

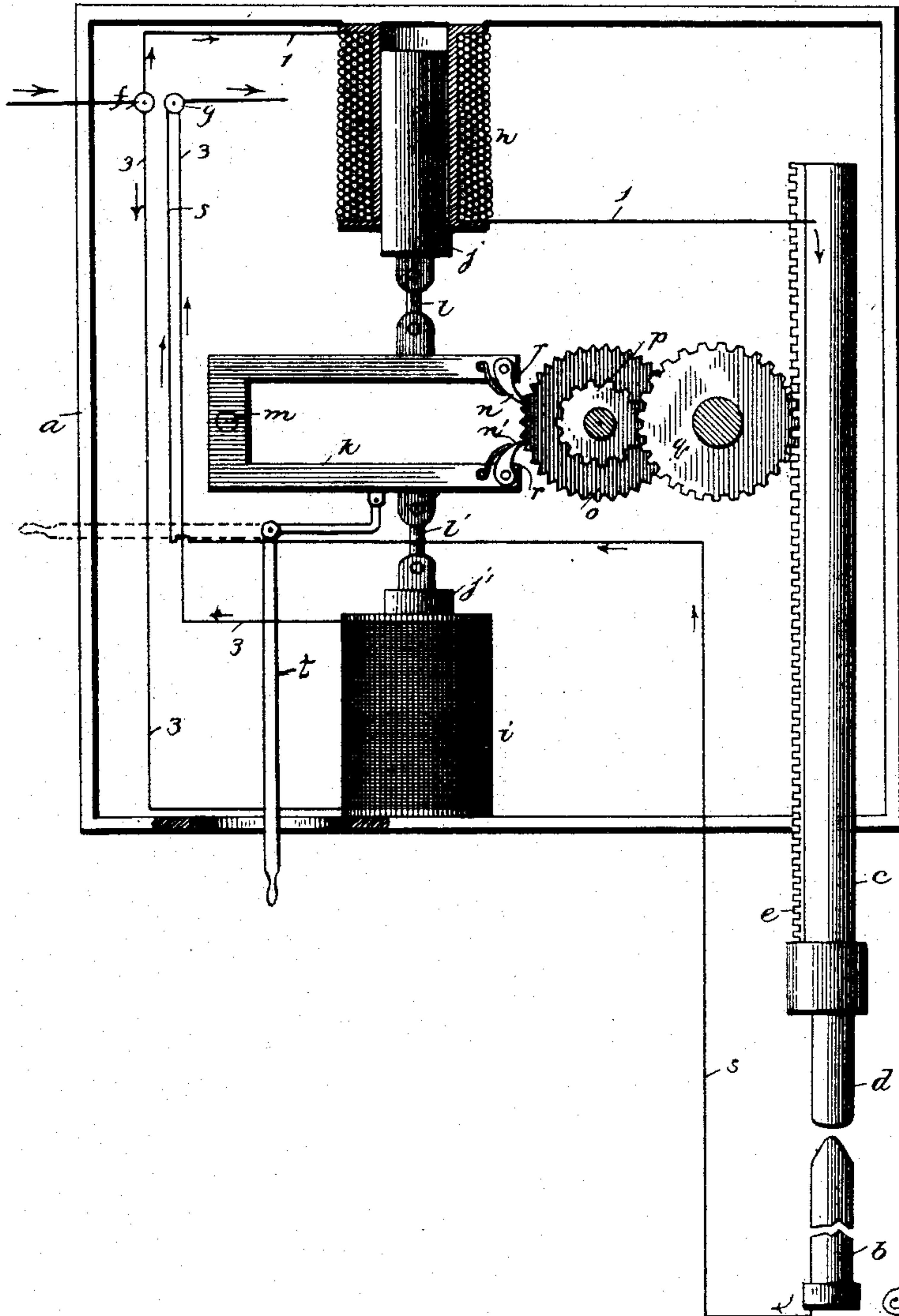
(No Model.)

F. P. COX.

ARC LAMP.

No. 411,713.

Patented Sept. 24, 1889.



Witnesses:

John Enders  
H. E. Peck.

Inventor  
Frank P. Cox

O. E. Duffy  
Attorney.



# UNITED STATES PATENT OFFICE.

FRANK P. COX, OF TERRE HAUTE, INDIANA.

## ARC LAMP.

SPECIFICATION forming part of Letters Patent No. 411,713, dated September 24, 1889.

Application filed May 24, 1889. Serial No. 311,917. (No model.)

*To all whom it may concern:*

Be it known that I, FRANK P. COX, of Terre Haute, in the county of Vigo and State of Indiana, have invented certain new and useful Improvements in Arc Electric Lights or Lamps; and I do hereby declare that the following is a full, clear, and exact description of the invention, which will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawing, and to the letters of reference marked thereon, which form part of this specification.

My invention relates to an improvement in arc electric lights or lamps.

The object of my invention is to provide an improved arc lamp, exceedingly simple, cheap, and effective in construction, the operative mechanism of which is composed of a minimum number of durable parts, reliable and sure in action, and wherein the length of the voltaic arc between the carbons is automatically regulated and the carbons kept the correct distance apart, and hence a constant and steady light produced by opposing electro-magnetic devices energized by the main and a shunt current, so that when the carbons are correctly adjusted the force of the magnetic devices will act against and neutralize each other; but when the carbons approach too near or recede too far from each other the force of one or the other (as the case may be) of the magnetic devices is increased and the resultant force of the two magnetic devices acting on each other actuates improved mechanical means to again adjust the carbons.

These objects are attained by, and my invention consists in, certain novel features of construction and in combinations of parts more fully described hereinafter, and particularly pointed out in the claims.

The accompanying drawing represents a section of the upper box of an arc lamp, showing portions of the upper and lower carbons and the improved regulating and feeding apparatus partially in section.

The operating or regulating mechanism of the lamp is preferably inclosed or supported within a suitable box or casing *a*. If desirable, the frame carrying the lower stationary carbon-stick *b* can be suspended from this box,

which box also carries the adjustable holder *c*, for the upper movable carbon *d*, removably secured to said holder. The holder *c* is vertically movable and is provided with a longitudinal rack or gearing *e*. The main line enters the lamp at the point *f* and extends to the upper-carbon holder through the connection *l*, and through the upper-carbon rod and carbon to the lower carbon, and through the connection *s* to the point *g*, and there connecting with the main line. A shunt or short circuit *3* from the main line connects the two points *f g*. In the upper portion of the box a vertical series coil or magnet *h* is located and included in the main circuit between the point *f* and the upper-carbon rod, said coil being wound on a suitable spool. A shunt-coil *i*, formed of fine wire on a spool, is included in the shunt-current, and preferably located in a vertical position beneath and a distance from the series coil *h*. Said coils are provided with the metal cores or armatures *j j'* which are sucked into the same when a current is flowing through the coils, and the outer ends of these cores are loosely connected with the upper and lower sides, respectively, of a pivoted and vertically-swinging frame or armature-lever *k*, preferably by means of the pivoted links *l l'*. This swinging frame is pivoted at its closed end, at *m*, to allow its opposite portion to swing in a vertical plane, and is approximately U-shaped, having two horizontal arms extending from the pivotal end of the frame, the core of the series coil being preferably connected to the upper arm and the core of the shunt-coil to the lower arm of the frame. Oppositely-extending pawls *n n'* are pivoted to the free ends of these arms of the swinging frame, and engage the teeth of a ratchet or notched wheel *o*, suitably mounted and provided with a concentric pinion *p*, secured thereto, and meshing with a suitably-journaled gear-wheel *q*, which gear-wheel meshes with the rack of the upper-carbon holder to raise or lower the same, the gear *q* being larger than pinion *p* to obtain the required relative movement of the carbon. It will thus be seen that the cores of the two coils pull on the swinging frame in opposite directions, and that if the frame is drawn down the pawl *n'* will disengage the notched or ratchet wheel, while the pawl



*n* will engage and turn the wheel. Each pawl is provided with a stop *r*, to prevent it, when being disengaged with the wheel, from falling into the next notch of the same, and thereby prevent the wheel from being turned by the other pawl. The current in the main and shunt circuits constantly passing through the respective coils therein keeps them energized, and these two electro-magnetic devices are so arranged and proportioned relatively to each other that when the arc is of the proper length their power or force is equal, and as they are opposed to each other the swinging frame remains stationary; but if the arc becomes too long the resistance in the main circuit is increased, and hence a larger amount of current will pass through the shunt-circuit and coil and less through the series coil, thereby increasing the power of the shunt magnetic device, and the resultant of the two opposing forces pulling on the swinging frame will draw the same down, and thereby rotate the notched wheel toward the left and lower the upper-carbon rod until the arc is reduced the proper length, when the parts of the operating mechanism are restored to their normal position. If the arc becomes too short, less current flows through the shunt magnetic device and more through the series magnetic device as the resistance in the main circuit is reduced, and hence the resultant of the two opposing forces draws the swinging frame up and raises the upper carbon through the medium of the gearing. As the carbons are fed together the resistance in the main circuit gradually decreases, the current in the main circuit gradually increases, while that in the shunt-circuit gradually decreases. Thus, as the carbons approach the proper positions the magnetism of the series and shunt coils also approach equilibrium, so that when the arc is of just the proper length the movements of the coils or magnets are just exactly balanced and the carbons are not brought too near together and then separated again, and hence the action does not continue except long enough to bring all the parts into proper position.

It will be readily seen that the device is exceedingly cheap, simple, sure, and reliable, and altogether automatic in action. When the main current is broken, the swinging frame drops by gravity, thereby allowing the carbons to come together, and the moment the circuit is closed again the frame is immediately lifted to its normal position by the series magnetic device and the carbons immediately adjusted. If desirable, dash-pots and springs can be added to steady the action. When the lamp is shut out of the current or circuit and the upper carbon and frame have dropped to their limits of downward movement, if it is desired to trim the lamp and insert a new upper carbon the armature is lifted to throw its upper pawl from engagement with the ratchet-wheel by means of a lever *t*, extending to the exterior of the lamp

and pivoted within the same and connected to the frame so that when the lever is swung the frame is lifted and the carbon-holder *c* can be raised and the old carbon removed and a new one inserted. This lever can be so formed and pivoted as to extend down through the bottom of the lamp, as shown, or it can extend through the side of the box, as shown by dotted lines.

It is clearly evident that various changes and modifications might be made in the form and arrangement of the parts described without departing from the spirit and scope of my invention; hence I do not wish to limit myself to the precise construction herein set forth; but,

What I claim is—

1. In an arc light, the combination, with gearing to positively adjust the carbons, of a freely and vertically swinging armature-lever or frame pivoted at one end and having a pair of parallel arms each provided with means, respectively, to operate said gearing in opposite directions to raise or lower the carbon, an electro-magnetic device directly acting on said lever to draw the same in one direction to operate the gearing to lengthen the arc, and an opposing shunt electro-magnetic device directly acting on said frame directly against the force of the main magnetic device to swing the frame in the opposite direction and actuate the gearing to lower the carbon, substantially as described.

2. In an arc light, the combination, with gearing to positively adjust the carbons and a notched wheel to operate said gearing in both directions, of a single freely-swinging armature-lever or frame having a pair of pawls to engage said notched wheel and respectively rotate the same in opposite directions when said lever is swung in opposite directions, a magnet in the main circuit to draw said lever in one direction and raise the carbon, and an opposing shunt-magnet to draw said lever in the opposite direction against the force of the main magnet to lower the carbon, substantially as described.

3. In an arc light, the combination, with mechanical means to adjust the carbons and a notched wheel to actuate the same to raise or lower the carbon, of an armature-lever pivoted at one end to swing in a vertical plane and having a pair of arms extending from the pivotal point toward said wheel, pawls on the ends of said arms to respectively and oppositely rotate the wheel when said lever is swung in opposite directions, a series coil directly above and having its armature connected to the upper arm of said lever to raise the same, and a shunt-coil directly below and having its armature connected to the lower arm of the same, substantially as described.

4. The combination of an approximately U-shaped frame pivoted at its closed end to swing in a vertical plane, oppositely-extending pawls on the ends of the arms thereof having stops, a ratchet-wheel rotated in oppo-



site directions by said pawls, gearing operated by said wheel, a carbon-holder having a rack engaged by the gearing, a vertical series coil located above and having a core loosely connected with the upper arm of said frame, and a vertical shunt-coil located below and having its core loosely connected with the lower arm of said frame, substantially as described.

5. In an arc light, the combination of a swinging frame to raise or lower a carbon, a series and a shunt electro-magnetic device to

swing the frame in opposite directions, and a lever connected with said frame and by which the same can be operated by hand to raise the carbon, substantially as described.

In testimony that I claim the foregoing as my own I affix my signature in presence of two witnesses.

FRANK P. COX.

Witnesses:

RICHARD DAHLEN,  
CHAS. D. JOHNS.