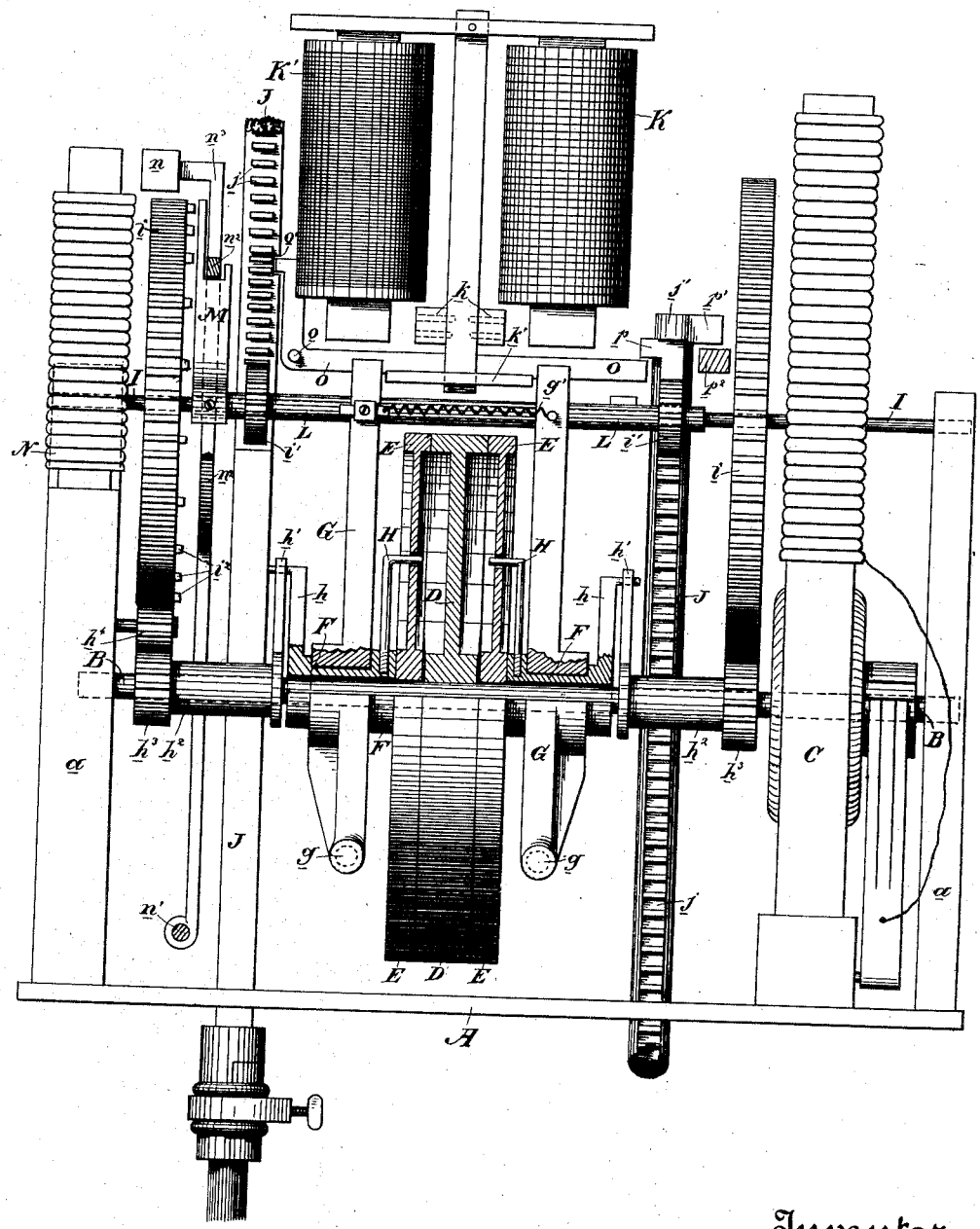
(No Model.)

A. HARDING.

ELECTRIC ARC LAMP.

No. 356,282. Patented Jan. 18, 1887.



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UNITED STATES PATENT OFFICE.

AUGUST HARDING, OF OAKLAND, CALIFORNIA.

ELECTRIC-ARC LAMP.

SPECIFICATION forming part of Letters Patent No. 356,282, dated January 18, 1887.

Application filed May 24, 1886. Serial No. 203,159. (No model.)

To all whom it may concern:

Be it known that I, AUGUST HARDING, of Oakland, Alameda county, State of California, have invented an Improvement in Electric-Arc Lamps; and I hereby declare the following to be a full, clear, and exact description of the same.

My invention relates to that class of electric lamps in which means are employed, controlled by an electro-magnet in the main circuit and an electro-magnet in a derived or shunt circuit around the arc, for automatically adjusting the carbon points; and my invention consists in a shaft operated in one direction by an electric motor and carrying a friction-gear fast upon it, friction-gears loose on the shaft and adapted, normally, to engage the opposite faces of the fast gear; a mechanism controlled by an electro magnet in the main circuit and an electro-magnet in the shunt-circuit around the arc for throwing either of the loose gears from its engagement; power-transmitting mechanism between one of the loose friction-gears and the carbon holders or rods whereby they may be fed down; power-transmitting mechanism between the other of said loose gears and the carbon holders or rods whereby they may be elevated; a means controlled by an electro-magnet in the main circuit for relieving the holders or rods when the current is interrupted, and mechanism by which one of said holders or rods may be hung up and brought into action by the other upon reaching the limit of its movement, together with various details of construction and arrangement, all of which I shall hereinafter fully describe.

The general object of my invention is to provide simple and effective means for adjusting the carbon points.

The particular object is to give an unlimited reciprocating motion to the carbon-holder, while the armatures of the controlling-magnets have but a small and limited motion. They are therefore not appreciably affected by being nearer to or farther from their poles, and are only affected by the varying strength of the electro-magnet and the shunt around the arc.

Referring to the accompanying drawing for a more complete explanation of my invention, the figure is an elevation of my lamp, some of the parts being shown in section.

A is a frame, having posts *a*. In these is journaled a shaft, B. Upon one end of the shaft is secured an electric motor, C, the tendency of which is to rotate the shaft in one direction. Upon said shaft, about its middle, is rigidly secured a double-faced friction-gear, D.

E are two friction-gears, one bearing on one face of the gear D and the other on the other face, and both gears are loose on the shaft B. These friction-gears are held normally in contact with the gear D by means of the sleeves F, mounted loosely on the shaft B and bearing against the hub of the gears E. The sleeves are held to position by the levers G, which are pivoted at the points *g*, embrace the sleeves loosely, and have their upper ends united by a spring, *g'*, which draws them together. The sleeves are very loose upon shaft B, and they may therefore move without cramping.

As long as the two gears E remain in a normal position the gear D on the shaft B cannot move; but when one is released said gear D moves and carries the other gear, E, with it. This effect is attained by so gearing up the gears E that the motion transmitted from one is in one direction and that from the other is in the other direction, so that when both press gear D it cannot move.

The sleeves F are connected with the friction-gears E by the crank-arms H, the upper ends of which engage the gears and their lower ends are secured in the sleeves. To the other end of the sleeves are attached crank-arms *h*, the outer ends of which are connected with the arms *h'* of the sleeves h^2, which are mounted loosely upon the shaft B. The outer ends of these sleeves carry pinions h^3.

Journaled in the posts *a* is a shaft, I, upon each end of which are secured the gears *i*. One of these gears meshes directly with the pinion h^3 below and the other meshes with an idler-pinion, h^4, which meshes with the other pinion h^3. It will be seen that by the intervention of the idler the power transmitted to the upper shaft, I, is the reverse in direction on one side to its direction on the other.

J are the carbon holders or rods. These have ratchet-faces, as shown, and with these faces engage the pinions *i'*.

Supposing for the time being that the pin-

ions i' are fast on the shaft I and that we have but the one carbon-holder to actuate, the operation of the mechanism as far as described is as follows: If the left-hand lever G be moved over so as to relieve its pressure on the sleeve F, and thus to relieve the gear D from the engagement of the left-hand gear E, the gear D is now permitted to rotate under the power of the electric motor, and it carries the other or right-hand gear E with it. As has been said, the arrangement of the chain of gears described transmits power in different directions on each side, and when the two gears E are in engagement with the gear D the latter gear is incapable of moving; but when the pressure of one of the gears E is removed it will yield to its rotating power and will carry the other gear with it. Now, through the right-hand gear E, the crank-arm H, the sleeve F, the crank-arm h, the arm h', the sleeve h^2, the pinion h^3, and the gear i power is transmitted to the shaft I, whereby the pinion i' is rotated and the ratchet carbon-rod J is fed down. If, now, the reverse of this operation is had by moving the opposite lever G the motion is transmitted through the chain of gearing on the other side and a reverse movement is imparted to the shaft I, whereby its pinion is caused to raise the carbon holder or rod.

The movement of the two levers G is effected by means of the electro-magnet K in the main circuit and the shunt-magnet K′ around the arc. Between these are pivoted armatures k, which carry a cross-arm, k', which lies between the two levers and is adapted to come in contact with either, according to the direction of its movement. I need describe but briefly the manner in which the magnets operate in this connection, as they are in use in other lamps for the same purpose. As the carbon burns out and the resistance of the arc grows greater the current through the shunt-circuit becomes stronger and the armature is attracted by the magnet K′, thereby forcing the left-hand lever over and relieving the friction-gear D of the engagement of the left-hand gear E. The gear D, being now free to move, carries the other gear, E, with it, and through the gear-chain I have described transmits motion to the pinion i' and feeds the carbon-rod down. If the points now get too close, so that the resistance is weakened, the magnet K becomes relatively strong enough to attract the armature, and thus to move the right-hand lever, so that the gear D is relieved of the engagement of the right-hand gear E, leaving it free to move with the left-hand gear, whereby power is transmitted through the chain of gears on the left and the pinion on the shaft I made to raise the carbon rod. It will be seen, therefore, that said rod is under perfect control. This is the operation supposing the pinion i' is directly connected with the shaft I. Now, in case the current is interrupted for any cause, and that at the time of the interruption the carbon points should be separated, it is obvious that as the governing-magnets are no longer in operation the points will remain separated, and will thereby prevent the re-establishment of the current; but if by the breaking of the current the chain of gearing is also broken, then the carbon rod, being freed, will drop so as to bring the points in contact, in order to permit the re-establishment of the current. To this end, instead of mounting the pinion i' directly on the shaft, I secure it upon a sleeve, L, which is loose on the shaft I. One end of the sleeve has pivoted to it an arm, M, which accompanies the sleeve in its rotation, but is adapted to have a movement on its pivot in the plane of the length of the sleeve. N is an electro-magnet in the main circuit, and n is an armature. This consists of a standard-leg pivoted at the point n', a ring-body, n^2, and an arm, n^3, above the ring.

The top of the arm on the sleeve L is notched and embraces the spring-body n^2 of the armature, which acts as a guide, so that the armature, when attracted by its magnet, carries the arm M over with it. The inner face of the gear i is provided with notches or pins i^2, and with these the arm M engages when carried over with the armature.

As soon as the current begins to flow the action of the magnet N takes place, and the arm M is thrown to its engagement with the gear i and the chain is complete, so that motion is transmitted to the pinion-carrying sleeve L; but when the current is interrupted the armature falls back, carrying the arm M away from the gear, and thus breaking the chain, so that the carbon rod is freed and can fall to carry its point into contact with the opposing point in order to re-establish the current.

The carbon-rods may, of course, be elevated by hand when the lamp is not in operation, because then the chain of gearing is broken. In case I wish to use two carbons, I have the following mechanism, by which but one set of points will be in use at one time and by which the rod in use will at the limit of its movement bring the other into action.

The ratchet-face of one of the rods is made permanent. The other is provided with a separate rack-bar, j, which fits in a groove in the rod and is adapted to have a slight play therein. The rod is hung upon the rack-bar in any manner, as by the cross-bar j' at its top, so that when the rack moves down the rod will follow it, and when the rack is raised it carries the rod up with it. The rack is shorter than the groove-seat in which it fits, so that it can move down therein until limited by the base of the groove.

O is a bent lever pivoted at the point o. Its short arm engages a small socket, o', in the side of that rod J which has the permanent ratchet-face, and thus hangs said rod up. The position in which the rod is suspended is above its teeth, so that the pinion i' does not affect it while the gearing is operating the other rod.

Upon the top of the movable rack-bar is a

short arm or lug, *p*, and the long arm of the lever O lies directly under it, so that when the rack has moved down to the limit the arm or lug coming in contact with the long arm of the lever O causes the short arm of said lever to disengage itself from the socket in the other rod, J, whereby said rod is brought into action. This takes place at the moment when the other rod, *j*, has finished its movement and is itself hung up by reason of the arm *p'* on its top coming to rest upon a fixed bearing, *p²*. Now, it will be seen that if the rack upon the said rod J were fast it would have to be arranged with such precision that it should finish its engagement with its pinion *i'* at the moment it brought the other rod into action. This nicety of construction is entirely avoided by having it movable, so that when the rod is stopped the rack may be fed down by the pinion until it is disengaged, whereupon it drops down to its limit in the base of its seat, and it has not affected the rod which remains hung up.

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

1. In an electric-arc lamp, and in combination with a shaft and an electric motor tending to turn the shaft in one direction, a friction-gear fast on the shaft, friction-gears loose on the shaft and normally engaging the opposite faces of the fast gear, power-transmitting mechanism between the loose friction-gears and the carbon holder or rod, and a means, controlled by an electro-magnet in the main circuit and an electro-magnet in a shunt-circuit around the arc, for throwing either of the loose gears from its engagement, substantially as herein described.

2. In an electric-arc lamp, and in combination with a shaft and an electric motor tending to turn the shaft in one direction, a friction-gear fast on the shaft, two friction-gears loose on the shaft and engaging, normally, the opposite faces of the fast gear, power-transmitting mechanism between each of the loose gears and the carbon holder or rod, an electro-magnet in the main circuit, an electro-magnet in a shunt-circuit around the arc, and armatures operated thereby, and pivoted levers operated by the armatures to throw either of the loose friction-gears out of engagement with the fast gear, substantially as herein described.

3. In an electric arc lamp, and in combination with a shaft and a motor tending to turn the shaft in one direction, a friction-gear fast on the shaft, friction-gears loose on the shaft and normally engaging the opposite faces of the fast gear, power-transmitting mechanism between one of the loose gears and the carbon holder or rod, so as to feed said holder down, power-transmitting mechanism between the other loose gear and the carbon holder or rod, whereby it is raised, and a mechanism, controlled by an electro-magnet in the main circuit and an electro-magnet in a shunt-circuit around the arc, for throwing either loose gear out of engagement with the fast gear, substantially as herein described.

4. In an electric-arc lamp, the rotating shaft B, and the friction-gear D', fast thereon, in combination with the loose friction-gears E, the sliding sleeves F, bearing against the loose gears, and the pivoted spring-united levers G, bearing against the sleeves and holding the loose gears to their engagement with the fast gear, a connection between the sleeves and the loose gears, and a chain of gearing between the sleeves and the carbon holder or rod for feeding it down or up, the electro-magnet K, the shunt-magnet K', and the armatures *k*, having a cross-arm, *k'*, for operating the levers, substantially as herein described.

5. In an electric-arc lamp, the rotating shaft B, the gear D, fast thereon, the gears E, loose thereon and engaging the opposite faces of gear D, and a mechanism, controlled by an electro-magnet in the main circuit and an electro-magnet in a shunt-circuit around the arc, for throwing either gear out of engagement with the fast gear, in combination with the ratchet carbon holder or rod J, the shaft I, having a pinion, *i'*, engaging the rod, power-transmitting mechanism between one of the loose gears E and the shaft I by which it is rotated in one direction, and power-transmitting mechanism between the other loose gear and the shaft for rotating it in the reverse direction, substantially as herein described.

6. In an electric-arc lamp, the rotating shaft B, the gear D, fast thereon, the gears E, loose thereon and engaging the opposite faces of gear D, and a mechanism, controlled by an electro-magnet in the main circuit and an electro-magnet in a shunt-circuit around the arc, for throwing either gear out of engagement with the fast gear, in combination with the ratchet carbon holder or rod J, the shaft I, the loose sleeve L on the shaft, carrying the pinion *i'*, engaging the rod J, and power-transmitting devices by which the rotation of the loose gears E is transmitted in reverse directions to the shaft I, and a mechanism controlled by an electro-magnet in the main circuit for throwing the sleeve L in and out of gear with the shaft I, substantially as herein described.

7. In an electric-arc lamp, the rotating shaft B, the gear D, fast thereon, the gears E, loose thereon and engaging the opposite faces of gear D, and a mechanism, controlled by an electro-magnet in the main circuit and an electro-magnet in a shunt-circuit around the arc, for throwing either gear out of engagement with the fast gear, in combination with the ratchet carbon holder or rod J, the shaft I, the loose sleeve L on the shaft, having a pinion, *i'*, engaging the rod J, and a pivoted end arm, M, power-transmitting mechanism by which the rotation of the loose gears E is transmitted in reverse directions to the shaft I, the electro-magnet N in the main circuit, and the pivoted armature *n*, engaging arm M, and a connection between said arm and the power-

transmitting mechanism which is made and broken by the movement of the armature *n*, substantially as herein described.

8. In an electric-arc lamp, the ratchet-faced carbon holder or rod J, the shaft B, and the electric motor by which the shaft is turned in one direction, in combination with the friction-gear D, fast on the shaft, the friction-gears E, loose on the shaft, the sleeves F, bearing on the loose gears and connected therewith, the pivoted levers G, having their tops united by a spring, whereby they cause the sleeves to press the loose gears against the fast gear, the electro-magnet K, and the shunt-magnet K′, and their armatures *k*, having a cross-arm, *k′*, whereby the levers are affected to relieve one or the other of the loose gears from its engagement with the fast gear, the shaft I, a chain of gearing between one of the sleeves F and the shaft I, by which it is turned in one direction, a chain of gearing between the other sleeve F and the shaft I, by which it is turned in the other direction, the sleeve L, loose on the shaft I, and having the pinion *i′*, engaging rod J, and the pivoted arm M, the magnet N, and the armature *n*, engaging the pivoted arm M of the sleeve and throwing it into or out of engagement with the chain of gearing, all arranged and adapted to operate substantially as herein described.

9. In an electric-arc lamp, the shaft I, the pinions *i′*, carried thereby, and power-transmitting devices, controlled by an electro-magnet in the main circuit and an electro-magnet in a shunt-circuit around the arc, for rotating the pinions in either direction, in combination with the carbon holder or rod having a permanent ratchet-face with which one of the pinions *i′* engages, the carbon holder or rod having a longitudinally-movable rack-bar with which the other pinion *i′* engages, the pivoted bent lever O, by which the first carbon holder or rod is suspended out of engagement with the pinion, the arm or lug on the movable rack-bar of the other carbon holder or rod by which the lever O is disengaged, and the arm or lug on the last-named carbon holder or rod by which its movement is limited, substantially as herein described.

In witness whereof I have hereunto set my hand.

AUGUST HARDING.

Witnesses:
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