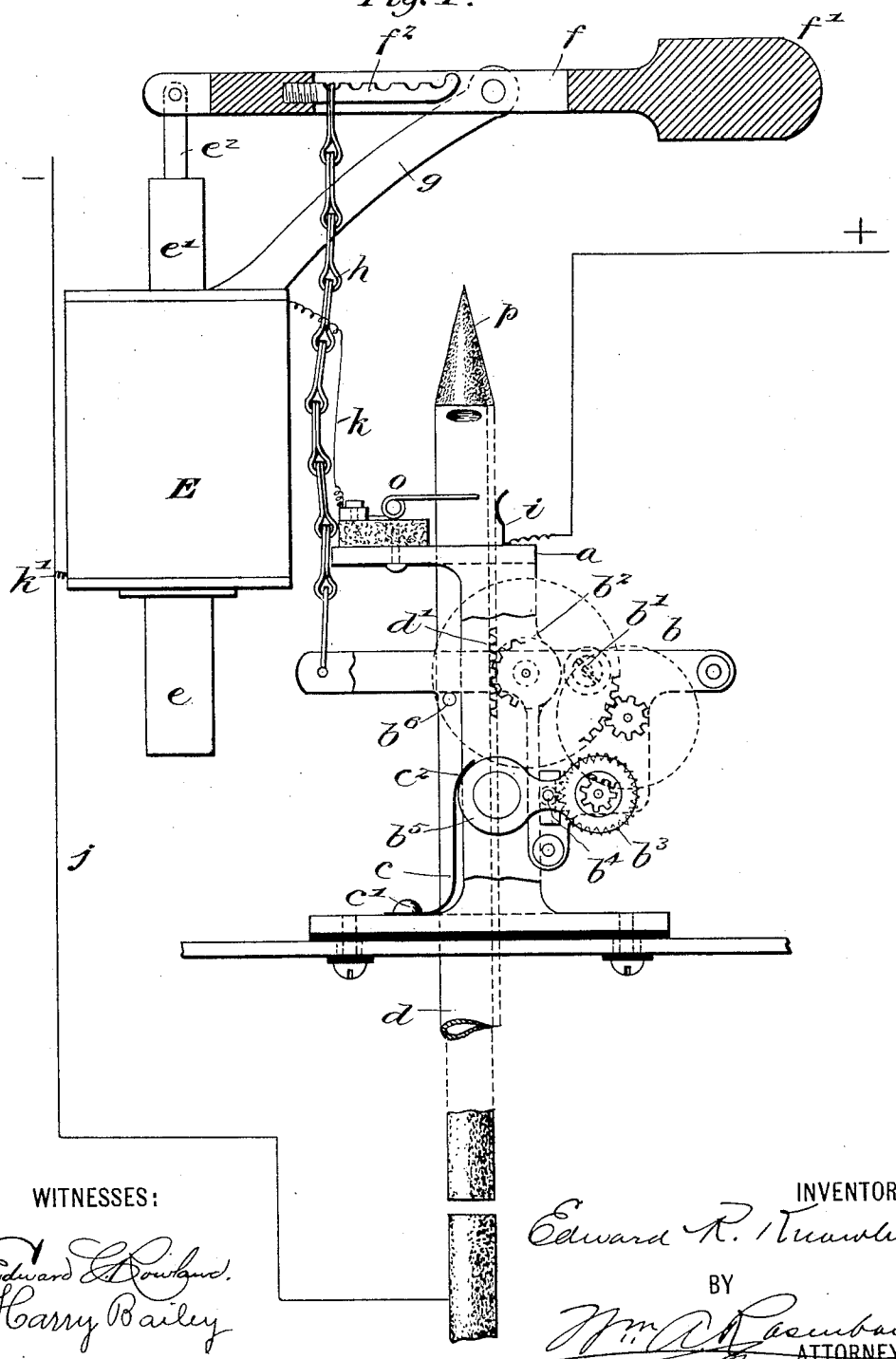
(No Model.) 3 Sheets—Sheet 1.

E. R. KNOWLES.

ALTERNATING CURRENT ARC LAMP.

No. 577,864. Patented Mar. 2, 1897.

Fig. 1.



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(No Model.) 3 Sheets—Sheet 2.

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ALTERNATING CURRENT ARC LAMP.

No. 577,864. Patented Mar. 2, 1897

Fig. 2.

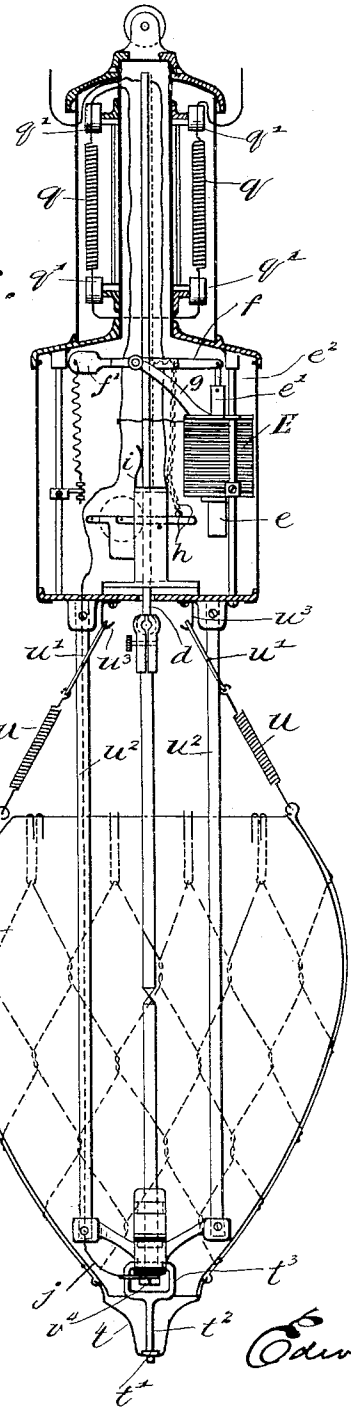


Fig. 3.

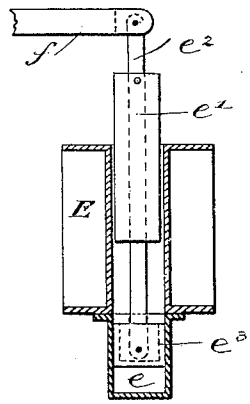
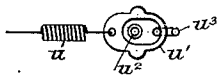


Fig. 4.



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ALTERNATING CURRENT ARC LAMP.

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Fig. 5.

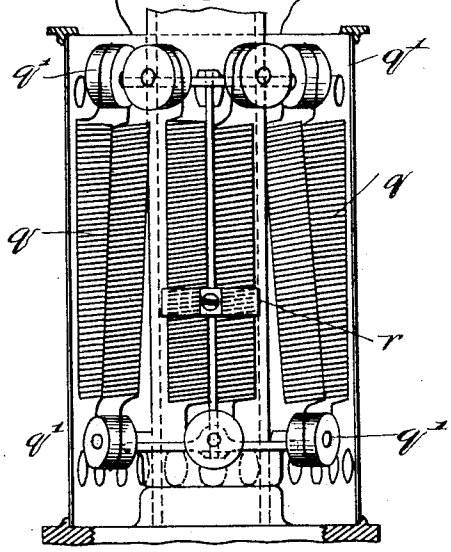


Fig. 6.

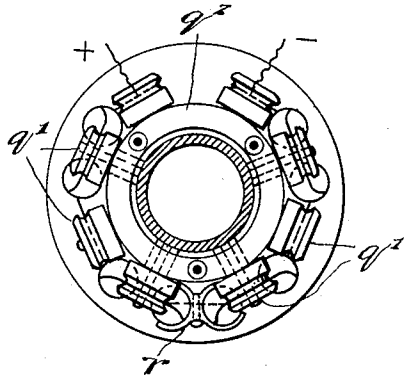


Fig. 7.

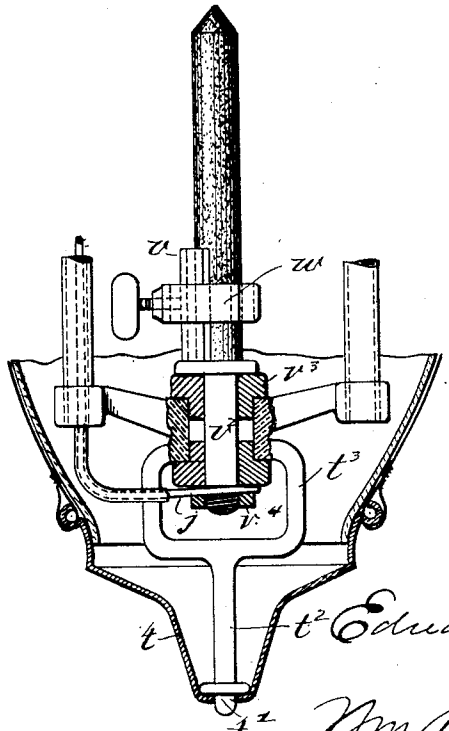


Fig. 8.

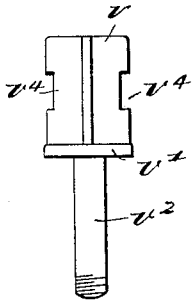
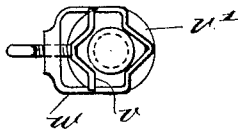


Fig. 9.



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UNITED STATES PATENT OFFICE.

EDWARD R. KNOWLES, OF BROOKLYN, NEW YORK.

ALTERNATING-CURRENT ARC-LAMP.

SPECIFICATION forming part of Letters Patent No. 577,864, dated March 2, 1897.

Application filed August 19, 1896. Serial No. 603,181. (No model.)

To all whom it may concern:

Be it known that I, EDWARD R. KNOWLES, a citizen of the United States, residing at Brooklyn, in the county of Kings and State of New York, have invented certain new and useful Improvements in Alternating-Current Arc-Lamps, of which the following is a full, clear, and exact description.

This invention relates to electric-arc lamps, the main feature of which has special reference to alternating-current lamps.

The primary object is to furnish a lamp which will establish the arc when the current is turned on without the preliminary chattering of the carbons which usually takes place in this type of lamp. The cause of this chattering is the mere fact that the current passing through the lamp is alternating in character. An alternating current rises and falls between zero and maximum potential with great frequency, so that a single impulse does not last long enough to heat up the abutting ends of the carbons and the intervening atmosphere sufficiently to produce a stable arc. The passage of a number of impulses, however, finally heats the carbons and the atmosphere between them, so that the current will bridge the arc-gap and flow with regularity. In the meantime the carbons hammer together and cause the chattering. If, when the current is first turned on, it is permitted to flow through the carbons for a short space of time before they are separated, and then they are separated slowly, the arc will be formed at once and maintained constant without any chattering or hammering of the carbons, because in the interval of time referred to the carbons become heated and an atmosphere adapted to carry an arc has been formed.

The principal feature of my invention herein described is the means whereby the carbons are held in contact for a short period of time immediately after the current is turned on for the purpose referred to.

The invention also embodies other features of minor importance, but which taken together comprise a very practical and successful arc-lamp.

In the accompanying drawings, Figure 1 is a view of the lamp mechanism somewhat conventionally illustrated. Fig. 2 is a view of the complete lamp on a small scale and partially in section. Fig. 3 is a section of the lamp-magnet. Fig. 4 is a detail of the globe-sustaining device. Figs. 5 and 6 are respectively a side elevation and plan of the lamp-rheostat. Fig. 7 is a side elevation, partially in section, of the lower-carbon holder and its connecting parts; and Figs. 8 and 9 are details of the holder itself.

Referring to Fig. 1, a is a frame supporting the bottom of the lamp-case, but insulated therefrom in the usual manner.

b is a second frame consisting of two side pieces connected by cross-rods of the same general construction as is commonly used in lamps of this character. This frame is pivoted to the main frame at the point b'. In it is mounted a train of gear having at one end the pinion b^2, which engages with a rack in the carbon-rod, and at the other end an escapement-wheel b^3, which is controlled by a verge b^4 and an oscillating weight b^5. Said weight is of the general shape of the figure "8," stamped out of sheet metal. The periphery of the ring at one end bears against a delicate spring c, fixed at c' and having a curved end c^2, which impinges against the edge of the ring. This spring acts as a brake or detent to prevent the oscillation of the weight and retard the gearing. By making this detent yielding the train is not stopped too suddenly and its action improves the operation of the lamp. The downward movement of frame b is limited by pin b^6.

The upper-carbon rod is represented by d and is provided with a rack d', before referred to. A single magnet E is used to strike the arc and maintain the same. The magnet is of the solenoid type and is provided with a dash-pot e, attached centrally below it and forming an extension of the passage through the coil.

e' is the core, which in this instance is hollow and pivotally suspended at its upper end upon a rod e^2, which passes entirely through it and into the dash-pot, where it carries a piston e^3. The opening in the core is larger than the rod and permits of slight lateral movement of the core to prevent binding as it moves in and out of the magnet. The upper end of rod e^2 is hung at one extremity of a lever f, pivoted near its middle point to a bracket g. The opposite end of lever f is pro-

vided with a weight f' or an equivalent spring. The lever connects with the swinging frame d by a chain, cord, or other flexible device h. This may be adjustable in length in any preferred way, the means here shown being a notched arm f^2, secured to the lever f, which by shifting the end of the chain into one or the other notches changes its position relative to the pivot of the lever f, and consequently the effective length of the connector h.

One side of the main circuit is connected with the brush i, which bears constantly against the upper-carbon rod. The main circuit then leads through said rod, the upper carbon, and the lower carbon, and thence to the other side of the main circuit j. The magnet E is in a shunt to the arc, being connected in a circuit k, leading from a point k' to a cut-out spring o. This spring is mounted upon a block of insulating material and bears at its free end normally against the side of the carbon-rod. The carbon-rod terminates at the top in a cone p of insulating material. At the base of the cone there is formed a small notch that stands in the path of the end of the spring. When the rod is fed downward to nearly the full limit, the spring enters the notch, and the final movement of the rod puts the spring under slight tension, which eventually causes it to leave the notch and spring against the cone of insulating material above and thus open the shunt-circuit. Nothing is regarded as new in this cut-out except the conical point on the rod, which, whether it be of insulating material or not, permits the rod to pass freely upward through the lamp and past the cut-out spring whenever it has been removed for cleaning or repairs.

The operation of the lamp is as follows: The carbons are normally separated, in which position they are held by the weight f', the core of the magnet being elevated and the flexible connector h being straight or under tension. When the current is first put through the lamp, the magnet gets all of it and pulls down its core e', the movement being comparatively slow, due to the action of the dash-pot. The parts continue to lower until the frame b strikes the pin b^6, at which moment the oscillating weight b^5 is released from the detent c, and the gearing thus being free commences to rotate under the weight of the carbon-rod. The core e' meanwhile continues to lower until the carbons come together, at which time a considerable slack has been made in the flexible connector h. The moment the carbons touch the full current flows through them and heats up the abutting surfaces. The magnet being deënergized the moment the carbons touch, releases its core and permits the weight f' to again withdraw it and straighten out the slackened connector h. This latter requires an appreciable amount of time, during which the carbons become heated. This upward movement of the core and the straightening of the connector is gradual on account of the action of the dash-pot, and when finally the frame b commences to rise it will do so at a deliberate speed. The moment the frame b moves the gearing becomes locked by contact between the weight b^5 and detent c, and the further movement of the frame determines the length of the arc. The increase of resistance of the arc causes more current to flow through the shunt, which again lowers frame b sufficiently to allow the gearing to rotate and feed the upper carbon downward. In this operation the connector h is not materially slackened, because the moment the frame strikes the pin b^6 the gearing is released and the resistance is altered. While burning, the frame b will practically be floating immediately above the pin b^6.

Referring now to Figs. 2, 5, and 6, showing the lamp-rheostat, it will be seen that the coils of resistance-wire q are arranged vertically between two circular rows of insulators q', the insulators being secured to rings q^2. The insulators above and below are staggered in position, so that the coils standing between them will occupy a slightly-inclined position. This is true of all the coils except two, those shown immediately in front in Figs. 5 and 6. These two are parallel, and a metallic clip r is arranged to embrace both of them and maintain itself in any position thereon by friction. By adjusting this clip at any point in the length of the coils the resistance of the lamp may be altered.

Another feature of my lamp is the means for supporting the lamp-globe. The wire-netting s is hooked over the upper edges of the globe, as shown in Fig. 2, and is secured to the rim of a metal cup t at the lower end, in which the lower end of the globe rests. The weight of the globe is supported by two springs u, attached to the upper edge of the netting and carrying rings u', which embrace the side rods u^2 of the lamp. The rings are adapted to pass over hooks u^3, fixed to the under side of the lamp-casing, and thus the globe is flexibly supported and is not liable to become broken by sudden jars or thrusts upon the lamp. In trimming the lamp the globe is lowered by removing the rings from the hooks and allowing them to slide downward upon the rods until they are caught by the cross-piece carrying the lower-carbon holder. By hooking the upper edge of the net over the edge of the globe and then drawing down and securing the lower edge to the cup I provide a simple means for applying the net. The cup t at the lower end of the globe is conical in shape and is provided with an opening at the apex, into which a plug t' on the end of a stem t^2 projects. The plug normally closes the hole in the cup and prevents particles of carbon from falling, while at the same time it furnishes a passage for removing said carbon particles when the globe is lowered for trimming and cleaning the lamp. The lower-carbon holder consists of the plate v, having an angular seat for the carbon and side notches v^4, formed integrally with a disk v'

and a bolt v^2, and a small metal frame w, adapted to embrace the carbon and the plate v, occupying the notches v^4 in the latter and carrying a thumb-screw for pressing the carbon between the plate and one side of the frame. Bolt v^2 passes through a large opening in the cross-piece connecting the lower ends of the side rods, and is insulated therefrom by means of non-conducting bushings v^3. These are made smaller than the opening into which they pass to permit of slight lateral adjustment of the carbon. The hole and bushings are held in place by a nut v^4, which also clamps the conducting-wire j. The stem t^2 projects from a loop t^3, formed integrally with the cross-piece.

Having thus described my invention, I claim—

1. The method of starting an alternating-current arc-lamp in operation, which consists in holding the carbons in contact after the current is turned on, long enough to allow the carbons to become heated sufficiently to maintain the normal arc and then slowly separating the carbons to establish the arc.

2. An arc-starting mechanism for alternating-current arc-lamps, comprising the combination of means for holding the carbons in contact for a sufficient time to heat the carbons to maintain the normal arc, with means for thereafter slowly separating the carbons to establish the arc.

3. An arc-starting mechanism for alternating-current arc-lamps in which the carbons are normally separated, comprising the combination of means for contacting the carbons, means for thereafter holding the carbons in contact for a sufficient time to heat the carbons to maintain the normal arc, and means for thereafter slowly separating the carbons to establish the arc.

4. In an arc-lamp, the combination of an arc-striking magnet, a carbon-rod, a swinging frame carrying a train of gearing in engagement with said rod, a stop limiting the movement of the frame, a pivoted lever to which the armature of the magnet is attached, and a flexible connection between the lever and the swinging frame whereby the former may move after the latter is held by its stop, substantially as and for the purpose set forth.

5. In an arc-lamp, a train of gearing controlled by an escapement, the latter having an oscillating weight provided with a rounded surface and the gearing being mounted in a swinging frame, in combination with a yielding detent for said weight, the detent having a corresponding rounded surface, substantially as described.

6. In an arc-lamp, the combination with the frame, of a globe-holder consisting of a wire-netting embracing the globe and springs connecting the netting with the lamp-frame, substantially as described.

7. In an arc-lamp, the combination with the frame, of a globe-holder consisting of a wire-netting embracing the globe and springs connecting the netting with the lamp-frame, said springs having attached to them rings which embrace the side rods of the lamp and which normally engage with hooks on the lamp-frame, for the purpose set forth.

8. In an arc-lamp, the combination of the globe and a net embracing the same, said net being secured at its upper edge by hooks passing over the upper edge of the globe, as set forth.

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

EDWARD R. KNOWLES.

Witnesses:
FRANK S. OBER,
HARRY BAILEY.