No. 774,789. PATENTED NOV. 15, 1904.

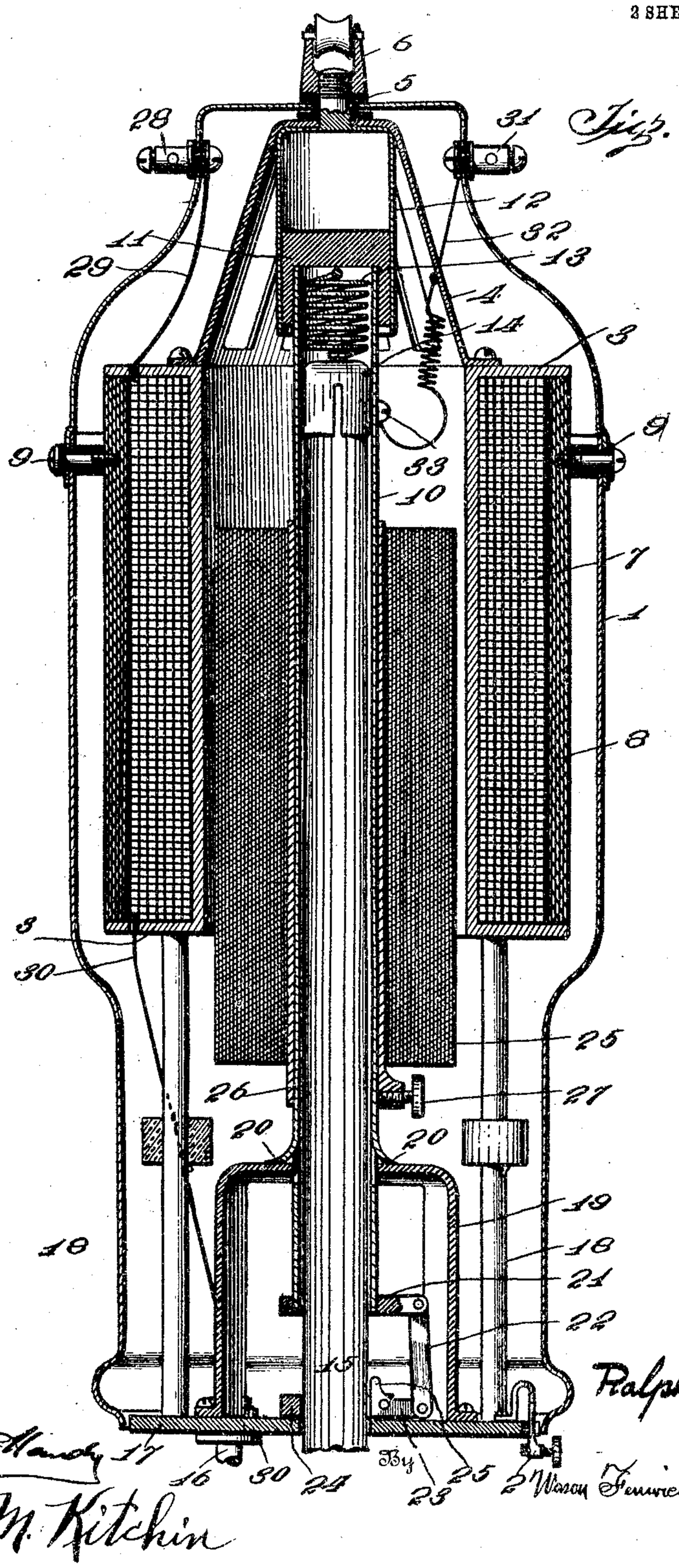
R. SCOTT.

ELECTRIC ARC LAMP.

APPLICATION FILED OCT. 14, 1903.

NO MODEL. 2 SHEETS—SHEET 1.

Fig. 1.



Witnesses

L. Linford Handy

Edgar M. Kitchin

Inventor

Ralph Scott.

By Wason Fennick & Lawrence.

Attorneys.

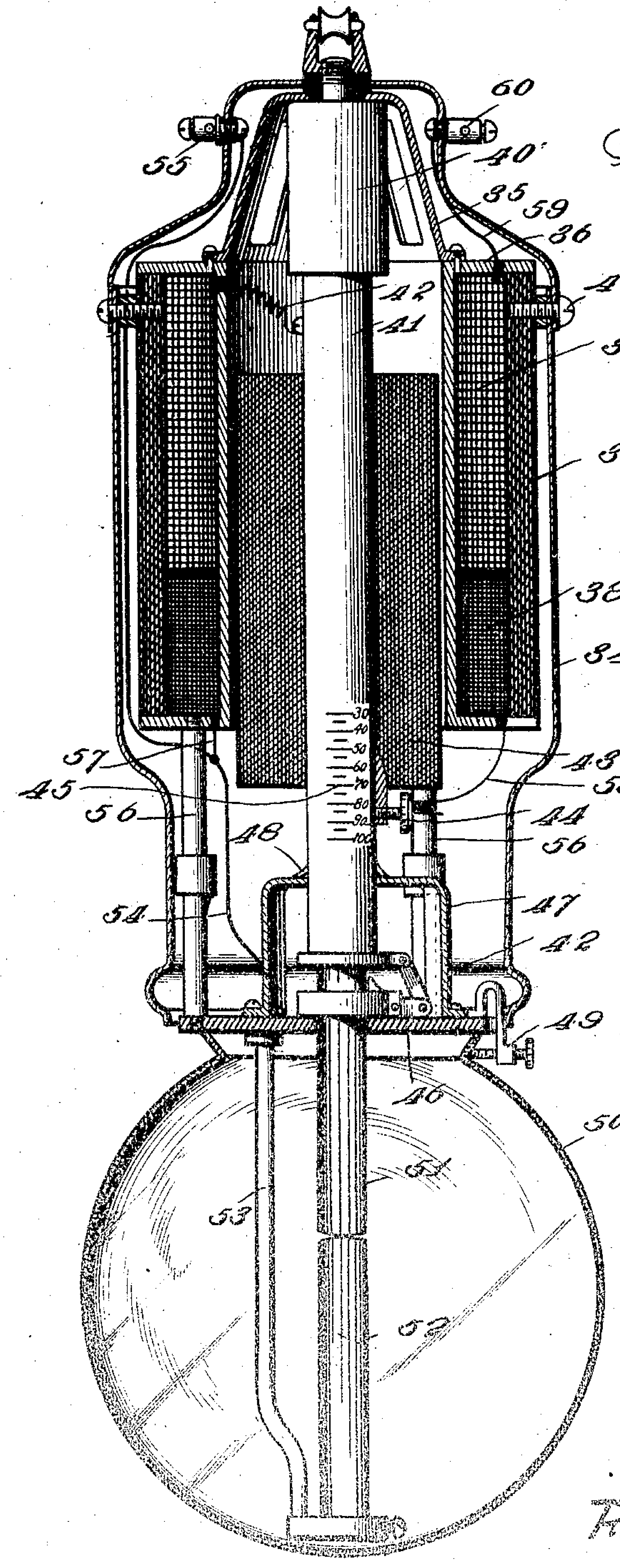
No. 774,789. PATENTED NOV. 15, 1904.

R. SCOTT.

ELECTRIC ARC LAMP.

APPLICATION FILED OCT. 14, 1903.

NO MODEL. 2 SHEETS—SHEET 2.



Witnesses,

L. Ensley Handy

Edgar M. Kitchin

Inventor,

Ralph Scott.

By Mason Fenwick and Lawrence,

Attorneys.

No 774,789. Patented November 15, 1904.

UNITED STATES PATENT OFFICE.

RALPH SCOTT, OF WILKESBARRE, PENNSYLVANIA, ASSIGNOR OF ONE-HALF TO MARCUS A. MILLER, OF NEW YORK, N. Y.

ELECTRIC-ARC LAMP.

SPECIFICATION forming part of Letters Patent No. 774,789, dated November 15, 1904.

Application filed October 14, 1903. Serial No. 177,012. (No model.)

To all whom it may concern:

Be it known that I, RALPH SCOTT, a citizen of the United States, residing at Wilkesbarre, in the county of Luzerne and State of Pennsylvania, have invented certain new and useful Improvements in Electric-Arc Lamps; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to improvements in inclosed arc-lamps, and particularly to that type known as "gravity-feed ring-clutch."

The object in view to be attained by the present invention is the securing of an even continuous arc and the prevention of sudden making and breaking of the arc, which, together with other objects, is accomplished by certain novel constructions, combinations, and arrangements of parts, which will hereinafter fully appear in the specification and be particularly pointed out in the claims.

In the accompanying drawings, Figure 1 represents a vertical longitudinal central section through an arc-lamp embodying the features of the present invention and adapted for multiple circuits. Fig. 2 represents a similar view of a slight modification of the same adapted for series circuits.

In the present art it is common to build lamps for use on circuits employing an alternating current of a standard frequency of sixty-six and other lamps especially adapted for a frequency of one hundred and thirty-two. Of course lamps may be constructed for any given frequency; but by the present invention I contemplate producing a lamp adapted for use in a circuit whose current may be of any frequency whatsoever, the parts of the lamp being adjusted for producing a maximum efficiency on any frequency of alternation of the current and for varying current consumption. Further, it has been observed that in the ordinary lamps now in use the carbon pencil is at times shaken loose from its clutch member and permitted to drop by reason of the fact that the moving system is subjected to constant vibration, owing to the reversing of polarity of the core of the solenoid. This I obviate by the improved clutch hereinafter fully described.

Referring to the drawings by numerals, 1 indicates any suitable casing inclosing the moving system and other elements comprising the present improved lamp, and any preferred form of catch 2 is provided for supporting an inclosing globe for the arc. (Not shown.) A spool 3 of fiber or other non-conducting material is supported within the casing 1 by an apertured cap 4, attached thereto at its lower end and at its upper end carried by a bolt 5, insulated from the frame 1, extending through the same and engaging any preferred form of lamp-supporting means 6, preferably of the ordinary type illustrated. A series coil 7 is wound upon spool 3 and is inclosed by a laminated soft-iron casing 8, whose permeability adds to the efficiency of the lamp, as will hereinafter appear. In forming the coil 7 I preferably attach the ends of the wire during the process of winding to a translating or generating device, also using indicating means in common use for determining the proper number of turns the coil should have to attain a maximum efficiency. A laminated solenoid-tube 8 is preferably supported by screws or other suitable supporting means 9, extending through the casing 1, insulated therefrom and threaded into said tube.

Vertically movable within said spool 3, and preferably arranged centrally of the same, is a carbon-containing tube 10, tightly fitting or incorporated at its upper end in a graphite plunger 11, moving within a cylinder 12, carried by bolt 5 within the cap 4, said plunger and cylinder forming a dash-pot for damping the movement of the tube 10. A conductor 13 is arranged within the tube 10 with one end grounded on the same and the other engaging a cap 14 of conducting material, said conductor being coiled or folded for permitting the cap 14 to move longitudinally of the tube 10, said cap 14 being of a size and shape adapted to snugly receive and retain by frictional contact a carbon pencil 15. Arranged vertically beneath the carbon 15 is a second carbon arranged in a manner illustrated in Fig. 2, but not shown in Fig. 1, the support-

ing-bracket 16 being arranged to carry said carbon and being insulated from the plate 17, positioned at the lower end of the casing 1, carried by standards 18, connected to the lower end of spool 3. An apertured or open housing 19 is fixed to the plate 17 and extends upwardly therefrom and is provided with an opening in its upper end for receiving the lower end of tube 10, the aperture in the upper end of the housing 19 being of a diameter equal approximately to the diameter of the tube 10, whereby said tube may be guided in its vertical movement.

The tube 10 is preferably provided at a comparatively short distance from its lower end with laterally-projecting lugs 20, usually stamped from the body of the tube 10 and adapted to engage the top of the housing 19 for limiting the downward movement of said tube. To the lower end of the tube 10 is fixed a collar 21, pivotally carrying a link 22, depending therefrom and pivotally engaging at its lower end a dog 23, pivoted to a ring 24, encircling the carbon 15, said dog being provided with a nose 25, adapted in operation to engage the carbon 15 on one side, while the opposite side of the carbon is engaged by the ring 24.

A core or plunger 25 surrounds the tube 10 within the spool 3 and is made up of layers of soft iron, so as to be readily affected by the flux from the coil 7 and yet be free from the liability of becoming heated by the eddy-currents generated by the reversal of polarity. The plunger 25 is preferably carried by a sleeve 26, surrounding the tube 10 and projecting below the lower end of the plunger 25. A set-screw 27 is threaded through the sleeve 26 and engages the tube 10 for locking the plunger in any adjusted position to said tube. It will thus be observed that when it is desired to alter the position of the plunger 25 relative to the coil 7 it is only necessary to loosen the set-screw 27, move the plunger 25 longitudinally of the tube 10, and clamp the same in the desired position by means of the set-screw.

A binding-post 28 is carried by the casing 1 and insulated therefrom and is connected with a conductor 29, which conductor in turn is connected with one end of the coil 7, the other end of said coil being connected with a conductor 30, leading to a binding-post 31[a], connected with the bracket 16, which bracket is formed of conductive material for supplying current to the lower carbon. A binding-post 31 is carried by and insulated from case 1 and carries a conductor 32, grounded, as at 33, onto the tube 10.

In operation the lamp disclosed in Fig. 1 of the drawings is usually arranged in multiple and supplied with an alternating current, the line-wires connecting with binding-posts 28 and 31, the circuit through the lamp being closed through the conductor 29, coil 7, conductor 30, bracket 16, the lower carbon, upper carbon 15, cap 14, conductor 13, tube 10, conductor 32, and binding-post 31. The plunger 25 is positioned on the tube 10 for a given frequency, and should for any reason the arc become too short the reduction in resistance would increase the flux of the coil 7 and lift the plunger 25, in turn lifting collar 21 and link 22 and pressing the nose 25 of dog 23 against carbon 15, tilting the ring 24 and lifting the carbon 15 by the clutch sufficiently for lengthening the arc to the desired extent. At this point it is to be observed that the solenoid-tube 8 reduces the reluctance of the path traveled by the flux of coil 7 and facilitates the lifting of the plunger 25 with a less number of windings than would be necessary should the said casing be omitted. Should the arc become too long from utilization of the carbons, the lack of current in coil 7 reducing the flux will release the plunger 25 and permit the clutch carried by tube 10 to release the carbon 15, which drops by gravity, said ring 24 and nose 25 releasing the carbon as soon as the tube 10 is dropped sufficiently for causing the dog 23 to come in contact with the plates 17.

The adjustability of the plunger 25 is of the utmost importance in this construction, as it adapts the lamp for use in connection with alternating currents of any frequency. Although the lamp may produce an arc when the plunger 25 is at any position upon the carbon-tube, yet the adjustability of the same enables the operator to secure a maximum efficiency when connecting the lamp to a given circuit. Of course the position of the plunger must be varied according to the frequency of the current supplied; but when once positioned for a given circuit supplied with a current of given frequency the same may remain without further adjustment unless it is desired to change the current used by the lamp. It will thus be seen that the necessity for different sizes and special constructions of lamps for currents of various frequency is obviated.

The elements disclosed in Fig. 2 correspond exactly with the structure shown in Fig. 1, with the exception of the addition of a shunt-coil, and I will therefore merely refer to the parts in order that their construction and arrangement may be understood. Within an inclosing casing 34 is arranged an apertured cap 35, supporting a non-conducting spool 36, carrying a series coil 37 and a shunt-coil 38, said coils being inclosed in a laminated soft-iron tube 39, supported by screws or bolts 40, extending through casing 34. A dash-pot 40′ is arranged within the cap 35 and has its plunger carried by the upper end of a carbon-tube 41, which tube is dampened in its movement by said dash-pot and limited against lateral play. A suitable conductor 42 is grounded on the tube 41 and connects the same with one

end of the coil 37. The lower end of the tube 41 is provided with a clutch mechanism 42 exactly like that disclosed in Fig. 1 and operating in a similar manner. Surrounding the tube 41 is a laminated plunger 43, forming the core of the compound solenoid formed by the windings just described. Said plunger 43 carries a set-screw 44, adapted to engage the tube 41 for locking the parts together. Upon the tube 41 I preferably apply in any manner desired a graduated scale 45, indicating the points at which the set-screw should be placed for obtaining the highest efficiency with the given number of alternations indicated upon said scale. Within the lower end of the casing 34 is arranged a plate 46, supporting a guiding frame or bracket 47, apertured for receiving the lower end of tube 41 and guiding the same, said tube being provided with lugs 48 for limiting the downward movement thereof. The plate 46 carries any suitable supporting-bracket 49, of yielding material, adapted to engage an inclosing globe 50, surrounding the carbons, and thus inclosing the arc. The clamping of the globe 50 in position by means of a springy or yielding bracket 49 permits of the escape of explosive gases which are sometimes generated in the globe of an arc-lamp. The carbon 51 is carried by tube 41, and the carbon 52 is carried by bracket 53, carried by and insulated from plate 46, a conductor 54 connecting said bracket with binding-post 55, carried by and insulated from casing 34. Suitable supports 56 56 rise from plate 46 and support spool 36. A conductor 57 leads from conductor 54 to and connects with one end of the coil 38, the other end of said coil connecting with a conductor 58, which latter conductor is grounded upon one of the standards 56. The end of coil 37 opposite that connected with conductor 42 is connected to conductor 59, leading to binding-post 60, said binding-post being insulated from casing 34. In operation current flowing through post 60 and conductor 58 passes through coil 37 and conductor 42 to the tube 41, thence to a carbon pencil 51 and through carbon 52, bracket 53, conductor 54, and binding-post 55, said binding-posts 55 and 60 connecting with the line-wires. When the circuit is closed, as described, the carbons being in contact will move apart to form the arc under the action of the magnetic flux of coil 37 upon the plunger 43, said plunger being retained at the proper distance for forming an arc of the desired length for producing a maximum efficiency relative to the frequency of the current supplied. If the lamp is to be applied on a circuit whose alternate current has a frequency of ninety, the set-screw 44 is positioned on the tube 41, as indicated in Fig. 2, and the lamp is in condition for use on that particular circuit. If it is desired to change the lamp to a different circuit of higher frequency, the screw is set lower upon the scale, or if the lamp is to be used in a circuit of lower frequency the set-screw is raised, whereby the plunger 43 may be secured at the proper point for being affected most advantageously by the flux of coil 37. The purpose of the shunt-coil 38 is to exert a differential action upon the plunger and maintain the arc continuously at its proper length. The phase relations of the currents of coil 38 and coil 37 are maintained at the proper point by the adjusting of the plunger 43, which result cannot be attained when using a fixed plunger.

It is very desirable that the caps 4 and 35 and the frames or brackets 19 and 47 be of an open construction to allow for a free circulation of the air within the casings 1 and 34.

It is well known in the art that with the ordinary arc-lamp when the circuit is suddenly broken the release of the arc-maintaining plunger by the drop in the flux of the helix permits the upper carbon to strike the lower carbon with a sharp blow, which reëstablishes the circuit with such suddenness as to cause the plunger to lift to a greater degree than is permissible for the amount of current supplied for a constant arc, and the result is such an increase in the resistance of the circuit as to materially lower the flux of the helix and permit the plunger to again drop, which lifting and dropping action is ordinarily termed "pumping," which may also result from the placing of too heavy a load upon a given circuit, the current supplied endeavoring to maintain all the lamps with their arcs intact when not sufficient current is supplied for overcoming the resistance of the circuit. I effectually overcome this objectionable pumping regardless of the cause by the use of the lateral projecting lugs 20, which are designed to engage the housing 19. The dash-pot at the upper end of the tube is of the common type and is usually employed to prevent pumping, but does not effectually avoid the same. I find that by the use of the lug 20 the drop of the plunger is prevented from producing too sudden a release of the clutch mechanism carried by the lower end of the tube, and the upper carbon is thereby prevented from feeding too rapidly down upon the lower carbon.

Having thus fully described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In an arc-lamp, the combination with a movable carbon-support, a carbon-pencil-engaging pawl carried thereby, a carbon-support beneath said movable carbon-support, and a plunger carried by said movable carbon-support, of a circuit for said carbon-supports, a coil surrounding said plunger, and means for limiting the downward movement of said movable carbon-support for limiting the degree of release of said clutch.

2. In an arc-lamp, the combination with a movably-mounted carbon-tube and a carbon-support beneath the same, of a plunger con-

nected to said tube, a circuit for said tube and carbon-support, a helix interposed in said circuit and surrounding said plunger, clutch mechanism carried by the lower end of said tube and adapted to be released by the downward movement of said tube, and means for limiting the downward movement of the tube.

3. In an arc-lamp, the combination with a movably-mounted tube and a carbon-support beneath the same, of a circuit for said tube and support, a helix in said circuit, a plunger connected to said tube and inclosed by said helix, clutch mechanism carried by said tube and adapted to be operated by longitudinal movement thereof, a lug extending from said tube, and means lying in the path of movement of said lug for limiting the longitudinal movement of the tube.

4. In an arc-lamp, the combination with a vertically-movable carbon-tube and a carbon-support beneath the same, of a circuit for said tube and support, a helix interposed in said circuit, a plunger connected with said tube within said helix, a lug projecting laterally from said tube, a housing inclosing the lower end of said tube and extending in the path of movement of said lug, and a clutch carried by said tube and adapted to be released by longitudinal movement thereof.

5. In an arc-lamp, the combination with a carbon-tube, means carried thereby for preventing movement of the carbon within said tube, said means being adapted to be released upon longitudinal movement of said carbon-tube, a carbon-support beneath said tube, a circuit for said support, means for maintaining an arc between the carbon of said support and the carbon of said tube, and means for limiting the longitudinal movement of said tube.

6. In an arc-lamp, the combination with a carbon-tube, a support beneath said tube, a circuit for said tube and support, and means for maintaining an arc between the carbons carried by said support and said tube, of means carried by said tube for retaining said carbon against longitudinal movement with respect to the tube adapted to be released upon longitudinal movement of the tube, and means for limiting the degree of release of said carbon-retaining means.

In testimony whereof I hereunto affix my signature in presence of two witnesses.

RALPH SCOTT.

Witnesses:
ALICE M. MEYNES,
CASSELL SEVERANCE.