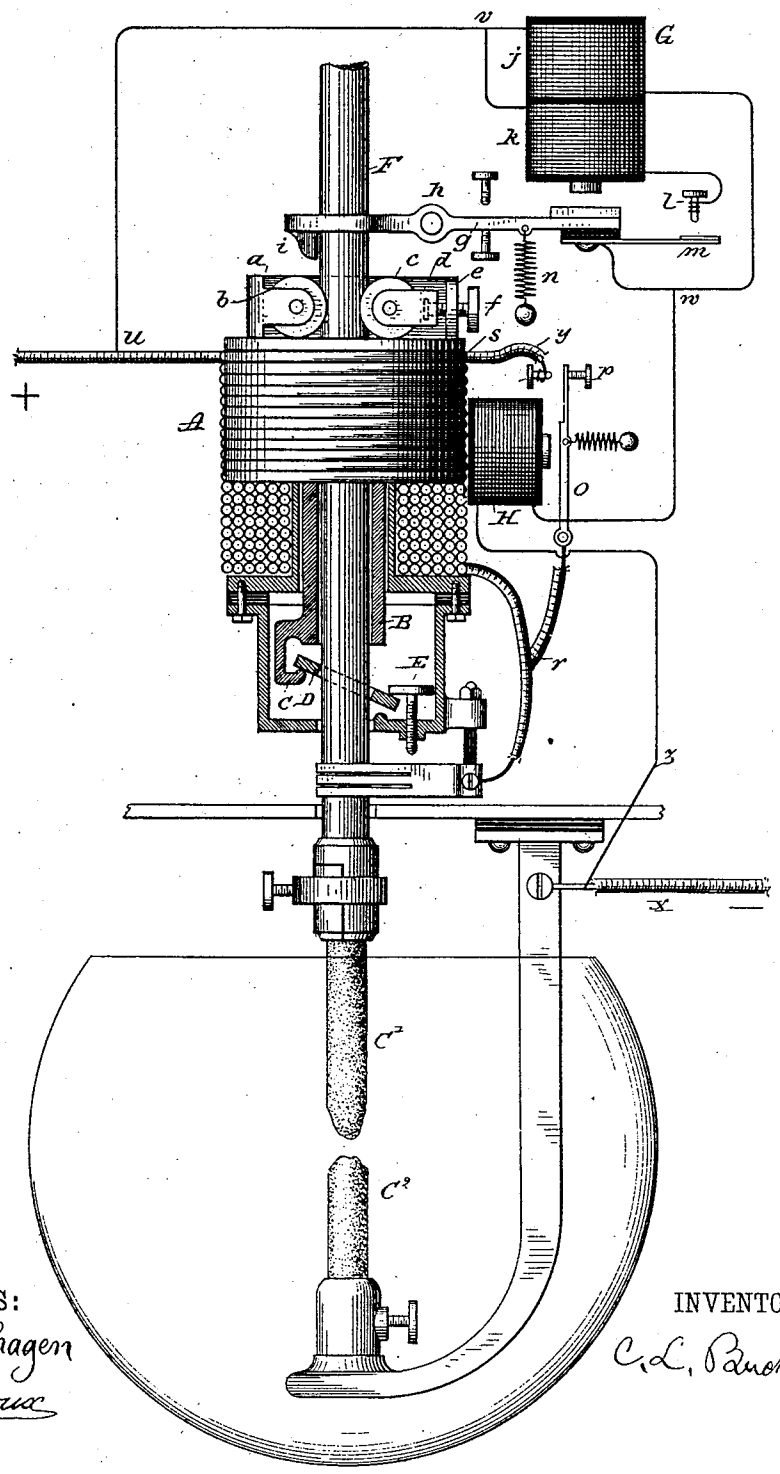
(No Model.)

C. L. BUCKINGHAM.

ELECTRIC ARC LAMP.

No. 320,841. Patented June 23, 1885.



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ELECTRIC-ARC LAMP.

SPECIFICATION forming part of Letters Patent No. 320,841, dated June 23, 1885.

Application filed August 26, 1884. (No model.)

To all whom it may concern:

Be it known that I, CHARLES L. BUCKINGHAM, of the city, county, and State of New York, a citizen of the United States of America, have made a new and useful Improvement in Electric-Arc Lamps, of which the following is a specification.

My invention is an improvement in that class of lamps in which, first, an electro-magnet in the arc-branch primarily separates the carbons to establish an arc, and then causes the lifting-clutch to release the carbon-holder, leaving it suspended by a second and independent support; second, the feeding of the carbons is controlled by a second and shunt-branch electro-magnet. In lamps of this particular class, as well as those in general in which the arc is established by an arc-branch electro-magnet, it often occurs that, while the current is flowing in full strength through said electro-magnet, the carbon-holder slips through its lifting-clutch, thus permitting the carbons to come together while the lifting-clutch is in its extreme upward position. It is obvious that it is then incapacitated from lifting the carbon-holder to re-establish the arc. To re-establish the arc it would be necessary either for an attendant to go to the lamp and manually separate the carbon points, or else that the current on the line be temporarily suspended, thereby permitting the clutch to fall to its lowest position. The clutch when in its lowest position is assumed to be capable of establishing an arc upon a resumption of current.

The object of my invention is to enable an arc to be instantaneously re-established at any time, in the event of an accidental slipping together of the carbon points, while a current of full strength is flowing over the arc-branch. To this end I employ a shunt of low resistance around the arc-branch electro-magnet, and said shunt is opened and closed through the agency of an electro-magnet which is included in the fine-wire shunt-branch. This shunt-branch electro-magnet is adapted to attract its armature at the moment an arc of normal length is established, and long before the electro-magnet in the same shunt-branch is actuated to feed the carbons together. With such an arrangement it is to be observed that the current passing through the arc-branch electro-magnet primarily separates the carbon points and establishes an arc; that at the moment the arc is established enough current will flow through the fine-wire shunt to cause one of its electro-magnets to close a short circuit around the arc-branch electro-magnet, thereby depriving said arc-branch electro-magnet of enough current to retain the lifting-clutch in a position of suspension; that upon the short-circuiting of the arc-branch electro-magnet the lifting-clutch is released and falls to its lowest position, ready to again grasp and raise the carbon-holder upon the breaking of the short circuit around the arc. While a normal current is flowing through the arc-branch, enough current, at the same time, is flowing through the fine-wire shunt to cause the electro-magnet therein, above mentioned, to retain the shunt around the arc-branch electro-magnet closed; but in the event of the slipping together of the carbon points the arc-branch resistance is greatly reduced, and the current upon the high-resistance shunt-branch is so far reduced as to permit the shunt-branch electro-magnet to break the short circuit of the arc-branch electro-magnet, thereby causing a strong current to again flow through the latter electro-magnet and to re-establish the arc.

In my lamp the carbon-holder is held between rollers whose pressure is so adjusted that, when uninfluenced by either the lifting or feeding electro-magnet, said carbon-holder will be stationarily suspended between the rollers or any suitable friction-support.

To establish an arc between the carbons, the arc-branch electro-magnet is capable of lifting a carbon-holder against the action of the pressure-rollers or friction-supports, and likewise to effect a feed. The influence of the lifting-magnet having first been removed, the feeding electro-magnet is capable of forcing the carbon-holder in an opposite and downward direction against the action of the pressure-rollers or friction-support.

I will now describe my invention by reference to the accompanying drawing.

F is a carbon-holder, which is raised to po-

sition to establish an arc between C' C'' by means of a ring-clamp, D, or other suitable clutch. The carbon-holder is tightly pressed between rollers *b c*, respectively journaled in supports *a d*, the latter of which is adjustable by means of stationary block *e* and set-screw *f*. When otherwise unsustained, said carbon-holder will be stationarily supported by said rollers against the action of gravity.

When the carbons are in contact, as they normally are, an arc is established by a main-line current first passing through the coils of the arc-branch electro-magnet A, whereby the hollow axial armature B is raised, and its lifting-toe C lifts one side of the ring-clutch until it clutches and raises the carbon-holder, and until the opposite side of the ring is arrested by an adjustable stop, E. The main-line current is divided at point *u* over two branches—one including electro-magnet A and the light-giving carbons, the other a high-resistance shunt, *z*, around the arc, which embraces feeding electro-magnet G and short-circuiting electro-magnet H—and reunites with the main circuit at *x*. When, now, a current is first sent to line, the arc is immediately established, and, when of a normal length, enough current is diverted to the shunt-branch to cause electro-magnet H to attract its armature *o* from its back contact, *p*, to its front contact, *y*, thereby closing a short circuit which begins and terminates at *s* and *r* of the arc-branch around the coils of A. When armature *o* is thus attracted, nearly the entire current of the arc-branch is diverted from the coils of A, and armature B and the ring-clutch at once fall to their lowest position, thereby releasing the lifting-clutch from the carbon-holder and leaving it supported, with the arc intact, wholly through the agency of clamping-rollers *b c*. Armature *o* will remain attracted and the coils of A short-circuited as long as the arc resistance continues normally great. If, however, by an overfeed or through other accident the carbons should be brought so close together as to greatly diminish the arc-resistance, nearly the entire current of the shunt-branch would be diverted, and thereby electro-magnet H would release its armature *o*, thus breaking the short circuit of A. The breaking of said short circuit will again result in a strong current in the coils of A, and the lifting-clutch will again be brought into operation and the carbon-holder lifted until the arc has attained its normal length.

Although clamping-rollers *b c* are adequate to support the carbon-holder against the action of gravity, the carbon-holder is readily given an upward movement by means of the lifting-magnet A, and a downward movement by means of a positive feeding apparatus. The feeding of a carbon-holder is effected through a differential electro-magnet, G, having two oppositely-wound coils, *j* and *k*, the first of which is normally closed, while the latter is normally open between anvil *l* and circuit-closing arm *m*, which is attached to armature-lever *g*. The two branches begin and terminate at *v* and *w*. When only a normal arc-resistance exists, not enough current is flowing in the shunt to cause G, through coil *j*, to attract its armature, and in that case the armature-lever *g*, pivoted at *h*, is held in a retracted position by spring *n*, and the clamping-toe *i* is in its extreme upward position, and is not in contact with the carbon-holder. If, however, owing to the consumption of the carbons, or for any other reason, the arc-resistance should become abnormally high, the current in coil *j* of G will attract its armature, and *i* will clutch the carbon-holder and thrust it downward a small fraction of an inch, and until *m* and *l* come in contact. When *m* and *l* make contact, a current is set up in *k*, and the effects of the two equal coils become neutral and the armature is retracted. After being retracted, if enough current remain in the shunt-branch to again attract the armature of G, of course the carbon-holder will be fed a second step, and the step-by-step feeding will continue until an ample feed of the carbons has occurred.

At all times when enough current is flowing in the shunt to actuate the feeding devices, armature *o* will remain attracted and A short-circuited; but *o* will also be attracted and A short-circuited long before the feeding devices will be operated. Although *o* should be attracted by a weak current in the shunt, it should not be attracted before an arc is established. To render the movement of *o* slow, a dash-pot, or any well-known form of retarding device, may be employed.

What I claim, and desire to secure by Letters Patent, is—

1. In an electric lamp, the combination of a lifting electro-magnet for establishing an arc, a clamping apparatus for supporting the carbon against the action of gravity which is independent of the lifting and feeding apparatus, and a second electro-magnet and feeding apparatus which are independent of the lifting and supporting devices.

2. In an electric lamp, the combination of an arc-branch electro-magnet, a shunt-branch electro-magnet which is called into action when the normal arc is established, and a clutch for establishing the arc through the agency of the arc-branch electro-magnet, which clutch is unlocked from the carbon-holder and returned to its normal position under the control of the shunt electro-magnet, and which remains in readiness to re-establish the arc in case of an overfeeding of the carbon-holder.

3. In an electric lamp, the combination of a clutch and mechanism for causing the clutch to first lift the carbon apparatus, to then cause the clutch to release the carbon, and to imme-

diately return said clutch to a position to again lift said carbon upon an abnormal diminution of arc-resistance.

4. In an electric-lamp, the combination of a lifting electro-magnet and a clutch, a short circuit for said lifting electro-magnet, and a shunt electro-magnet for opening and closing said short-circuit, whereby the clutch is adapted to lift and release the carbon and to be returned to its original position upon the establishment of a normal arc.

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