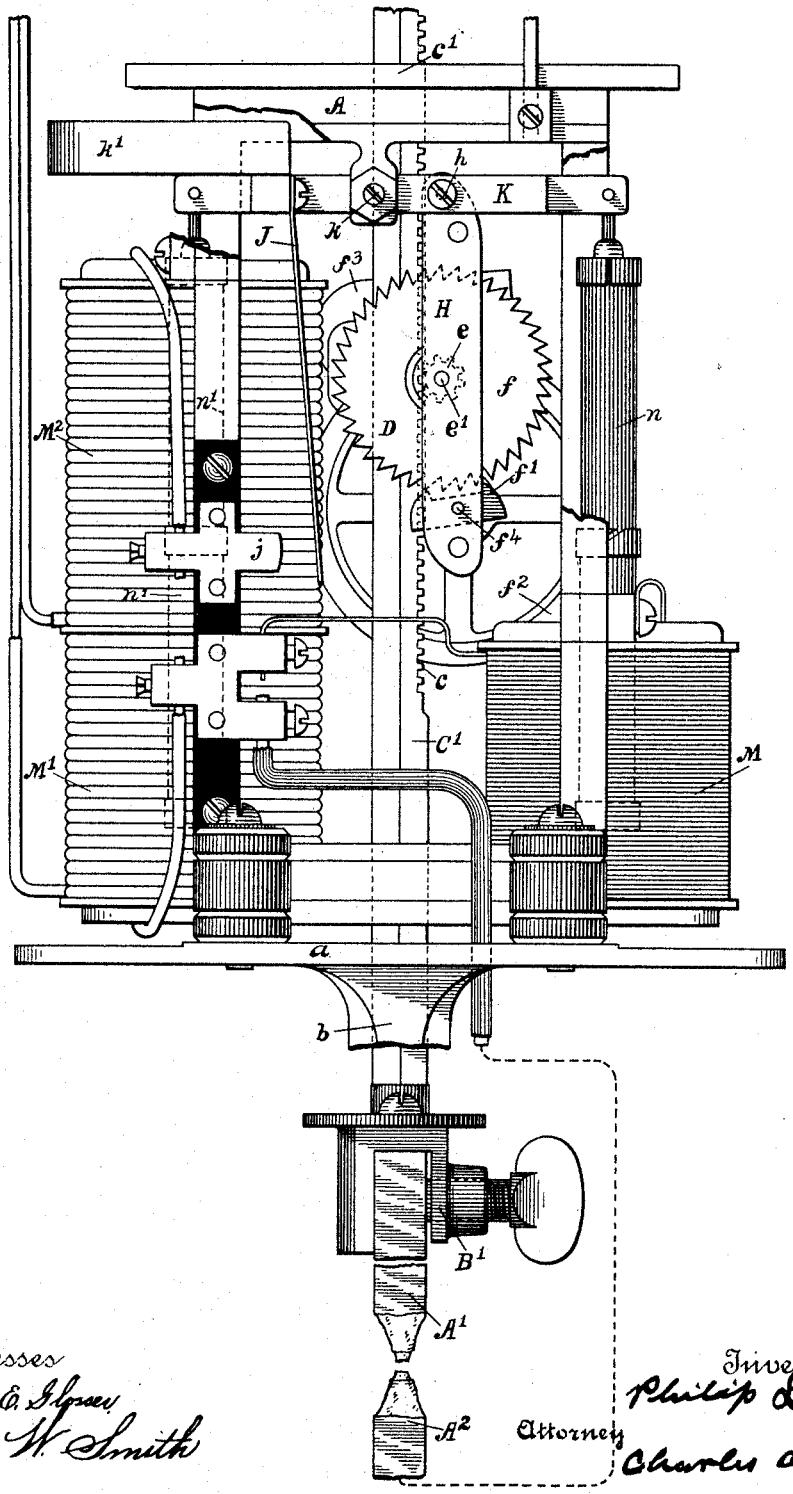
(No Model.) 3 Sheets—Sheet 1.

P. LANGE.

ARC LAMP.

No. 428,008. Patented May 13, 1890.

Fig. 1.



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(No Model.)

3 Sheets—Sheet 2.

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ARC LAMP.

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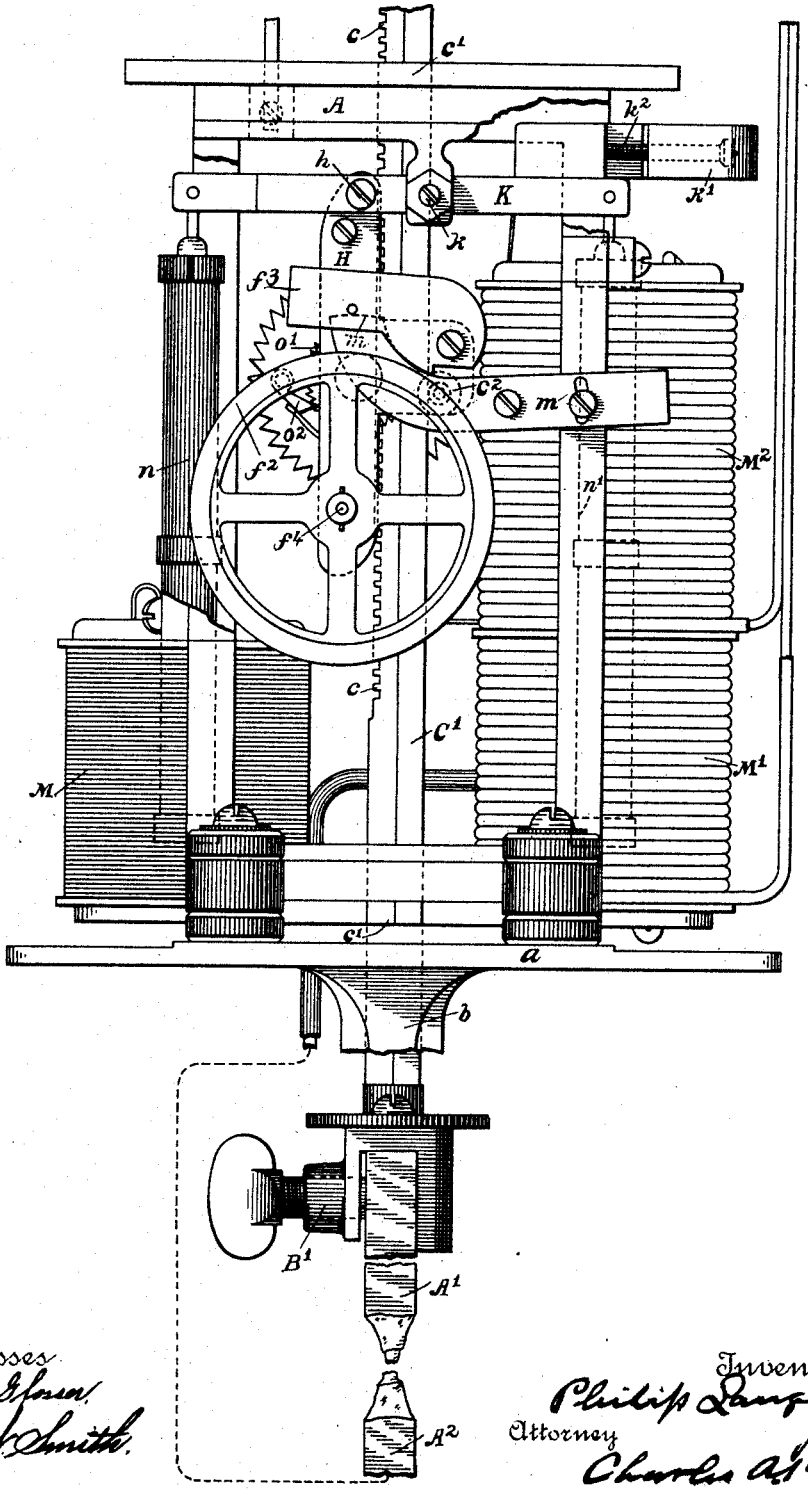
Fig. 2.



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(No Model.) 3 Sheets—Sheet 3.

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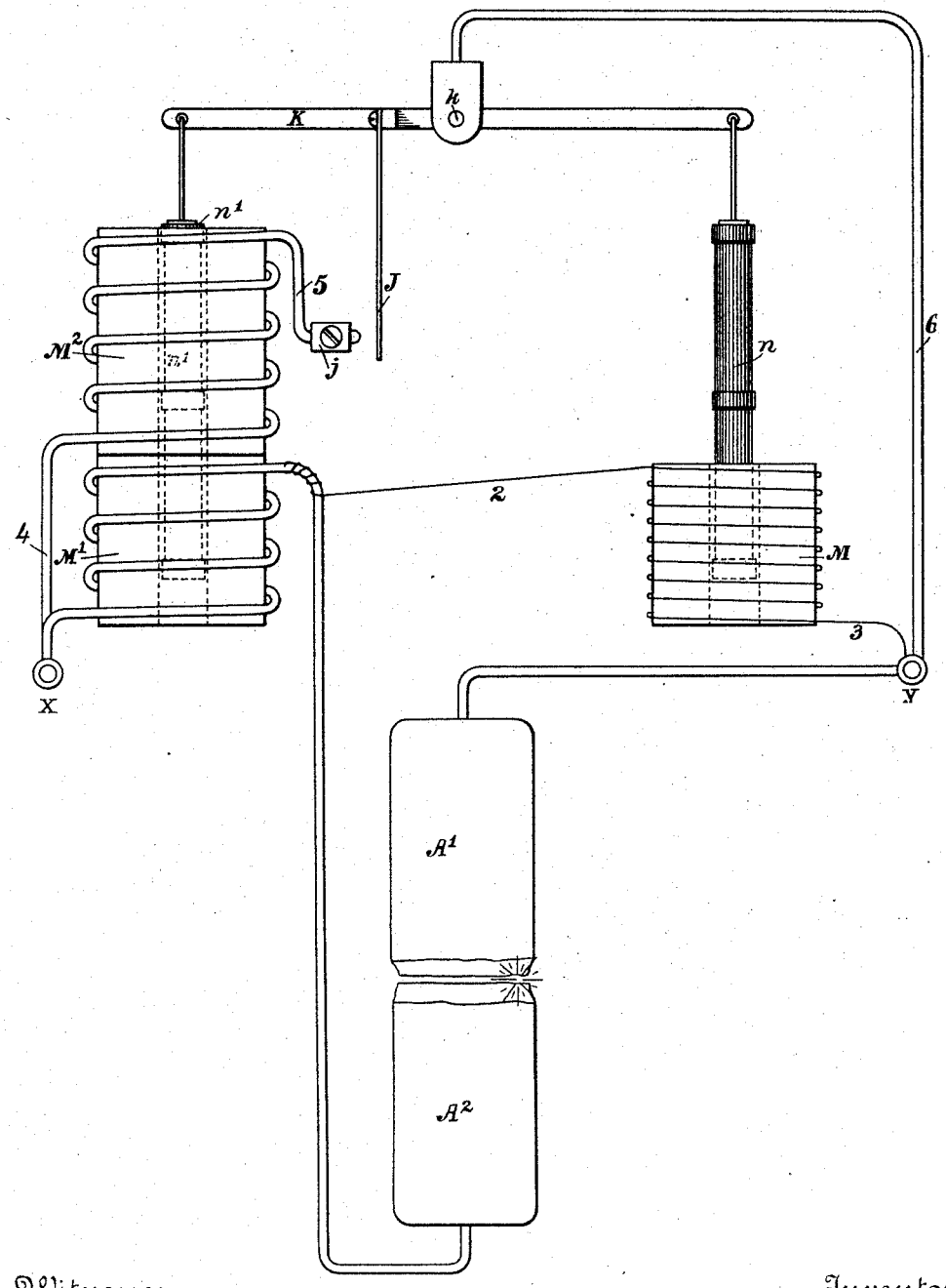
ARC LAMP.

No. 428,008. Patented May 13, 1890.

Fig. 3.



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UNITED STATES PATENT OFFICE.

PHILIP LANGE, OF PITTSBURG, PENNSYLVANIA, ASSIGNOR TO THE WESTINGHOUSE ELECTRIC COMPANY, OF SAME PLACE.

ARC LAMP.

SPECIFICATION forming part of Letters Patent No. 428,008, dated May 13, 1890.

Application filed January 11, 1890. Serial No. 336,651. (No model.)

To all whom it may concern:

Be it known that I, PHILIP LANGE, a citizen of the United States, residing in Pittsburg, in the county of Allegheny and State of Pennsylvania, have invented certain new and useful Improvements in Apparatus for Producing Light by Electricity, (Case No. 381,) of which the following is a specification.

The invention relates to a method of producing light by the consumption of electrodes by electric currents, and to certain improvements in the construction of apparatus employed therefor.

The object of the invention is to provide an arc lamp which is simple in construction, efficient and reliable in its operation, which will burn a longer time without requiring attention than the arc lamps now commonly in use, and which may be operated by electric currents rapidly alternating in direction. The lamp may be used in connection with continuous electric currents also; but it is especially designed for alternating currents.

The invention involves a new method of operation, as well as improvements in the construction and organization of the parts, all of which will be particularly described in connection with the accompanying drawings.

In the drawings, Figure 1 is a side elevation of the working portion of the lamp. Fig. 2 is a reverse view. Fig. 3 is a diagram showing the circuits.

Referring to the figures, A represents a frame for holding the various parts of the feeding and controlling mechanism. The electrodes are represented at A′ and A^2. They are shown as being broad and flat, presenting extended edges to each other, and during the operation of the lamp the arc travels along their edges from side to side. By constructing the lamp to be operated by alternating currents certain advantages are secured, which will be set forth in connection with the operation of the lamp. The lower electrode A^2 is held in a suitable clamp carried upon the arms *b*, which extend downward from a bracket *a*, which is insulated from the frame A. The upper electrode is carried in a clamp B′ at the end of a rod C′, provided with a rack *c*. This rod is allowed to feed forward under the influence of its own weight and that of the electrode, its movements being controlled by a clock-train D. The rod passes through the openings *c′* in the frame, and is held in position by a guide-wheel c^2. The rod may with advantage be of rectangular cross-section, the openings *c′* corresponding in shape, and the rack *c* is then formed along one corner of the rod. The rack is engaged by a pinion *e* upon an arbor *e′*. A scape-wheel F is mounted on the arbor *e′*, and an escapement-anchor *f′* is employed for releasing the scape-wheel and allowing it to turn gradually, so that the rod may feed forward. The escapement-anchor is carried upon an arbor f^1, which also carries a vibrating brake-surface f^2. For convenience and delicacy of construction this is in the form of a balance-wheel. A brake f^3 is employed for controlling the vibrations of this brake or balance-wheel f^2. When the brake rests upon the wheel f^2, the escapement is prevented from vibrating, and therefore the rod C′ is held by the pinion. When, however, the brake is lifted from the wheel, then the escapement is allowed to vibrate, thus permitting the rod to gradually fall.

For the purpose of releasing the brake-wheel at the proper moments, the entire escapement, including the brake, is carried in a movable frame H, which is suspended by pivots *h* from a pivoted beam or frame K. The pivoted frame K is supported from the lamp-frame A by pivots *k*, and its position is determined by means of electro-magnets or solenoids M′, M^2, and M. These are provided with movable cores *n′* and *n*, suspended from the opposite ends of the pivoted frame K. These cores are subdivided for the purpose of adapting the lamp to use with alternating electric currents. They may conveniently be made of bundles of wire magnetically separated from each other. When the core *n′* is drawn downward, the brake is allowed to rest upon the brake-wheel and the rod C′ is held. When the core *n* is drawn into its solenoid, then the brake rests upon a detent *m*, thus releasing the brake-wheel, which is carried away from the brake. This allows the escapement to act, allowing the rod C′ to feed

forward until the frame K is tilted in the opposite direction. The moving of the frame in the opposite direction also serves to raise the carbon rod, and thus separate the electrodes from each other a sufficient distance to establish an arc of the proper length, assuming that they have first been brought into contact with each other. For the purpose of permitting the rod to be raised independently of the action of the escapement, the pinion is coupled to the escapement-wheel through a ratchet and pawl, as shown at o' o^2, in a manner well understood.

The system of circuits is illustrated in Fig. 3. The coil M is of fine wire and connected directly across the terminals X and Y of the lamp by conductors 2 and 3. The coil M′ is of thick wire and is connected in series with the electrodes. The coil M^2 is of thick wire and is connected in a normally-open shunt-circuit across the electrodes by conductors 4, 5, 6, and 7. The connections of this shunt are completed by a spring contact-arm J, carried by the frame K and caused to strike against the point j when the rod C′ has for any reason failed to feed forward, and the core n is drawn still farther into its solenoid by reason of the increased current forced to traverse it by reason of the high resistance of the arc. When the carbons are separated such a distance that the arc is too long, sufficient current is forced to traverse the coil M to draw its core n downward. This tilts the frame K in the proper direction to release the brake-wheel and permit the escapement to act. If now the rod C′ feeds forward, the resistance of the arc decreases, decreasing the flow of current through the shunt-coil M, and this permits the coil M′ to raise the entire escapement-frame and the rod C′ slightly. If the electrodes were first placed in contact with each other, then this movement of the frame would be sufficient to establish an arc of the proper length. After the arc has once been established the oscillations of the frame are very slight and usually only sufficient to diminish the pressure of the brake sufficient to allow the rod to be fed forward as required to compensate for the consumption of the electrodes. If, however, the rod fails from any cause to feed when the releasing mechanism is operated, then the coil M^2 is placed in circuit, affording a low-resistance by-path or shunt for the lamp, permitting the current to flow to other lamps in series without encountering abnormal resistance. The core n', upon which the coil acts, is of such length and so placed with reference to the two coils M′ and M^2 that when the former alone is in circuit the tendency is for the core to be drawn downward in opposition to the action of the solenoid M upon its core n; but when the circuit of the coil M^2 is completed then its tendency is to lift the core n' and place it in a neutral position with reference to itself. This insures that the low-resistance shunt-circuit shall remain closed when the lamp is in operation, and at the same time the parts will be held in position to release the rod C′. When the circuit between the electrodes is again closed, then the action of the coil M′ upon the core n' is sufficient to open the circuit of the coil M^2.

The pivoted frame K may be provided with a balance-weight k', and screws k^2 may be employed to nicely adjust its position.

While the use of flat carbons or electrodes presenting extended edges to each other is not new in systems employing currents continuous in direction, it is new, so far as I am aware, to employ such carbons with alternating electric currents, and certain new and useful results follow the employment of flat carbons with alternating currents. One result of the use of continuous currents with flat carbons is to hollow out or render concave the upper carbon and fill it with pits. This causes the arc to be more or less covered and casts a shadow. At the same time the edges of the upper electrode are liable to chip off, causing a flickering and unsteadiness in the light. When, however, the current is alternating in direction, both the confronting surfaces are worn away into a wedge shape and a steady continuous arc is maintained. This travels steadily to and fro between the confronting edges of the carbons, and they wear away evenly. The lamp will burn for a much longer time than when constructed with a single carbon rod or even with two carbon rods, and a great saving is made in the cost of trimming or replacing the carbons.

I claim as my invention—

1. An arc lamp consisting of the combination of a stationary electrode, a movable electrode, and a governor for the movable electrode, comprising a series coil, a shunt-coil, a releasing mechanism for the movable electrode, operated by the action of the two coils, a second shunt-coil, a single core common to the series coil, and the second shunt-coil brought into operation by the action of the first shunt-coil and assisting the same when brought into operation and constituting a shunt-circuit of low resistance across the arc.

2. In an electric-arc lamp for alternating currents, a regulator consisting of a series coil, a core therefor, a shunt-coil, a core therefor, a pivoted support carrying the two cores, a clock-train released by the differential action of the two coils upon their respective cores, and a shunt-coil in a normally-open circuit acting upon the core of the series coil and in opposition thereto and brought into action by the operation of the shunt-coil.

3. In an arc lamp, the combination, with a movable carbon, of an escapement device therefor, consisting of a scape-wheel, an escapement-anchor therefor, a vibrating brake-surface applied to and moving with said anchor, a brake applied to the brake-surface for arresting its movement, a pivoted support carrying the scape-wheel, the brake-surface, and the arresting device, electro-magnetic de-

vices for controlling the position of the pivoted support, and a detent interposed in the path of the arresting device, substantially as described.

4. In an arc lamp, the combination, with a movable carbon, of an escapement device therefor, consisting of a scape-wheel, an escapement-anchor therefor, a balance-wheel brake vibrating with and controlling the movements of the anchor, a pivoted support common to both the anchor and the balance-wheel brake, and an arresting device applied to the balance-wheel, and electro-magnetic devices for releasing said balance-wheel from its arresting device, substantially as described.

5. In an arc lamp, the combination, with a movable carbon, of an escapement device therefor, consisting of a scape-wheel, an escapement-anchor therefor, a vibrating balance-wheel brake fixed to the anchor, an arresting device applied to said brake, a pivoted support carrying the escapement-anchor, the brake, and the arresting device, a fixed releasing-detent for the arresting device, electro-magnetic devices for controlling the relative positions of the brake and releasing device, and a movable frame supporting the escapement mechanism.

6. In an electric-arc lamp, the combination, with a movable electrode-holder, of the tilting frame, two electro-magnets and their respective cores, said cores being pivoted to said frame upon opposite sides of its pivot, an escapement mechanism pivoted directly to and carried by said frame engaging said holder and raised and lowered by the action of said electro-magnets, and a releasing device for said escapement pivoted directly to said frame and controlled by the operation of said electro-magnets.

7. In an arc lamp, the combination of the movable electrode-holder, the series coil, the high-resistance shunt-coil, the low-resistance shunt-coil included in a normally-open circuit, the circuit-closing device for the normally-open coil brought into action by the operation of the shunt-coil, and the single core for the series coil and the normally-open shunt-coil acted upon in opposite directions thereby, whereby the connections of the shunt-coil are held complete by the current traversing the same, except when the lamp is in operation.

8. In an arc lamp, the combination of the pivoted frame K, the electro-magnetic devices for controlling its position, the carbon rod C′, the escapement mechanism for controlling its movement, the frame H, carrying said escapement mechanism and pivoted to and suspended from the frame K, and the wheel c^2, holding the rod in engagement with the escapement mechanism, substantially as described.

9. In a regulator for electric-arc lamps, the combination of a core, two polarizing-coils applied thereto and tending to polarize the core in the same direction when traversed by currents, the said coils being located at different points along the length of the core, whereby the core is attracted into different positions by the action of the respective coils, and a circuit-controlling device for placing one of the coils in circuit only when the lamp is not in operation.

10. The combination, with an electric-arc-lamp mechanism, of carbon electrodes for the lamp placed in the same perpendicular plane and having extended confronting edges, and a generator of rapidly-alternating electric currents having its terminals connected with the respective electrodes, substantially as described.

In testimony whereof I have hereunto subscribed my name this 9th day of January, A. D. 1890.

PHILIP LANGE.

Witnesses:
E. HARDER,
J. W. SMITH.