J. C. LINCOLN.

ELECTRIC ARC LAMP.

APPLICATION FILED JAN. 31, 1905.

949,151. Patented Feb. 15, 1910.

2 SHEETS—SHEET 1.

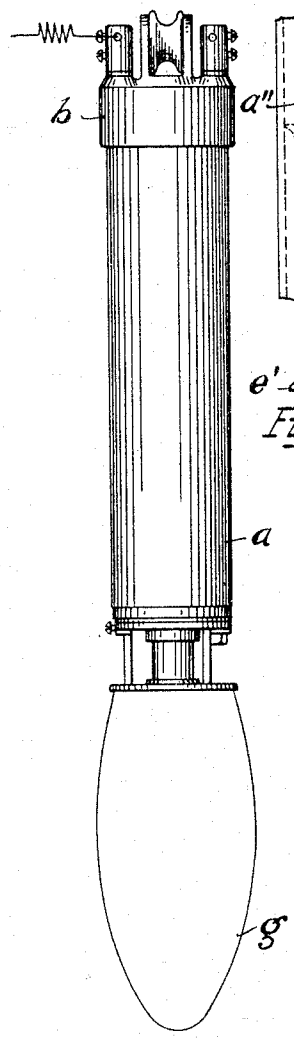

Fig. I.

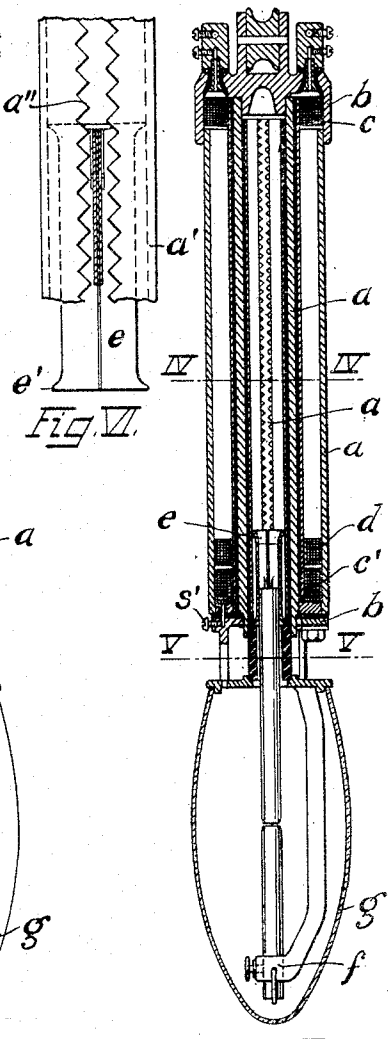

Fig. VI.

Fig. II.

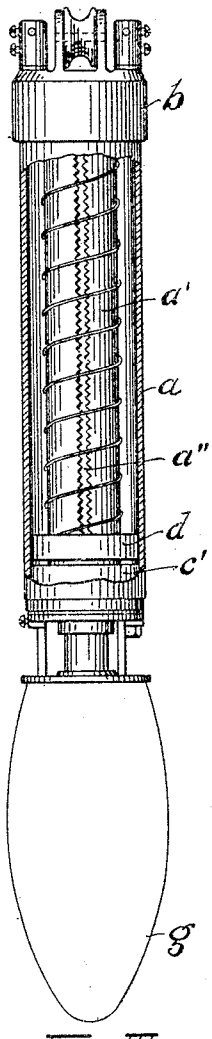

Fig. III.

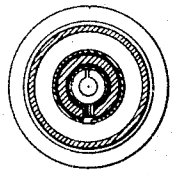

Fig. IV.

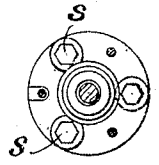

Fig. V.

Witnesses:

F. C. Valentine

Reuben Hitchcock

Inventor,
John C. Lincoln
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2 SHEETS—SHEET 2.

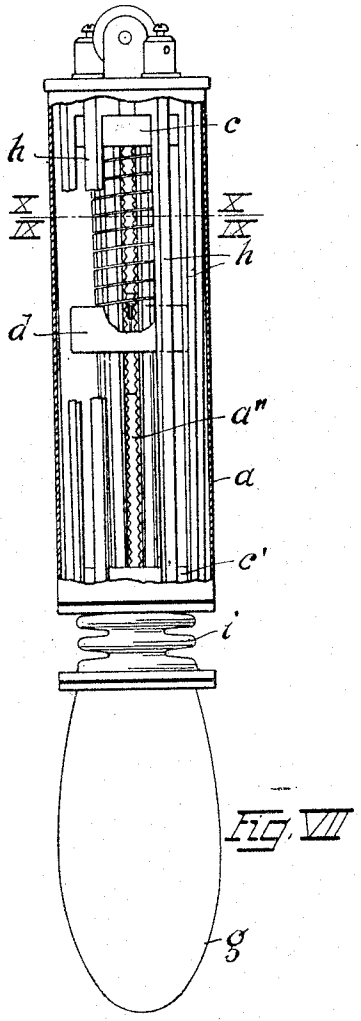

Fig. VII

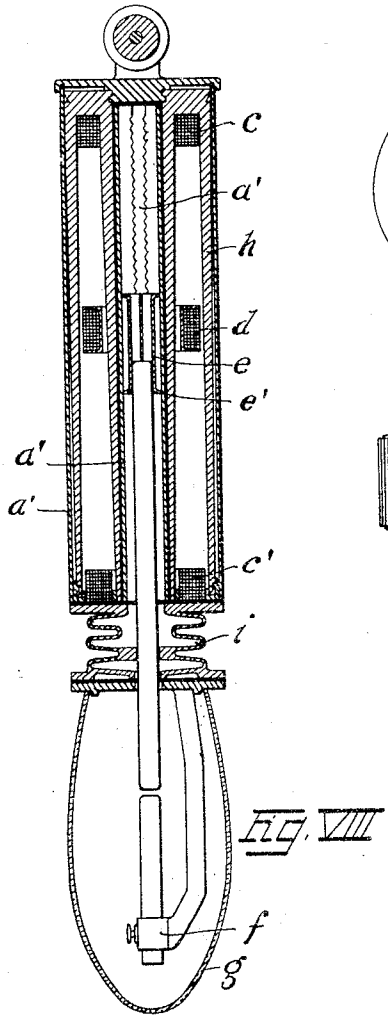

Fig. VIII

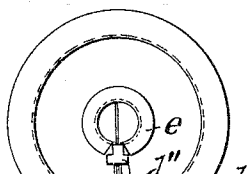

Fig. XI

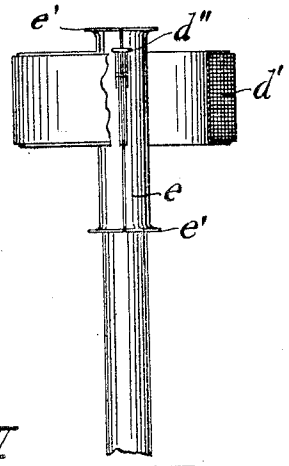

Fig. XII

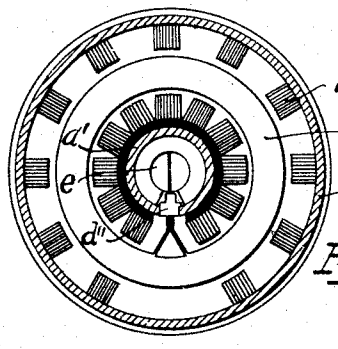

Fig. IX

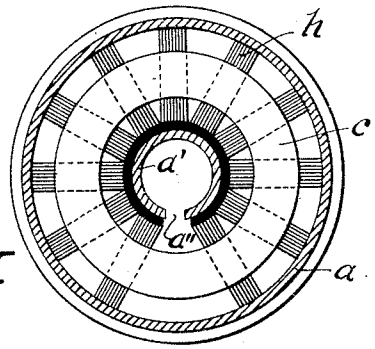

Fig. X

Witnesses:

F. C. Valentine

Reuben Hitchcock.

Inventor,

John C. Lincoln

by Albert G. Davis & Co.,

his attorney.

UNITED STATES PATENT OFFICE.

JOHN C. LINCOLN, OF CLEVELAND, OHIO, ASSIGNOR TO THE LINCOLN COMPANY, OF CLEVELAND, OHIO, A CORPORATION OF OHIO.

ELECTRIC-ARC LAMP.

949,151. Specification of Letters Patent. Patented Feb. 15, 1910.

Application filed January 31, 1905. Serial No. 243,470.

To all whom it may concern:

Be it known that I, JOHN C. LINCOLN, a citizen of the United States of America, and a resident of Cleveland, in the county of Cuyahoga and State of Ohio, have invented certain new and useful Improvements in Electric-Arc Lamps, of which the following is a specification.

My invention relates to improvements in electric arc lamps, and has for its object, the provision of a structure of extreme simplicity, and one highly advantageous in its operation. The said improvements herein described are applicable more particularly to lamps operated upon constant potential circuits, either alternating or direct, although many of the features to be explained are not limited to such application.

My improvements are explained in connection with a type of lamp, wherein the movable parts are reduced to a minimum, and directly supporting the adjustable carbon of the lamp; while the entire structure is simplified, and at the same time is proportioned to secure the most efficient operation in the continued use of said lamp.

Reference to the drawings depicting lamps embodying my improvements, will disclose the fact that an inclosing field-structure, either laminated or solid, and excited by stationary field windings, coöperates with the movable armature coil directly supporting the carbon-holder and carbon of the lamp. Therein a novel form of damping or checking device is preferably employed in lieu of the ordinary dash-pot; while the coils or windings inclosed within the magnetic body of the field structure, preferably are utilized for the inductive resistance required in satisfactorily operating such lamps upon constant potential alternating current circuits.

Further features and advantages of my improved construction, will become clear by making reference to the accompanying specification and drawings, wherein:—

Figure I., is a front elevation of a lamp embodying certain of my improvements. Fig. II., is a vertical section thereof. Fig. III., shows the lamp with the surrounding field-structure partially broken away. Figs. IV. and V., are the indicated cross sections upon the lamp of Fig. II. Fig. VI., is a detail of the checking or damping device. Fig. VII., is a view in elevation of a lamp, with the casing and laminated field-structure partially broken away. Fig. VIII., is a vertical section of a two-coil lamp of the laminated type. Figs. IX. and X., are transverse sections, as indicated upon the corresponding section lines in the drawings. Fig. XI., is a plan view; and, Fig. XII., is a view in elevation partially broken away, each showing the preferred armature and carbon-holder used in these lamps.

Throughout the several figures of the drawings, I have employed the same characters of reference to indicate similar parts.

Referring to the first sheet of drawings, it will be seen that the frame or casing of the lamp also comprises the inclosing tubular portion a of the field structure. This is surmounted or magnetically bridged by a cap b, at the top of the lamp, and by the annular part b', at the base of the casing. An inner slotted tube of iron a' forms the interior limb of the magnetic circuit; its thickness being greater in order to afford a magnetic body of sufficient cross section to accommodate the lines of force set up in the exterior casing a. Near the top and bottom of the field-structure thus formed, are provided the oppositely wound coils c, c', which serve to establish or excite the field. Within the annular space between the outer and inner limbs of said field-structure, is mounted the armature coil d, which is connected through the slot, with the tubular carbon-holder e, supported by and sliding within the inner tube a' of said field-structure. This armature, better shown in Figs. XI. and XII., preferably is formed of sheet aluminum, and is provided with insulated windings d' of aluminum wire comprising the armature coil. Extending within the serrated or sinuous slot a'', is the steel tooth or detent d'', which engages both walls of said slot. Its purpose will be readily understood when it is noted that in moving the armature and carbon-holder in either direction, the same must be slightly turned back and forth upon their axes under the influence of the slot and detent, while maintained in alinement with the containing-tube, by means of the engaging flanges e', at the top and bottom of the carbon-holder. This construction admirably subserves the purpose of a dash-pot, checking any tendency to sudden movement of the armature and carbon-holder in either upward or downward direction. Supported from

the bottom of the field-structure, are shown the lower carbon-holder *f*, and the arc-inclosing globe *g*.

In order to make the operative-parts of the lamp readily accessible, while retaining the greatest simplicity of construction, I have removably secured the casing *a* beneath and within the magnetic crown or cap *b*, by means of the screw-bolts *s* and the annular plate which they engage. By simply removing these and the screw *s'*, it is seen that the globe is released and the casing *a* may then be slipped down to gain access to the contained lamp-parts.

The lamps shown in the second sheet of drawings differ from the one already described, in providing a laminated field-structure much better adapted for alternating current work, and also setting forth the construction of such field, when simply two sets of windings or coils are used in the lamp, viz., stationary and movable coils. These coils or windings may either be mutually attractive or repellant, depending on the position of the field-coil.

I have set forth and claimed in my co-pending application, Serial Number 241,193, certain features hereof, but will explain the particular constructions shown in Figs. VII. to X. Therein the field-structures are built up of laminated punchings *h* of sheet iron, forming essentially two tubular limbs, between which the windings are disposed, as before. These are arranged in eleven groups about the central tube carrying the carbon-holder, and, by reason of their laminated construction, are of course free from eddy currents otherwise produced during the operation of the lamp.

In the lamp of Fig. VII., the magnetic circuit is completed by a bridge of iron, above and below; the lines of force generated by the two field coils *c*, *c'* thus readily finding closed paths. In the structure shown in Fig. VIII., however, it will be noticed that the punchings are formed with downwardly diverging inner walls, so that the magnetic gap between the two limbs, and between them and the inclosed annular armature gradually increases from top to bottom.

In my said application, I have described a lamp doing away with an exciting field coil, although obtaining substantially an equal pull or lifting effect upon the armature at all points within the field-structure, but herein I have secured practically the same effect with the use of a single field coil, and am thereby enabled to reduce the number of turns or windings upon the armature coil.

I have above referred to the fact that the armature preferably is of light construction, such as aluminum, and it will be appreciated by those skilled in the art, that the operation of the lamp is materially improved, by making the armature as light as possible within practical working limits.

In the lamps shown in Figs. VII. and VIII., the corrugated connecting-part *i* is provided between the field-structure and the arc globe; that in the lamp of Fig. VIII., necessarily being of non-magnetic material to insure a sufficient air gap between the limbs of the field-structure. By means of this part, the undesirable radiation and conduction of heat from the arc to the upper part of the lamp is largely obviated.

With the foregoing description in mind, the operation of my improved lamps will be readily comprehended. In the three-coil lamps, the two stationary coils being oppositely wound, and the series windings of the armature being similar to those of the upper coil, lines of magnetic force are set up in the field-structure, which tend to close or flow through the armature in its various positions of adjustment, and thus effect passage between the outer and inner limbs of the field-structure. Within this field thus established, said armature being serially connected with the arc, floats in the requisite positions of adjustment, and the pull or lifting effect is thereby caused to equal the weight of the armature, carbon-holder and suspended carbon. In the two-coil structure, the excitement of the field is materially contributed to by the armature coil acting in conjunction with the similarly wound upper coil, but by reason of the divergence of the two limbs of the field-structure, the pull or lifting effect is regulated, so that it is substantially equal at all points of adjustment: or, in other words, balances the weight of the armature and supported parts, as before. This explanation, I may say, is somewhat amplified in discussing the structure set forth in my said co-pending application, of which this is a modification in the respects pointed out. In each of the lamps of my improvements, the preferred type of damping device will check any tendency to sudden movement, which would lengthen or shorten the arc, by reason of the engagement of the detent with the closely embracing walls of the serrated or sinuous slot, thus steadying and regulating the upper carbon after the manner attained by the use of dash-pots.

Having now described improved lamps embodying my invention, I claim as new, and desire to secure by these Letters Patent, the following;—

1. In an electric arc lamp, the combination with the adjustable carbon-holder, of a checking or damping device, comprising a serrated slotted portion, and an engaging-part connected with the carbon-holder thereof, and adapted to move within said slotted portion, and partially check or damp the movement of said carbon-holder, substantially as set forth.

2. In an arc lamp, the combination with a relatively stationary part provided with a sinuous longitudinal slot, of an adjustable carbon-holder associated therewith, and an engaging tooth or detent approximately of the width of the slot, connected with said carbon-holder and laterally extending within said slot, whereby the movement of said carbon-holder is regulated, substantially as set forth.

3. In an electric arc lamp, the combination with a tubular part having a serrated or angular longitudinal slot therein, of an inclosed holder for the adjustable carbon guided thereby, and a tooth or detent connected with said carbon-holder and engaging with said slot, whereby the sudden movement of said carbon-holder is checked or regulated, and the arc thereby steadied, substantially as set forth.

4. In an arc lamp of the class described, the combination with an inclosing iron field-structure substantially equal in length to the stroke or travel of the adjustable carbon, of stationary windings associated therewith and normally exciting the same, movable or traveling windings forming an armature, and disposed within the field-structure, and a carbon-holder connected with and actuated by said armature, whereby the arc is adjusted; the said stationary and movable windings being in series relation with the arc, substantially as set forth.

5. In an arc lamp of the class described, the combination with an inclosing iron field-structure substantially equal in length to the stroke or travel of the adjustable carbon, of stationary windings associated therewith and normally exciting the same, movable or traveling windings forming an armature, and traveling substantially the length of the field-structure, and a carbon-holder connected with and wholly supported by the said armature, whereby the arc is adjusted; the said stationary and movable windings being in series relation with the arc, substantially as set forth.

6. In an electric arc lamp, the combination with an inclosing iron field-structure substantially equal in length to the stroke or travel of the adjustable carbon, of stationary exciting coils or windings respectively mounted near the ends thereof, a movable or traveling armature coil disposed therebetween, and a carbon-holder for the adjustable carbon of the lamp, connected with and actuated by said movable armature, substantially as set forth.

7. In an electric arc lamp, the combination with an inclosing iron field-structure substantially equal in length to the stroke or travel of the adjustable carbon, of stationary exciting coils or windings respectively mounted near the ends thereof, a movable or traveling armature coil disposed therebetween, and a carbon-holder mounted directly from and wholly supported by said armature; the same being adapted to receive and support the adjustable carbon of the lamp, substantially as set forth.

8. In a clutchless electric arc lamp, the combination with an iron field-structure of double tubular form, and having windings near the upper and lower extremities thereof, of an inclosed and inclosing armature coil mounted in position to be supported between the said field-windings, and between the walls of the double tubular field-structure, a carbon-holder connected with, and adjustably actuated by said armature, and means for damping or checking the movement of the said carbon-holder, substantially as set forth.

9. In an electric arc lamp, the combination with a stationary field-coil, and a movable armature-coil traveling substantially the length of the field-structure, the same being serially connected and similarly wound, of an inclosing iron field-structure, wherein the said coils are mounted; the said structure being proportioned to secure substantially an equal pull or lifting effect upon the armature throughout its path of movement, and a carbon-holder for the adjustable carbon of the lamp, connected with and actuated by the said movable armature, substantially as set forth.

10. In an electric arc lamp, the combination with a traveling armature equipped with series windings, of a carbon-holder for the adjustable carbon connected therewith, a coöperating iron field-structure and its stationary exciting windings also serially connected; substantially equal in length to the stroke of the adjustable carbon, and the same being proportioned to secure substantially a constant pull or lifting effect under conditions of constant current supply to the said windings, substantially as set forth.

Signed at Cleveland, this 30th day of January, 1905, in the presence of two subscribing witnesses.

JOHN C. LINCOLN.

Witnesses:
REUBEN HITCHCOCK,
ALBERT LYNN LAWRENCE.