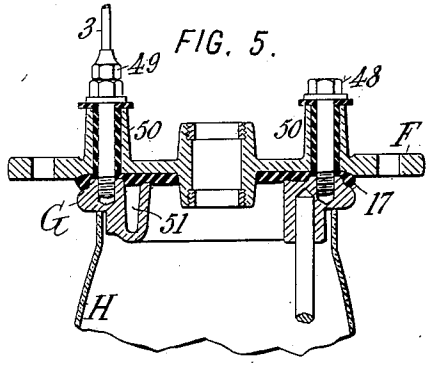
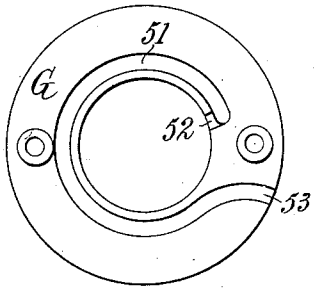


FIG. 6.



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No. 732,488. PATENTED JUNE 30, 1903.

J. J. WOOD.

ELECTRIC ARC LAMP FOR CONSTANT POTENTIAL CIRCUITS.

APPLICATION FILED JUNE 14, 1902.

NO MODEL. 3 SHEETS—SHEET 3.

FIG. 7.

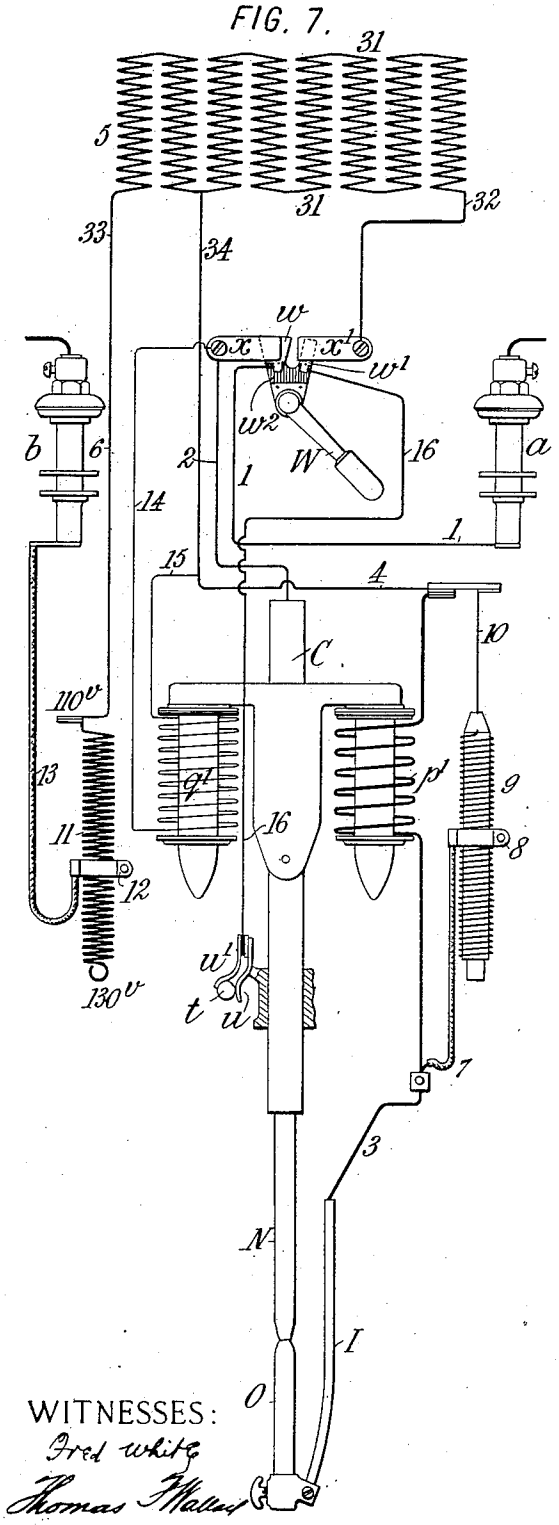
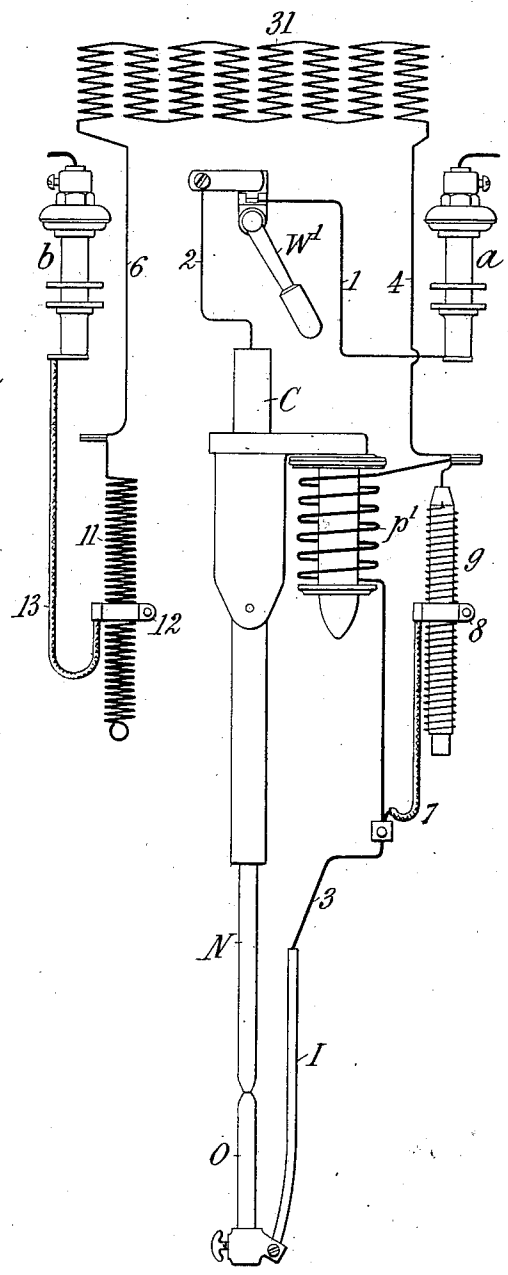


FIG. 8.



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No. 732,488. Patented June 30, 1903.

UNITED STATES PATENT OFFICE.

JAMES J. WOOD, OF FORT WAYNE, INDIANA.

ELECTRIC-ARC LAMP FOR CONSTANT-POTENTIAL CIRCUITS.

SPECIFICATION forming part of Letters Patent No. 732,488, dated June 30, 1903.

Application filed June 14, 1902. Serial No. 111,644. (No model.)

To all whom it may concern:

Be it known that I, JAMES J. WOOD, a citizen of the United States, residing at Fort Wayne, in the county of Allen and State of Indiana, have invented certain new and useful Improvements in Arc-Lamps for Constant-Potential Circuits, of which the following is a specification.

Arc-lamps for use on constant-potential circuits are provided with an external resistance which usually and preferably is contained in a special box or case which commonly is arranged above the lamp or lamp-case, the connecting-wires being extended between the respective cases. For a series lamp the external or steadying resistance includes a steadying resistance connected serially with the lamp and a compensating resistance through which the current is directed when the switch is turned to extinguish the lamp. For a multiple arc-lamp the external resistance is connected in series with the lamp and the lamp is extinguished by breaking the circuit at its switch-terminals. The external resistance case or box has to be adapted for supporting a considerable length of resistance-wire in such manner as to facilitate the disengagement and radiation of a considerable quantity of heat, this being especially important in a series lamp where the compensating resistance consumes practically the same amount of energy when the lamp is extinguished that is consumed in the lamp when it is in operation, this energy being converted into heat which is radiated from the resistance-wire.

My invention provides certain features applicable to lamps for use on constant-potential circuits and relating particularly to the construction and mounting of the external resistance-case, the connection therewith of the lamp-case, the construction and arrangement of the switch, and the several electrical connections, whereby the lamp is mechanically and electrically simplified, avoiding much of the complication heretofore inherent in such lamps.

My invention also provides an improvement applicable to inclosed arc-lamps and providing an improved construction of gas-cap for the arc-inclosing globe.

Figure 1 of the accompanying drawings is a vertical mid-section of a series arc-lamp for constant-potential circuits embodying my invention. Fig. 2 is a vertical section of the upper portion of the lamp-case and of the external resistance case in a plane at right angles to that of Fig. 1. Fig. 3 is a horizontal section through the external resistance-case, the resistant wire being omitted. Fig. 4 is a vertical section in the same plane as Fig. 2 of the shell or body of the external resistance-case. Fig. 5 is a fragmentary vertical section through the gas-cap of the arc-inclosing globe in a plane at right angles to that of Fig. 1. Fig. 6 is a plan of the lower member or plate of the gas-cap detached. Fig. 7 is a circuit diagram of the series arc-lamp. Fig. 8 is a similar diagram of the multiple arc-lamp.

I will proceed to describe the construction of the lamp, which is shown as a whole in Fig. 1.

The letter A designates as a whole what I shall herein refer to as the "lamp-case," and the letter B the external resistance-case. The lamp-case A is constructed at the top with a hood A', beneath which is attached a plate a', (constituting part of the double or differential regulating-magnet M,) to which plate is fastened a central tube C, on the lower part of which is fastened a heat-radiator E, which serves to close the bottom of the lamp-case. The magnet M has two cores projecting downwardly from the plate a', which cores are wound, respectively, with a series coil p' and a shunt-coil q'. The cores react differentially upon a pivoted armature or armature-lever S, which is pivoted at its middle to a middle leg m of the magnet, which leg projects downwardly from the plate a between the coils and serves to support the tube C, which passes through it. The armature S is controlled in its movement by a dash-pot U and connects by a rod l with the carbon feed-clutch R, engaging the upper carbon N. This carbon N is connected at its upper end to a trolley g within the tube C, which tube incloses the upper portion of this carbon, while its lower end projects down through a gas-cap F into an inner globe H, within which is inclosed the lower carbon O. An outer globe Q is shown hung from the holder Q', which is attached beneath the radiator E. The ar-

mature S operates an automatic cut-out T, which comprises a movable piece t, connected to the armature by a link t' and drawn by the final movement of the armature under the attraction of the shunt-coil q' in between two contact-terminals u and u', so as to close a short circuit or shunt, cutting out the lamp through a resistance. The operating parts are inclosed within an outer shell P, the upper end of which is thrust up into the hood A′ and which is removable downwardly (after taking off the globe-holder Q′) to get access to the interior of the lamp-case.

The construction of lamp thus briefly described is the same (except for the resistance-case B) as that set forth in my application Serial No. 98,984, filed March 19, 1902, patented March 31, 1903, No. 724,366, to which application reference is made for a more detailed description and illustration of these features of the lamp, which in themselves form no novel part of my present invention.

According to my present invention I mount a resistance-case B upon the top of the hood A′ of the lamp-case, this hood being modified to the extent of forming at its upper part a tubular neck to constitute a passage communicating with the lower part of the resistance-case. The latter is formed with a cast base or shell 20, (shown separately in Fig. 4,) covered over at the top by a cap or hood 30 and inclosed within a cylindrical sheet-metal casing or shell 40. The casting 20 is formed at its bottom with a neck 21, which fits on the neck 22 of the hood A′, so that, as best shown in Fig. 2, there is formed a communicating passage between the interior of the hood and the lower part or chamber 23 of the resistance-case, from which two passages 24 24, Fig. 4, lead through the casting 20 to the exterior thereof. There is thus provided a clear passage for the respective wires communicating between the resistance-coil in the box B and the electrical elements inclosed within the lamp-case A, whereby these wires are carried internally instead of being extended externally between the lamp-case and resistance-box, as has heretofore been customary. The casting 20 is formed at its bottom with a perforated flange 25, above which is a cylindrical shell 26, extending up to any suitable height, its dimension being variable according to the length of the resistant coil which is to be provided for. Around the exterior of the shell 26 are arranged vertical insulating and heat-resisting tubes 27 27 to any desired number, these tubes being preferably arranged as close together as can be with or without actual contact. To guide these tubes and retain them parallel, it is preferable to form the casting 20 with vertical ribs 28, which project partly between the tubes and determine their correct spacing and keep them properly in place. The tubes are held against the casting by any suitable means, preferably by bands 29, of wire, wound around the entire series of tubes and binding them against the cylindrical shell. The tubes are covered and inclosed by the outer sheet-metal wall or shell 40, which is fastened at any suitable number of points by screws 41, engaging the flange 25.

The resistant wire is coiled into a helix of such size that it will enter freely within the tubes 27. This coil or helix 31 is then extended through the tubes, passing upwardly through one, then downwardly through the next, upwardly through the next, and so on around the entire series, its opposite ends being joined to wires 32 and 33, which, as shown in the diagram, Fig. 7, extend down and join the lamp-circuit. In a series lamp an intermediate wire 34 divides the resistance-coil into the desired steadying resistance on the one hand and compensating resistance on the other and extends also down into the lamp-case.

The heat which is generated by the current passing through the resistance-coil 31 is in part conducted away by currents of air circulating upwardly through the tubes 27 and in part is communicated to these tubes, which are preferably of porcelain and therefore good heat conductors, the tubes conducting the heat to the shell or casting 20, which in turn radiates it to the air. To facilitate the dissemination of this heat, the shell or casting 20 is formed with vertical ribs 35 at intervals, these being arranged, preferably, to project inwardly, as shown in Fig. 3, into the space or chamber within the cylindrical part 26, and this space or chamber is open at bottom and top, so as to constitute an air-flue through which the air may ascend, being caused to circulate by the heat imparted to it and in ascending flowing over the surfaces of the ribs 35, so as to conduct away the heat therefrom. The cap-plate 30 is arranged to cover over the annular series of tubes, so as to prevent any rain falling on the resistant wire, while its central portion is left open to afford free escape for the air ascending through the central chamber within the resistance-case. Thus the cap 30 forms an annular portion 36, which covers the series of tubes, but is so far separated therefrom on both outer and inner sides as to permit of free escape of the air, which entering the perforations through the flange 25 ascends through the tubes 27 and between these tubes and the outer shell 40 and escapes from beneath the dependent flanges of the annular portion 36 of the cap. For suspending the lamp the cap is provided with ears 37, between which is confined the usual insulator 38 for the suspension-ring 39. The ears 37 are joined by a base connected by four arms or spokes 41 to the annular portion 36, and the cap is fastened to the casting 20 by screws, as shown in Fig. 2, which enter posts 42, Fig. 4. The casting 20 is in turn fastened to the hood A′ by means of a central screw 43, which screws into a boss on a cross-bar 44, crossing the neck 22 of the hood.

The described construction of resistance-

case is well adapted to rapidly radiate the heat which is generated in the resistance-coils, since ample opportunity is afforded for the free upward circulation of air and ample surface is provided for the radiation of heat to the air. The described construction also has the advantage over prior constructions that the resistance-case and lamp-case are directly connected by means of tubular portions or necks, constituting a communicating passage through which the connecting-wires are led, instead of extending these wires through the air between separated cases, where the wires are unsightly and are exposed to accidental derangement. The rigid connection of the resistance-case and the lamp-case is also preferable to the loose connection heretofore made by merely suspending the lamp-case beneath the resistance-case.

The switch W for cutting out the lamp by hand is mounted on the lamp-case, as in my constant-current arc-lamps, instead of being mounted upon the resistance-case, as is common with lamps for constant-potential circuits. I also locate the circuit-terminals or binding-posts upon the lamp-case instead of upon the resistance-case. By these changes I am able in a series lamp to reduce the number of connecting-wires passing between the resistance-case and lamp-case from four to three. The circuit arrangement for the series arc-lamp is found in Fig. 7. The positive and negative binding-posts are lettered *a* and *b*, respectively. From the post *a* the current passes by wire 1 to a conducting-segment *w* of the switch W and thence to contact-plate *x*, whence it follows wire 2 (which in the lamp is the plate or magnet-core *a'*) to tube C, and thence through the trolley to the upper carbon N, thence to lower carbon O, thence by its supporting-arm I and connections represented by wire 3 to the series coil *p'*, which is shunted by a shunt 7 8 9 10 to adjust the strength of the magnet to vary the quantity of current to be taken by the lamp, (the adjustment being effected by means of a clamp 8, which can be set at varying points along the resistance-coil 9, as usual,) thence by wire 4, which merges with the wire 34, leading up into the resistance-case, thence through the resistance 5, (being a portion of the resistant wire or coil 31, constituting the "steadying resistance,") thence by wire 6 and adjustable line resistance 11 and its adjusting-crank 12 and wire 13 to the negative terminal or binding-post *b*. The shunt-coil *q'* is, as usual, in a shunt short-circuiting the arc, and the series coil *p'* being connected at one terminal by a wire 14 to the switch-plate *x* (and thence through the switch to the post *a*) and at its other terminal by wire 15 to the wire 4 of circuit 4, and thence through the steadying resistance 5 and line-adjusting resistance 11 to the post *b*. To cut the lamp out by hand, the switch W is turned, so as to bring its plate *w* out of contact with the plate *x* and into contact with the opposite plate *x'*, whereupon the current flows from post *a* by way of wire 1, plates *w x'*, wire 32, thence through the entire length of resistant wire 31, (includingt he steadying resistance 5,) and thence through wire 6, resistance 11, clamp 12, and wire 13 to the post *b*. Thus the compensating resistance is switched into circuit to take the place of the resistance of the normal arc and magnet-coils, which are open-circuited. When the lamp cuts out automatically by an abnormal movement of the armature under the attraction of the coil *q'*, the bridge-piece *t*, being thereby drawn in between the cut-out terminals *u* and *u'*, closes a short circuit, whereby the current flows from post *a* by 1, *w*, *x*, 2, C, *u*, *t*, *u'*, and thence by wire 16 to the switch-plate *w'*, thence to plate *x'*, and by wire 32 through the entire resistance 31 and by wire 6, resistance 11, clamp 12, and wire 13 to post *b*. Thus I utilize the usual abnormal cut-out commonly applied in a constant-current arc-lamp to take the place of the complicated cut-outs heretofore used with constant-potential lamps. The particular construction of such abnormal cut-outs forms no necessary part of my present invention. The particular construction of cut-out comprising the part *u t' u'* here shown is that which is claimed in my aforesaid application, but may be substituted by any other known construction of abnormal or long-arc cut-out applied with constant-current lamps.

The switch W is of simple construction, having any suitable operating handle or part outside the lamp-case, any suitable oscillating spindle or other moving part passing through such case, preferably by passing vertically through a socket formed in the hood A', as shown, and a swinging arm or plate within the case carrying the conducting plate or segment *w w'*. In the construction shown the segments are fastened on an insulating-plate w^2. The switch-terminals *x x'* are stationary plates suitably fixed within the case and preferably double plates or blades, so as to engage both sides of the segment *w w'*.

Fig. 8 shows the arrangement of circuits for a multiple-arc lamp. For this lamp the shunt-coil *q'* is omitted, the regulating-magnet being controlled by a series coil only, as usual. The compensating resistance is also omitted, since the lamp is extinguished by breaking the circuit through it. From the post *a* the current flows by wire 1 to the switch W', thence by wire 2 to the tube C and carbon N, thence by carbon O, rod I, and wire 3 to the series coil *p'* and partly through the shunt 7 8 9, thence through wire 4 and resistance-coil 31, (which in this case constitutes merely the steadying resistance,) and thence by wire 6, resistance 11, clamp 12, and wire 13 to the post *b*. The switch W' is of any ordinary construction, adapted merely to break or close the circuit.

For an inclosed-arc lamp I provide an improved construction of gas-cap. (Shown in Figs. 1, 5, and 6.) The gas-cap is constructed

of a plate F, supported in any suitable manner and having a central opening through which the upper carbon N may move. Beneath this plate is fastened a ring G, which is insulated from the plate F by an interposed insulating-plate 17. The ring is fastened to the plate F in any suitable manner, as by screws 48 49 passed through hubs 50 50 with interposed insulation. As thus far described the construction is the same as that which I have heretofore employed, as set forth in my aforesaid application. I now provide a circuitous duct or channel through which a circulation of gaseous matter may take place between the interior and exterior of the inner globe H. Such a circuitous passage is not new in inclosed-arc lamps; but I provide for forming this passage in the ring G by making a groove 51 in the upper side of this ring, so that this groove is closed by the insulation 17, and thereby constitutes a closed duct or tube. As shown in Fig. 6, the groove is concentric for the greater part of its circumference and at one end communicates by ducts 52 with the interior of the ring, while at its other end it is turned outward at 53 to the exterior. The concentric portion of the groove is of considerable depth, as shown in Fig. 5, while toward the portion 53 it becomes shallower, so as to pass over the top of the globe H.

The regulating-magnet M of my present lamp differs from that set forth in my said application in that the central portion or tubular leg *m* instead of being extended down of full width, so as to form two wide ears embracing the armature, has its ears contracted or tapered, so as to concentrate the magnetic lines of force adjacent to the pivotal axis of the armature.

It will be observed that in my lamp for series installation the resistances 5 and 11 take the place of the usual steadying resistance applied in the resistance-case, and in my lamp for multiple installation the resistances 31, Fig. 8, and 11 take the place of such usual steadying resistances. Heretofore the steadying resistance has been placed in the overhead resistance-case and has been adjustable by means of a sliding connection or movable clamp to compensate for varying line-voltages. Such adjustment requires that the resistance-case shall be opened, and as the lamp-case must in any event be made so as to open and give access to its interior this necessitates that both cases shall be openable. According to my invention I subdivide the usual steadying resistance, placing portion 5 thereof in the resistance-case and the portion 11 thereof in the lamp-case, the portion 5 being a fixed resistance and the portion 11 being adjustable. Thus the resistance-case contains only fixed resistances, which do not require access, so that the case does not require to be readily openable, and all the adjustable parts or parts requiring inspection or access are placed within the lamp-case. Thus the lamp-case contains the magnet-adjusting resistance 9, the line-voltage-adjusting resistance 11, the cut-out T, and the several movable parts of the lamp which require occasional inspection or adjustment.

It must not be inferred from the particularity of detail with which I have herein described the preferred embodiment of my invention that I am by any means limited to the mechanical details herein set forth, since my invention is susceptible of a wide range of modification without departing from its essential features.

I claim as my invention—

1. An arc-lamp comprising a lamp-case and a resistance-case, the latter provided with a suspension device and the lamp-case fastened rigidly beneath the resistance-case whereby it is suspended therefrom.

2. An arc-lamp comprising a lamp-case, a resistance-case above the lamp-case, a suspension device applied to said resistance-case, and a rigid connection uniting the resistance-case to the lamp-case, and adapted to constitute the means for suspending the latter rigidly from the former.

3. An arc-lamp comprising a lamp-case having a hood at its top, a resistance-case above the lamp-case comprising a body-shell fastened at its bottom rigidly to the top of the lamp-case, and a cap for said resistance-case fastened on top of said body-shell with a suspension device applied to said cap, whereby the lamp-case is suspended through the resistance-case body-shell and cap.

4. An arc-lamp comprising a lamp-case having a hood formed with a tubular neck at its top, a resistance-case above the lamp-case, having a body-shell formed at its bottom with a neck fitting said neck on the hood, and with passages for inclosing the connecting-wires leading from said neck to the resistance-coil.

5. An arc-lamp comprising a lamp-case, and a resistance-case above the lamp-case, formed with a body-shell communicating at its lower part with the interior of the lamp-case, having an outer support for the resistance-coil, and an air-flue within it and formed with intercommunicating passages for the circuit-wires leading from the lamp-case across said air-flue to said coil.

6. An arc-lamp comprising a lamp-case formed with a tubular neck at its top, a resistance-case above the lamp-case having a body-shell formed at its bottom with a neck fitting the neck of the hood and rigidly attached thereto and having an outer support for the resistance-wire with an air-flue within said support, and an annular cap fastened on top of said body-shell.

7. An arc-lamp comprising a lamp-case terminating in a tubular neck at its top, a resistance-case above the lamp-case having a body-shell formed at its bottom with a neck fitting thereon, said body-shell formed with an upright wall, a chamber within said shell open at bottom and top to constitute an air-flue, a resistant wire supported outside said wall,

and a passage for connecting-wires leading from within the lamp-case to said resistant wire.

8. An arc-lamp comprising a lamp-case A, and a resistance-case B above it, the lamp-case formed with a hood A′ terminating at its upper end in a neck, the resistance-case comprising a body-shell 20 formed at its bottom with a chamber 23, an outer support 26 and tubular passages 24 extending from said chamber to the exterior of said support.

9. An arc-lamp comprising a lamp-case A, and a resistance-case B above it, the lamp-case formed with a hood A′ terminating at its upper end in a neck, the resistance-case comprising a body-shell 20 formed at its bottom with a chamber 23, an outer support 26, and connecting portions comprising uprights 42 and a cap 36 fastened to said uprights.

10. An arc-lamp having an external fixed resistance arranged in a case exterior to the lamp-case, and having connected serially therewith an adjustable resistance within the lamp-case, and the latter constructed to open to give access to the latter resistance for adjusting it.

11. An arc-lamp for a constant-potential circuit, having its steadying resistance divided into two portions, the fixed portion arranged in an external resistance-case above the lamp-case, and an adjustable portion arranged within the lamp-case.

12. An arc-lamp for a constant-potential circuit, having a switch with fixed and movable conducting-segments, a terminal post connected to a movable segment, a fixed segment normally in contact therewith and connected through the carbons, magnet-coil, and steadying resistance, with the opposite terminal post, and a fixed segment adapted to be touched by said movable segment in the abnormal position of the switch, connected through the compensating resistance with said opposite post.

13. An arc-lamp for a constant-potential circuit, having a switch with two fixed and two movable conducting-segments, a terminal post connected to one movable segment, the fixed segment normally in contact therewith connected through the carbons, magnet-coil, and steadying resistance, with the opposite terminal post, the other movable segment and the other fixed segment normally in contact and connected to the automatic cut-out and through the compensating resistance, to said opposite post.

14. In an arc-lamp, a gas-cap for the arc-inclosing globe, comprising a fixed upper plate F, a ring G beneath it, and an interposed insulating-plate, said ring formed with a groove in its upper face extending at one end to its interior and at its other end to its exterior, and serving as a sinuous duct for affording communication between the interior and the exterior of said globe.

In witness whereof I have hereunto signed my name in the presence of two subscribing witnesses.

JAMES J. WOOD.

Witnesses:
F. S. HUNTING,
D. C. DAVIS.