No. 669,055. Patented Feb. 26, 1901.

M. H. BAKER.

ELECTRIC ARC LAMP.

(Application filed Sept. 5, 1899.)

(No Model.) 2 Sheets—Sheet 1.

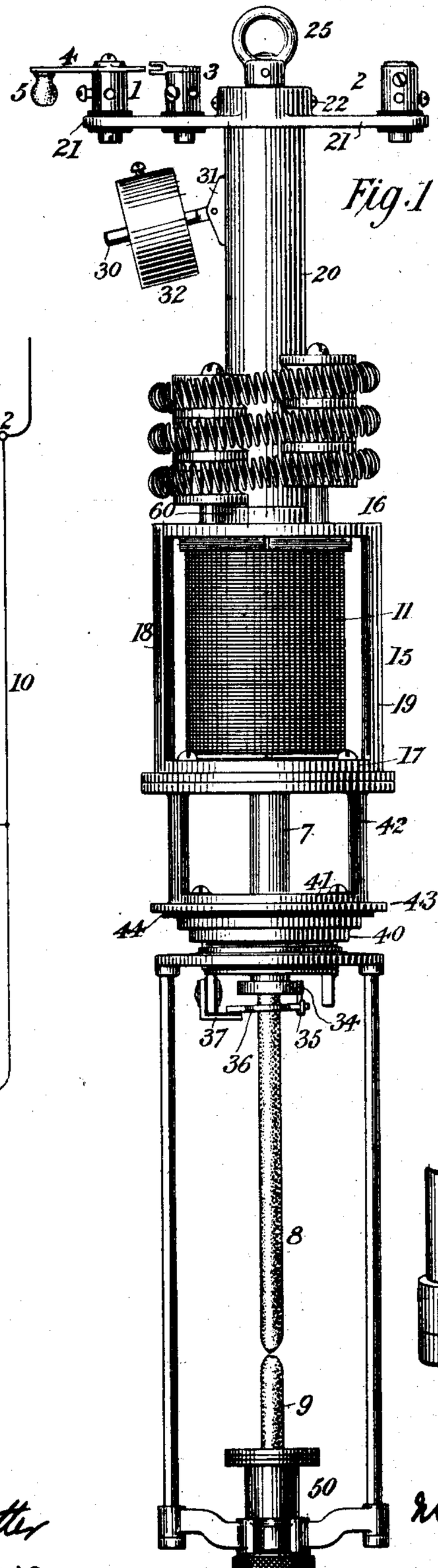

Fig. 1

Fig. 6

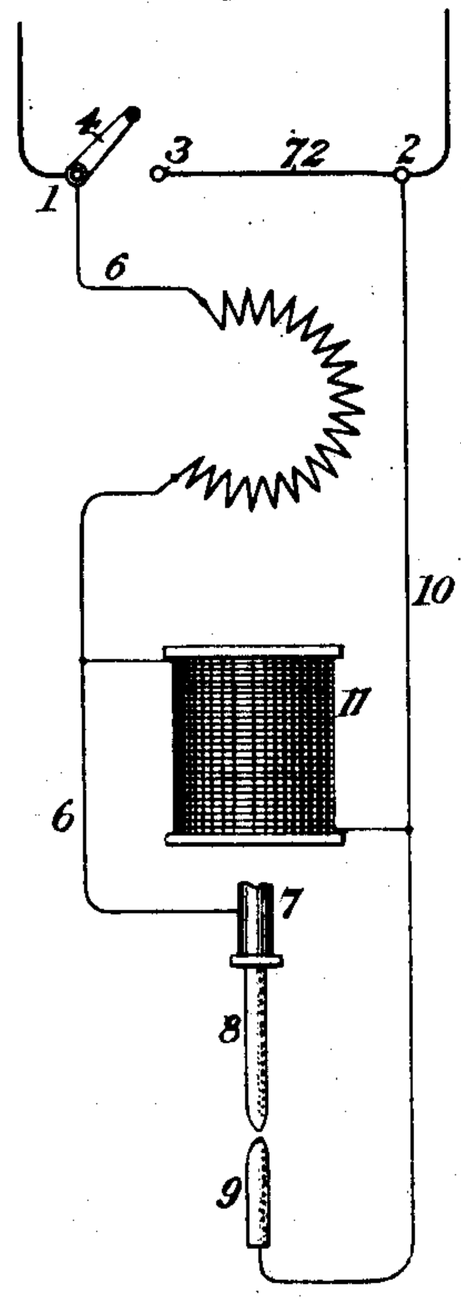

Fig. 7

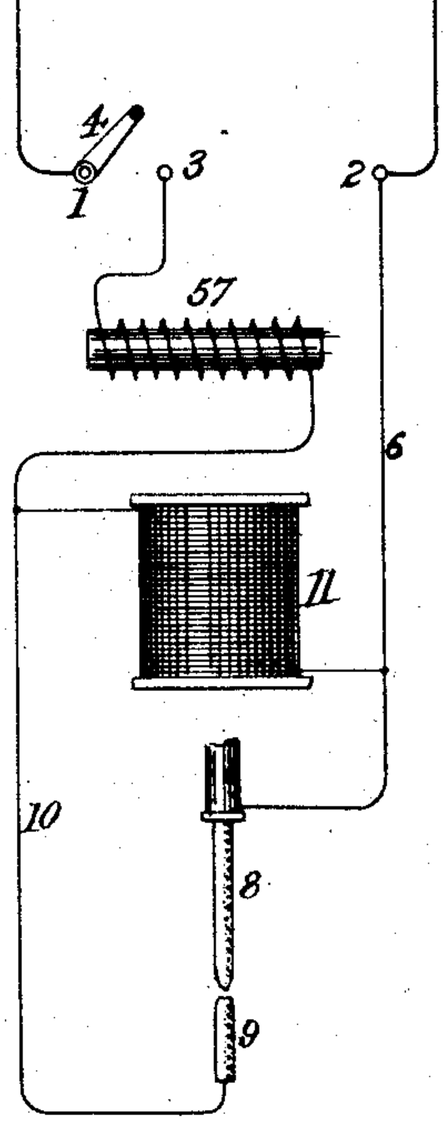

Fig. 5

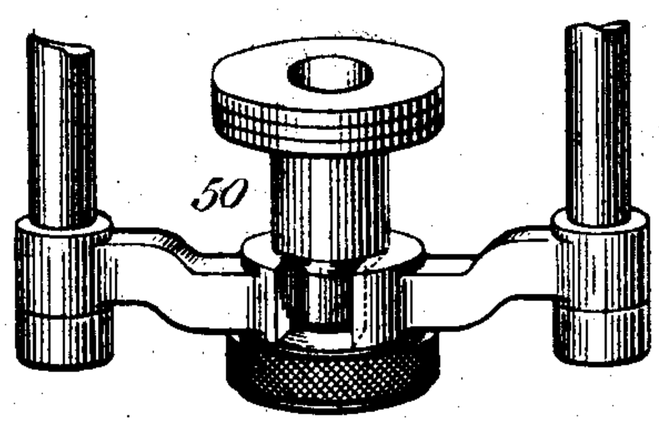

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Fig. 3

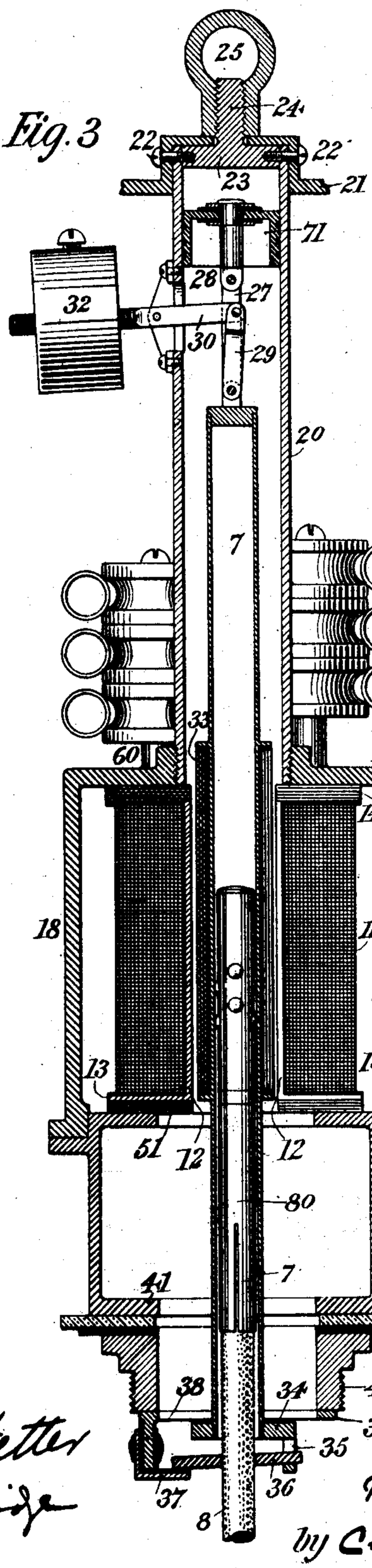


Fig. 2

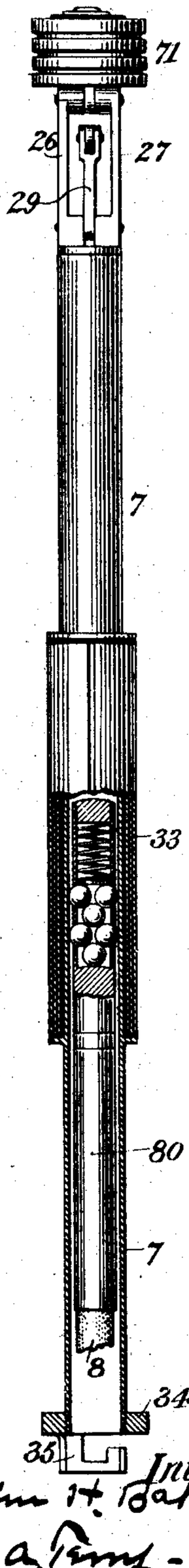
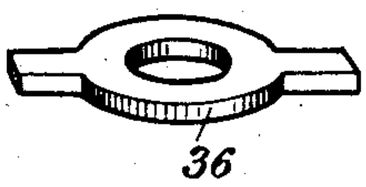


Fig. 4



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UNITED STATES PATENT OFFICE.

MALCOLM H. BAKER, OF NEW YORK, N. Y., ASSIGNOR TO THE MANHATTAN GENERAL CONSTRUCTION COMPANY, OF NEW YORK.

ELECTRIC-ARC LAMP.

SPECIFICATION forming part of Letters Patent No. 669,055, dated February 26, 1901.

Application filed September 5, 1899. Serial No. 729,440. (No model.)

To all whom it may concern:

Be it known that I, MALCOLM H. BAKER, a citizen of the United States, and a resident of New York, in the county of New York and State of New York, have invented certain new and useful Improvements in Central-Core Arc-Lamps, of which the following is a specification.

The subject of the present invention is an arc-lamp capable of being used upon either series or multiple circuits and of being operated by either direct or alternating currents. It has been impossible heretofore to construct a commercial arc-lamp for use on alternating-current circuits in which the solenoid-magnet and armature were concentric with the carbon and the carbon tube or rod of the lamp. It has been usual to employ a series winding on one or more magnet-spools and to arrange these at one side of the carbon tube or rod, whereby there has been considerable loss. In other words, no one has heretofore succeeded in constructing an alternating-current arc-lamp of the "concentric" type—that is to say, a lamp in which the solenoid and the carbon-carrying rod or tube have a common center. I have constructed such a lamp and I find that it is capable of perfectly successful use on alternating-current circuits as well as circuits operated by the direct current. When used upon alternating-current circuits, the lamp is free from noise or vibration, the working parts being controlled by the opposing action of a weight acting to draw the arc and a concentric solenoid in a shunt to the arc. There are no series windings employed in the lamp mechanism. For this reason and because, as stated, the working parts are controlled entirely by gravity and by a concentric magnet arranged as a shunt across the arc it follows that the operation of the lamp is virtually independent of the amount of current flowing through the main circuit, which includes the carbons. For this reason the lamp when used upon multiple alternating-current circuits may carry a small regulating-coil, as described farther on, which will maintain the current constant at any desired value, and thus cause the lamp to be independent of the voltage or the variations, as above described, or the lamp may carry a fixed reactance-coil, and the adjustment for varying voltages may be made by changing the number of turns in use on the shunt-coil until the desired amount of current flows in the main circuit. The adjustment of the arc-voltage is made entirely by altering the position of the counterweight, and after once being fixed it need not be altered. Owing to the structure of the lamp and the fact that the arc is drawn slowly by the action of the counterweight the starting of the lamp is always accomplished without any shock or jar or strain of any kind, whereby the life wear of the moving parts is considerably increased.

The main structural features of the lamp remain unchanged under all the conditions enumerated, except that the size of wire employed in the solenoid-magnet winding is varied and that a reactance-coil, resistance-coil, or a cut-out is introduced in the lamp-body according as the lamp is used upon multiple or series alternating-current or multiple or series direct-current circuits.

In adapting my lamp to the above-designated uses I have developed certain novel structural arrangements and devices which constitute improvements in a lamp of this kind, and it is upon these structural arrangements and devices that I rely mostly for producing the results at which I have aimed.

One of the peculiarities of the arrangements referred to is that of normally withholding the upper carbon from contact with the lower through the action of a counterbalancing-weight and of establishing the arc by first drawing down the upper carbon by means of the concentric magnet, whereupon the counterweight draws up the carbon as soon as the current passes through the main lamp-circuit, including the carbons, and thus lowers the voltage across the concentric-magnet terminals. To make this arrangement effective, I rigidly attach to the carbon-holding tube a sleeve consisting of several layers of thin iron, which constitutes the core of the concentric magnet and is drawn down by the latter at starting, whereby contact is established between the carbons. Thereupon the weight

or counterbalance assumes control of the carbon-carrying tube and withdraws the set tube and carbons until a balance is established between the downward pull of the solenoid and the upward pull of the weight.

By the employment of the lamp structure above described I do away with all springs and with practically all vibrations of the lamp mechanism. Inasmuch as the arc-voltage is maintained constant the life of the carbons is practically constant.

In order that the details of my invention may be fully understood, I have illustrated the same in the accompanying drawings, in which—

Figure 1 is a side elevation of one of my improved arc-lamps. Fig. 2 is a similar view of the carbon-carrying tube detached, the lower part of the said tube being shown in section. Fig. 3 is a central vertical section of the upper portion of the lamp-frame, showing the lamp-clutch in place. Fig. 4 is a detail view of the detachable clutch which I employ in connection with my lamp. Fig. 5 is a perspective of the lower part of the frame for holding the lower carbon. Fig. 6 is a diagram of the circuits of my lamp as adapted for series lighting, and Fig. 7 is a diagram of the circuits of my lamp as adapted for multiple work.

In the drawings, 1 and 2 are, respectively, the binding-posts for the incoming and outgoing circuits of my arc-lamp.

At 3 I show a third binding-post, which is capable of being electrically joined to the binding-post 1 in the usual manner for cutting the lamp into and out of the main circuit by means of a switch-arm 4, operated by a handle 5. In a series lamp the main circuit passes from the binding-post 1, along the wire 6, carbon-carrying tube 7, upper and lower carbons 8 and 9, and the wire 10 to the binding-post 2. A shunt-circuit extends across from the wire 6 to the wire 10 through a concentric solenoid-coil 11. The said solenoid 11 is supported on the outside of a tube 12, which surrounds the carbon-carrying tube 7. The said tube 12 is a split tube of brass secured at one end to a split disk or plate 13, of similar material, and at the other to a split laminated head 14, of iron, the said disk 13 and head 14 constituting the ends or heads between which the solenoid-coil is wound. The solenoid thus constituted is set into a frame 15, of iron, consisting of the heads 16 and 17, supported and held in a fixed position with relation to each other by means of arms or posts 18 and 19. These arms or posts may be formed in one piece with the heads 16 and 17 or they may be joined thereto by any suitable means. It should be noted that iron washers 81 are placed on the lower end of the solenoid, so that the solenoid-core, these heads, the iron lamp-body, and the upper laminated iron head of the solenoid constitute very nearly a closed magnetic circuit. The head 16 is provided at the top with a screw-threaded boss 60 for receiving the lower screw-threaded end of a metallic tube 20, which when secured in place within the said boss constitutes, practically, an extension of the tube 12, surrounding the carbon-carrying tube. On the top of the tube 20 a cross-arm 21, which carries the binding-posts 1, 2, and 3, is secured by any suitable means. I show the said cross-arm as being formed into a cap at its center and fitted over the upper end of the tube 20 and as being held in place by set-screws 22 22. Any other suitable device for securing the cross-piece to the tube may be employed. In the upper end of the tube 20 is firmly secured a plate or disk 23, closing the said end and carrying a screw-threaded rod 24, which receives a screw-eye 25 for suspending the entire lamp structure.

The carbon-carrying tube 7 is supported within the tubes 12 and 20, being so suspended in the said tubes as to have free longitudinal movement therein when the conditions are suitable. A separate view of the said carbon-carrying tube appears in Fig. 2. It will be seen that the upper end of the said structure is formed into a pair of arms 26 27, between which the plunger 71 of a piston 28 is swiveled. The said piston acts, as is well understood, as a dash-pot device, in connection with the closed upper end of the tube 20, to prevent too-sudden movements of the carbon-carrying tube. Between the opposite ends of the arms 26 27 is pivoted a tongue 29, which is itself formed into a yoke at its free end and has pivoted to it a link 30. The said link 30 extends outward through an opening in the tube 20 and is pivoted centrally to lugs 31 31 on the outside thereof. On the outer end of the link 30 a screw-thread is formed and by means of this formation a screw-threaded weight or counterbalance 32 is capable of adjustment on the said link. Thus the weight 32 acts to hold the carbon-carrying tube 7 in a raised position within the tubes 12 and 20 unless the power of the said weight is resisted by some other force. This force is provided by the solenoid 11, and in order to give effect to this force I provide a ring or sleeve 33, of iron, surrounding the carbon-carrying tube 7 and normally located above the center of the solen 11, so that when the said solenoid is energized by the passage of an electric current the magnetic pull will tend to draw the tube 7 downward against the force of the weight 32. Accordingly when the lamp is in action the position of the carbon-carrying tube, and consequently of the upper carbon, is determined by the balance between the power of the weight 32 and the magnetic pull of the solenoid 11.

The connections at the upper end of the carbon-carrying tube 7, as between the said tube and the dash-pot piston and also as between the said tube and the external weight

32, are such as to give great freedom and flexibility to the reciprocating movements of the said tube. The effect of the weight 32 can be varied by adjusting the position of the said weight upon the link 30. This capacity of my lamps for quick and easy adjustment in respect to current or arc voltage without removing the case from the lamp will be found of advantage in the case where it is desirable that a given lamp or lamps should supply more light than others owing to the position which the said lamp or lamps occupy.

On the lower end of the carbon-tube 7 is supported a ring 34, of any suitable metal, and on the bottom of the said ring is formed an angular arm 35, constituting a bayonet connection for detachably supporting a clutch 36. The said clutch is illustrated in detail in Fig. 4. The central portion of the clutch is in the form of a ring adapted to surround the carbon, with just enough intervening space so that the ring will not bind upon the said carbon when the clutch and the carbon are in planes at right angles to each other. When, however, the clutch is tilted with relation to the carbon, it binds upon the latter and either holds it in a fixed position or in case of a movement of the clutch carries the carbon with it. It will be seen that the clutch is provided with projecting arms on opposite sides of the central ring and that one of the said arms is adapted to enter the opening formed by the bending of the depending arm 35, while the other arm of the clutch is adapted to rest upon a ledge formed by a bent arm 37, attached to the rigid or fixed part of the lamp. The said bent arm 37 is secured to but insulated from an arm 38, depending from a metallic ring 39 on the lower end of the upper lamp-frame. The said ring is secured by screws to a screw-threaded T-shaped piece of metal 40, which in turn is secured by screw-bolts to a disk 41, of iron, constituting the lower end of a frame 42. The last-named frame is secured by screw-bolts to the head 17, as shown, and the described parts unite to form the lower end of the main lamp structure. Between the disk 41 and the T-shaped piece 40 is a disk 43, of metal, and a plate 44, of insulating material, is also inserted between the said parts.

The circuit of the lamp being closed, current passes through the solenoid 11, draws down the carbon-carrying tube, and establishes the main circuit by bringing the carbons into contact. Current is thus diverted from the solenoid-circuit, and the power of the solenoid is thereby weakened. Accordingly the weight 32 again lifts the upper carbon, thereby establishing the arc. In the process of pulling down the carbon-carrying tube the latter carries the clutch 36 into a horizontal position, after which there is no resistance to the sliding of the carbon by gravity within the clutch until contact is made, as described. On the surrender of the carbon-carrying apparatus into the power of the weight 32 the bent arm 35 lifts one end of the clutch and causes the latter to bind upon the carbon and raise it. Thus the clutch, although a separate and detachable part of the apparatus, is positive in its action upon the carbon when the latter is moved for establishing the arc. At other times, except when it has been carried to a position at right angles to the carbon, it assists gravity in moving the carbon downward against the force of the weight 32.

The described construction furnishes an excellent counterbalance for the moving parts of an arc-lamp, relieving all shock, strain, or jar, and is calculated to maintain the arc at a uniform length under all conditions of the circuit.

When it becomes necessary to trim the lamp, the trimmer needs only to lift the clutch out of the bayonet-joint and slip it off with the carbon, replacing both the clutch and the new carbon by reversing the process.

It should be stated that the upper carbon is secured within a split tube 80, forming part of the usual carbon-rod, and that the latter, as shown in Fig. 2, is held in position within the carbon-carrying tube in the usual manner by means of spring-pressed bearings impinging against the inside of the said tube.

The part 50 represents the frame which carries the lower carbon. This frame forms no part of my present invention and is simply illustrated in order to show a complete lamp.

In Fig. 7 I have illustrated the arrangement of circuits for a series lamp and in Fig. 8 the arrangement of circuits for a multiple-arc lamp. In the last-named lamp I employ a reactance-coil or a resistance 57, and I place it in the lamp-circuit, as shown, before leading off the solenoid-circuit. In a series lamp constructed in accordance with my invention the binding-posts 2 and 3 are permanently connected by a wire 72, and when the lamp is in operation the switch-lamp 4 is disconnected from the binding-post 2. The operation of cutting out the lamp consists in moving the said switch-arm into connection with the said binding-post. On the other hand, in a lamp adapted for use on multiple-arc circuits the binding-posts 2 and 3 do not have any connection except through the various lamp-circuits. The inleading wire or main is connected to the binding-post 1, and the lamp-wire 6 is joined to the binding-post 2, so that in order to put the lamp into operation it is necessary to move the switch-arm 4, so as to make electrical connection between the binding-posts 1 and 2. The lamp is switched out of the circuit by moving the said switch-arm away from the said binding-post.

I claim as my invention—

1. In an arc-lamp, a carbon-carrier, and a tube surrounding the same, a weight or counterbalance for the said carrier external to the said tube, and a pivoted arm or link joining

the said weight and carbon-carrier, the said weight or counterbalance being adjustable on the said arm or link.

2. In an arc-lamp, a carbon-carrier and a tube surrounding the same, a weight or counterbalance for the said carrier external to the said tube, and a pivoted arm or link joining the said weight and carbon-carrier.

Signed at New York, in the county of New York and State of New York, this 7th day of August, A. D. 1899.

MALCOLM H. BAKER.

Witnesses:
WM. H. CAPEL,
G. H. STOCKBRIDGE.