(No Model.)

J. E. GILES.

ELECTRIC ARC LAMP.

No. 442,617. Patented Dec. 16, 1890.

Fig. 1

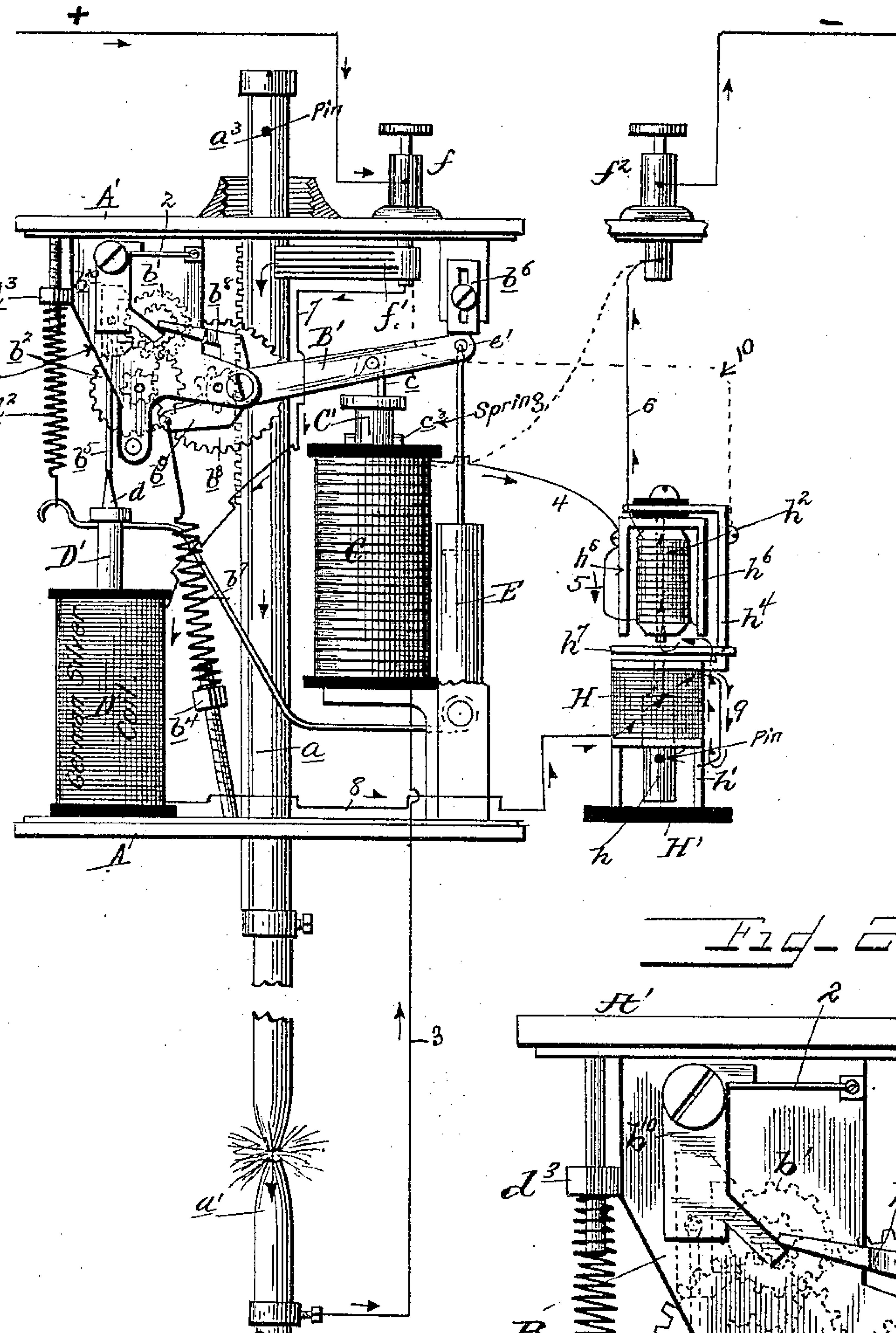
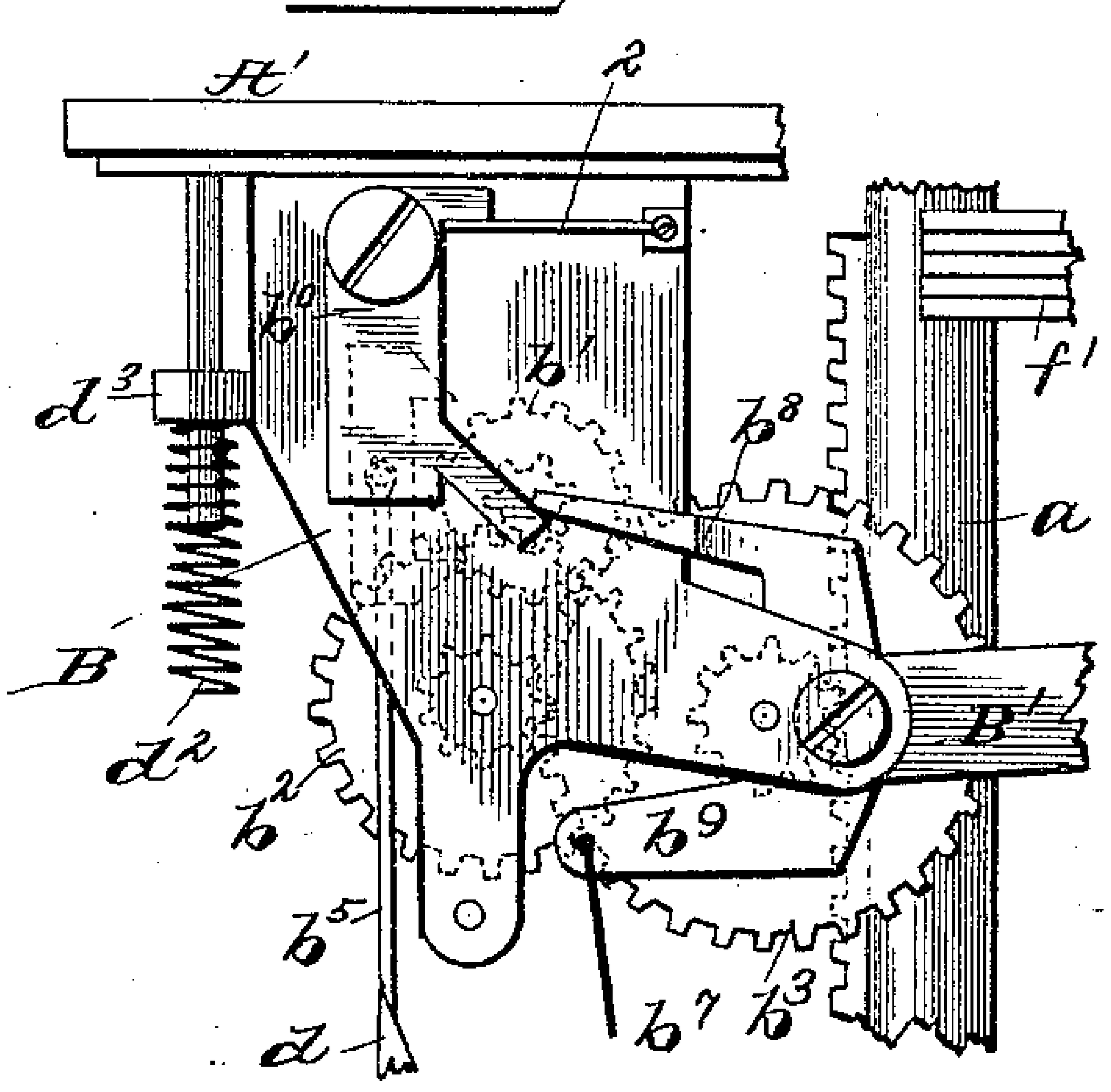


Fig. 2



WITNESSES

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JOHN E. GILES, OF HAZLETON, PENNSYLVANIA.

ELECTRIC-ARC LAMP.

SPECIFICATION forming part of Letters Patent No. 442,617, dated December 16, 1890.

Application filed August 21, 1889. Serial No. 321,494. (No model.)

To all whom it may concern:

Be it known that I, JOHN E. GILES, a citizen of the United States, residing at Hazleton, in the county of Luzerne and State of Pennsylvania, have invented certain new and useful Improvements in Electric-Arc Lamps; and I do 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, reference being had to the accompanying drawings, and to the letters and figures of reference marked thereon, which form a part of this specification.

This invention relates to arc lamps adapted particularly for use in series in a circuit of constant potential. Arc lamps have been and are now used in such circuits in multiple arc successfully; but when placed in series and without the aid of incandescent lamps to steady the arcs, serious trouble has invariably resulted, such as rupture of the arc, excessive noise, and an unpleasant and dangerous vibration of current-strength in the main system, from which the arc system is derived. My invention is designed to overcome these difficulties, and embodies certain features which will be clearly set forth in this specification, and definitely indicated in the appended claims.

In the accompanying drawings, which illustrate my invention, Figure 1 illustrates the system of construction followed in putting my invention into practice. Fig. 2 is a detail view of the wheel train and escapement.

A and A′ are metal plates, to which are secured the parts of the lamp.

a is a rack-bar, which carries the upper carbon.

a′ is the lower carbon.

A train of wheel-work, mounted in a suitable frame B, is secured to plate A′. The wheels b' b^2 are normally locked against action by a pallet or detent *b*.

B′ is a rocking frame, carrying the main wheel and rack-pinion b^3. This frame is pivoted to clock-frame B, as shown. Arms or extensions b^8 b^9 are secured to frame B′, rearwardly of its pivotal point, on one of which acts retractile spring b^7, the tension of which may be regulated by an adjusting-screw b^4. The escapement-pallet is provided with a co-operating spring 2, and carries a light pendulum b^5, which co-operates with a knife-edge *d*, secured to the core of the shunt-magnet. The pallet is pivoted in a movable bearing b^{10}, so that at certain times the pallet may be pushed out of engagement with the wheel-work and the carbon be permitted freely to descend.

b^6 is an adjustable stop for controlling the length of arc, and is secured to the frame-work in the path of movement of B′.

C is the main solenoid, and C′ its co-operating core. The latter is hung upon a hook *c* to the frame B′.

E is a dash-pot for slowing the action of the core C′.

The main coil C is supported on a bracket carried by post A^2, connecting the upper and lower plates A A′. The post is shown broken away to better illustrate other parts of the lamp. The shunt-coil or solenoid D is provided with a suspended core D′, carrying the knife-edge *d*, already alluded to. This core is carried by a pivoted arm *d′*, the free end of the latter being hooked over a spring d^2, provided with a regulating-nut d^3. It will be seen from this construction that the core D′ is frictionless in its movements, and that the only mechanical resistance to be overcome is the tension of the spring d^2 and the friction of the knife-edge.

f is the positive binding-post, and *f′* a brush bearing on the rack-bar *a*. For convenience of explanation I have placed the cut-out device outside of the lamp.

H′ is an insulating base provided with conducting-uprights *h′*, supporting a shunt-solenoid H.

h is an iron core for the solenoid. On an extension h^4 of the frame *h′* is supported a magnet h^2, insulated from the frame. Its core is provided with depending limbs h^6. h^7 is its armature.

f^2 is a negative binding-post.

Before explaining the operation of my invention I will first explain the causes of failure in the commercial form of lamp and how these causes are obviated in my lamp. The differential magnet contains inherent reaction qualities that render its use in a lamp on

a circuit of constant potential practically out of the question, and even when the main and shunt magnets are separated and have independent cores but are suspended from the same frame exactly the same effects follow. They should be separated and suspended independently. The feed must be exceedingly fine and of the most sensitive character. Feeding at long intervals, permissible in circuits of constant current, cannot be tolerated in this system. The feed must be effected without much friction or an unsuccessful lamp will result. I am aware that lamps have been constructed with an independent shunt; but in such cases the shunt-core carries the entire feeding mechanism, thus introducing a most serious objection. Such lamps while in common use on constant circuit systems never have been and cannot be used on circuits of constant potential. In my lamp the feed is controlled entirely by the resistance of the arc, and the only function of the shunt-coil is to unlock a knife-edge and permit the upper carbon to feed. In shunt-lamps as commonly constructed I find that the length of arc is not constant. When the lamp is started in operation and the shunt-coil is cold, a much larger proportion of the current will take that path than when the lamp becomes warm. So the lengths of arc in two lamps—one out of doors and the other in a warm room—will not be the same. Such differences will create lack of uniformity in lamp-resistance, a great desideratum in mixed systems thus being unprovided for. I overcome this difficulty by making the shunt-coils in part or in whole of German-silver wire, which undergoes but little change of resistance with change of temperature.

The operation is as follows: The current enters at f, passes through f', holder a, carbon a', conductor 3, coil C, conductors 4 5, magnet h^2, conductor 6, post f^2, energizing C and attracting C′; also energizing h^2 and making contact between the armature and core of h^2. On the passage of current, B′ is drawn down, and since the pivot of wheel b^3 is beyond the pivot of frame B′, wheel b^8 will be raised, carrying with it the carbon-holder a and springing the arc. c^3 is a small supplemental spring, and when the keeper of core C′ descends it comes into contact with this spring, and should the current be stronger than normal this spring will be pressed down by the magnet. When the carbon wastes away, the arc grows longer and the current reaches its normal strength. The spring will then throw core C′ up until a light contact is reached, at which place it will remain as long as a normal current flows. The shunt-terminal connects at post f, the current flowing through 7, solenoid D, conductor 8, cut-out solenoid H, conductor 9, pillar h', armature h^7, core and limb of magnet h^2, where it meets the main current. The strength of current flowing through this shunt is controlled entirely by the resistance in the main circuit resulting from an increase or decrease in the length of arc. Should the arc increase beyond the length for which the lamp is adjusted, the flow through the shunt will increase and core D′ will be drawn down, releasing pendulum b^5 from its contact with knife-edge d, allowing the wheel-work to act under the weight of the rack-rod and upper carbon. With one or more vibrations of b^5 the arc is shortened, the current in D is weakened, D′ rises, and b^5 is locked with d. This operation is repeated at intervals of from one to five seconds, making a practically-constant feed unaffected by the friction of any of the mechanical parts of the lamp. The length of arc is adjusted entirely by the spring d^2, a greater tension on this spring producing a longer arc. Spring b^7 is adjusted to permit the keeper of core C′ to come into light contact with spring c^3 when the lamp burns normally. Should the current increase beyond this the spring will permit a further deflection of arm B′, thus increasing the length of arc, and when the current returns to normal, which it will do suddenly, to save breaking, the arc arm B′ must rise quickly. Spring c^3 produces such action. Should the arc break from any cause, the action of spring b^7 will cause B′ and C′ to rise and projecting arm b^8 to fall, bringing this arm into contact with projecting arm of b, detaching the pallet from escape-wheel b', allowing the carbon-holder to descend quickly, bringing the carbon points into contact, and re-establishing the main circuit through C. On such re-establishment the arc is sprung, b^8 recedes from b, and the escapement is in condition to feed the carbon when called upon, spring 2 holding the escapement in proper relation.

While this lamp has been constructed mainly with a view to use in circuits of constant potential, it can readily be adapted for use upon a constant current circuit. For this purpose a hole is drilled in the core of the cut-out solenoid at h, and in the rack-bar at a^3. When the lamp is working in a circuit of constant potential, as hereinbefore described, pins are fixed in both of these holes. The pin in a^3 will prevent the carbon points from coming into contact when the upper carbon has been sufficiently consumed. When the pin rests on plate A′ the arc will be ruptured, armature h^7 will fall away from contact with the core of h^2, and the shunt will be ruptured. The pin in h prevents the core of H from being held sufficiently high by the shunt-current to interfere with the dropping away of the armature h^7, when the arc is ruptured by reason of the exhaustion of the upper carbon. When the lamp is used on a circuit of constant current, the pins at a^3 and h are removed, conductor 4 is removed from the limb of h^2 and connected, as shown in dotted lines, to binding-posts f^2, and a new conductor is led from binding-post f to h^4. Now, the current will flow, as before explained, to solenoid C, thence direct to post f^2; but should the arc break, the strength of current flowing through

the shunt will be largely increased and core h will be drawn up by the influence of H, causing the core to strike armature h^7 and bringing it in contact with the core of h^2. The main current will then flow direct from post f, over conductor 10 to h^4, thence by way of armature h^7 and conductor 6 to post f^2, thus cutting out the lamp and permitting the current to supply other lamps of the system. When the carbon of a lamp has wasted as much as can be allowed, the last tooth of rack a will have passed the pinion of b^3 and rod a will drop until the points of the carbons come into contact, permitting other lamps of the circuit to be supplied.

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

1. In an arc lamp provided with a fixed feed-regulating-wheel train, a detent for the train, a shunt-coil for releasing the detent, one of the wheels of the train being mounted on a movable axis, and a main coil for lifting the movable wheel and springing the arc.

2. In an arc lamp, the combination of a gravitative carbon-holder, wheel-work controlled by the current for permitting feed, a detent for the wheel-work, a pivoted frame in which the detent is mounted, and means controlled by a main-circuit magnet for rocking the detent-frame, unclutching the detent from the wheel-work, and connecting or disconnecting the detent with the wheel-work when an arc is sprung or broken, respectively.

3. In an arc lamp, the combination of a gravitative carbon-holder, a train of wheel-work, a scape-pallet controlling the rate of feed, a shunt-regulating coil, and a knife-edge detent carried by the core of said coil and controlling the pallet, said core being elastically supported by a pivoted arm so as to be free of frictional resistance in the coil, as and for the purpose described.

4. In an arc lamp, the combination, with a gravitative carbon-holder and means for controlling the feed and springing the arc, of a removable stop-pin for arresting the downward travel of the carbon-holder and opening the circuit after the carbons have been consumed, whereby the lamp may be adapted for use in constant-potential or constant-current lighting systems by the simple insertion or removal of the pin.

5. In an arc lamp, the combination, with a gravitative carbon-holder and means for controlling the feed, of a shunt-regulating coil, a cut-out for the shunt-circuit controlled by the main current, a magnet for operating the cut-out independently of the main current, and means for locking or unlocking the active relation of the magnet and cut-out, whereby the lamp is adapted for use on constant-potential or constant-current lighting systems.

6. In an arc lamp, the combination of a gravitative carbon-holder, a rack on the carbon-holder, a fixed train of wheel-work for regulating the feed of the same, the axis of the wheel engaging the rack being movable, a scape-pallet controlled by a regulating-coil for permitting the movement of the train, and a coil in the main circuit for lifting the engaging wheel.

7. An arc lamp provided with main and shunt regulating coils and a cut-out controlled by a magnet in the main branch for completing the shunt or rupturing the same, accordingly as current flows or ceases in the main branch.

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

JOHN E. GILES.

Witnesses:
G. F. KISNER,
JOHN H. MOYER.