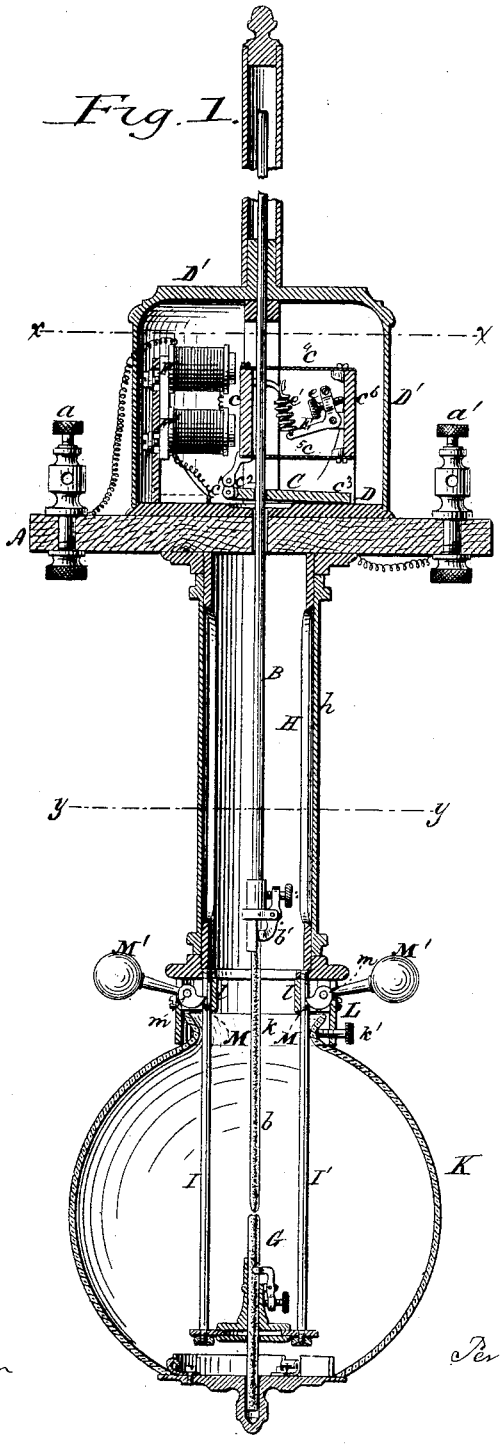
(Model.) 2 Sheets—Sheet 1.

E. WESTON.

ELECTRIC ARC LAMP.

No. 264,006. Patented Sept. 5, 1882.

Fig. 1.



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(Model.) 2 Sheets—Sheet 2.

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Figure 2.

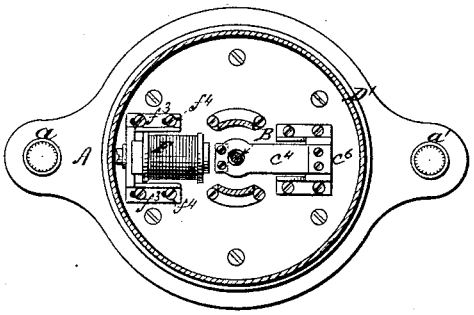


Figure 3.

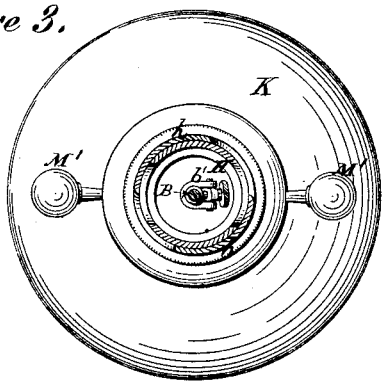
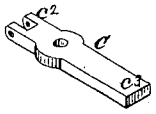


Figure 4.



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UNITED STATES PATENT OFFICE.

EDWARD WESTON, OF NEWARK, NEW JERSEY, ASSIGNOR TO THE WESTON ELECTRIC LIGHT COMPANY, OF SAME PLACE.

ELECTRIC-ARC LAMP.

SPECIFICATION forming part of Letters Patent No. 264,006, dated September 5, 1882.

Application filed October 6, 1880. (Model.)

To all whom it may concern:

Be it known that I, EDWARD WESTON, a subject of the Queen of Great Britain, and a resident of Newark, in the county of Essex and State of New Jersey, have invented certain new and useful Improvements in Electric-Arc Lamps, of which the following is a specification, reference being had to the accompanying drawings.

My improvements relate to that class of electric lamps in which the lower carbon is stationary and the upper carbon is allowed to descend by gravity in the act of feeding when by the lengthening of the arc the resistance of the circuit has increased to a predetermined extent.

My invention concerns mainly improvements in the construction of the regulating mechanism which controls the movement and position of the carbon-holder.

It also embraces improvements in the construction and disposition of the feed-regulating magnets, in the means of adjusting the same, and in other improvements, the nature of which will be hereinafter set forth.

In the accompanying drawings, Figure 1 represents in vertical section a lamp constructed in accordance with my invention; Fig. 2, a cross-section through the line *x x* in Fig. 1; Fig. 3, a section taken on line *y y;* Fig. 4, a view in perspective of a detached portion of the feed mechanism.

The lamp illustrated in the drawings, so far as the general principles of the feed-controlling mechanism are concerned, is typical of a well-known class of lamp termed "clutch" or "clamp" lamps. The general character and action of these lamps is substantially as follows.

The movement of an armature, a magnet, or equivalent mechanism—such as the well-known movable core and hollow helix—is availed of to raise the carbon holder or carrier through the instrumentality of a ring or perforated plate, which surrounds the said holder. On one side of the holder the ring or plate, which is usually termed the "clutch," is connected with or in any proper way arranged to be raised by the movable armature. On the other side of the holder there is arranged a stop—in many instances this stop is merely a part of the lamp-frame, upon which the clutch normally rests. If the armature is raised, the clutch is first tilted, and thus caused to grip the carbon-holder. A further movement of the armature will therefore carry up the clutch, and with it the carbon-holder. By the consumption of the carbons the armature is lowered, so that eventually the lower edge of the clutch again comes in contact with the stop. I have found it desirable, particularly so in lamps run in series, that the clutch should release the carbon-holder the instant that it encounters the fixed stop; otherwise the lifting-magnets are relieved of a part of their load, the obvious consequence of which is an undue elongation of the arc.

In order to obtain the release of the holder simultaneously, or approximately so, with the contact of the clutch and the fixed stop, I so construct or arrange the clutch that the points of support or connection with the movable magnet, and at which contact with the fixed stop is made, are in such relation to each other and the carbon-holder that practically the whole weight of the holder must be sustained by the lifting-magnets, except of course in the inappreciably short intervals during which the said holder is free and falls in the act of feeding. The plan preferred by me for the accomplishment of this result is to arrange the clutch mechanism in such manner that the point of contact with the stop shall be at a considerably greater distance from the carbon-holder than the point of connection with the armature, so that what may be regarded as the lifting-power required to release the clutch from the holder is so slight as not to cause an appreciable variation in the load of the magnets. The exact difference in distance from the carbon-holder of these two points will obviously vary according to circumstances. It is necessary, however, to the successful attainment of the results desired that the point on the clutch with which the fixed stop or its equivalent comes in contact should be several times (at least two and a half or three times) as far from the center of the carbon-holder as the point at which the clutch is connected with the armature. It

may be stated that this same end—viz., to increase several times the mechanical advantage in favor of the force which tends to free the clamp or clutch from the carbon-holder, as hereinafter described—may be attained by other equivalent means, as by the employment of compensating-levers, which connect to clutch to the movable armature. In other words, instead of increasing the leverage on one side of the carbon-holder, it may be decreased by the employment of ordinary levers on the other. This is illustrated in connection with a lamp constructed in a special manner; but I would state that it is equally applicable to many other forms of lamp.

In the drawings, the letter D′ represents a casing fixed on a base, A, and containing the feed-regulating mechanism. Above the casing D′ extends a tube, which is designed to contain the carbon-holder B when the latter is raised. Below the casing D′ is a tube or casing, H, which surrounds the carbon-carrier. To the bottom of this casing is secured the globe and support for the lower carbon, as will be more fully hereinafter set forth.

Around the carbon-holder B is a clutch or clamp, C, the principle of construction of which is illustrated in Fig. 4. It consists mainly of a plate perforated near one end, though, for sake of lightness, I prefer to form it as a ring having a tail-piece, c^3, and a short projecting ear, c^2, which may be fashioned in any desired way for readily connecting it with the movable armature.

The mechanism for operating the clamp C, by which the upper-carbon holder is controlled, consists of the soft-iron armature *c*, the lower end of which is connected by a link, *c′*, with the shorter end or bar c^2 of the clutch, the tail-piece of which should normally rest upon the bottom D of the casing D′, or upon any suitable stop that may be fixed or placed thereon. The armature *c* is held in a vertical position by means of two flat springs, c^4 and c^5, fastened respectively at one end to the upper and lower extremities of the armature and the opposite ends to a vertical standard, c^6, erected upon the floor D of the casing D′. The armature is adjusted with reference to the magnet which acts upon it by means of the adjustable elbow E, provided with the set-screw *e*, and connected with a hook affixed to the armature by means of the spiral spring *e′*. The armature is acted upon by two electro-magnets, F and F′, arranged one above the other, and presenting poles of respectively opposite polarities toward the armature. When no current is passing through the coils of the magnets F and F′ the upper end of the armature occupies a position nearly opposite the center of the pole of the upper magnet, while the lower end projects below the pole of the lower magnet. When the current passes through the coils of the magnets the armature, in obedience to the attractive force exercised upon it, moves upward without acquiring contact with the poles of the magnet. In moving upward the armature carries up the end c^2 of the clamp or clutch C and causes it to bind and lift the holder B, to the lower end of which the upper carbon is affixed by means of the screw-clamp *b′*.

By means of the adjustable elbow E the tension of the spring *e′* is varied, according to the amount of downward pressure required to adjust the armature with reference to the attractive force of the magnets F and F′, so that when there is a given diminution of the strength of current arising from the elongation of the arc, and the consequent weakening of the energy of the magnets, the weight of the carbon-holder *b* and the tension of the spiral spring *e′* will pull the armature *c* downward until the tail-piece of clamp C has come in contact with the plate or stop D. This sets the carbon-holder free and allows it to fall by its own gravity until by the approach of the upper carbon, *b*, toward the lower carbon, G, the length of the arc, and consequently the resistance in the circuit, is so diminished that the additional current flowing through the coils of the magnets F and F′ causes them to exert a preponderating force upon the armature in an upward direction, in obedience to which the armature rises and pulls up the clamp C until it binds upon and again holds the carbon-holder B stationary.

The magnets F and F′ are affixed to the upright standard *f* by means of the screws *f′*, which pass through the vertical slots f^2 in the standard. The standard *f* is provided with the feet f^3, (shown in Fig. 2,) which are secured to the plate D by the vertical screws f^4, which are inserted through slots in the feet f^3, so that the standard *f* and the magnets F and F′ are adjustable in a horizontal plane toward and from the armature. This capacity of both horizontal and vertical adjustment of the magnets with relation to the armature permits the accurate regulation of the lamp and facilitates the employment of a number of lamps in the same circuit by providing a convenient and effectual means of making their action uniform.

It will of course be understood that the magnets may be permanently affixed in position, and that the features of vertical and horizontal adjustability may be applied to the standard to which the armature is attached; but as the armature is connected with the clamp it is more convenient to make the magnets adjustable.

It may also be stated that instead of the single circuit around the magnets which I have herein described, I use in practice two circuits, one of which is that described, the other a shunt of high resistance, in which the current circulates in an opposite direction to that of the first. This, however, is a matter now well understood in the construction of series lamps.

The described construction and arrangement of magnets and armature form an important part of my present invention. It will be noted that the armature, from the character of its

supports, moves not in a vertical plane, but in the arc of a circle. In practice the magnets and armature are to be adjusted so that the latter, when at rest, shall be in the nearest position to the poles of the magnet of which it is capable, while at the same time its upper end should occupy a position nearly opposite the center of the upper magnet-pole. From this it will be seen that any movement induced in the armature by magnetic attraction will be upward and away from the poles of the magnet. In effecting this movement the lower pole acts to polarize the armature, while the upper pole exerts the lifting-power. By this means is attained a considerable range of movement without sensible variation in power, for the reason that as the attractive effect increases by the upward movement of the armature it is counteracted by the simultaneous movement of the armature away from the pole. For the attainment of this result it has been usual to employ helical magnets; but the present arrangement I deem preferable, as the helical magnets as commonly made are not as powerful nor as readily adjusted as those shown.

The second part of my invention, which I shall now proceed to describe, has for its object mainly the protection of the carbon-holder and other working parts of the lamp below the casing D′ from the effects of wind and weather. By the means which I have designed for accomplishing this other important objects are gained, the chief of which are that the possible accidents from contact of metallic bodies—such as a loose wire with two parts of the lamp, in which there exists a difference of potential—in this case cannot occur, and that the lamp may be handled without danger, while convenient and ready access is afforded to the carbons for the purpose of adjustment or renewal. These improvements (illustrated mainly in Fig. 1) are as follows: The lower portion of the sliding rod B is inclosed by a metallic tube, H, the upper end of which is affixed to the under side of the plate A, while at its lower end there are affixed the two vertical side bars, I and I′, of the frame, which supports the lower carbon and the glass shade which surrounds the arc. The tube H is longitudinally slotted in its opposite sides and surrounded by a similarly-slotted tubular shield, *h*. When the shield *h* is turned so that its slots coincide in position with the slots of the tube H, access is permitted to the upper-carbon holder, which facilitates the adjustment of the screw-clamp when a new upper carbon is required. The glass globe K has at the top an outwardly-turned flange, *k*, which is introduced into the lower end of the metallic sleeve L, having cast upon or otherwise affixed to its interior upon respectively opposite sides two shoulders, *l*, which are perforated to admit the vertical side bars, I and I′, of the frame. Each of these shoulders is vertically slotted to admit the weighted eccentrics M, which have horizontal axes of oscillation formed by the pivots *m*. The effect of the weights M′, affixed to the eccentrics, is to press the eccentrics against the side bars, I and I′. This result is further promoted by the weight of the globe K, which is secured to the sleeve L by means of the set-screws K′. By the pressure of the eccentrics against the vertical side bars, I and I′, the sleeve L, and the globe K thereto attached, are held stationary.

When it is desired to lower the globe—as, for example, to obtain access to the lower-carbon holder—the weighted ends of the eccentrics are lifted, and the eccentrics are thus withdrawn from contact with the vertical side bars, I and I′, and the sleeve and globe will then slide down by their own weight. When upward pressure is applied to the globe the eccentrics yield of themselves and slide along the vertical bars, allowing the globe to be pushed up. Upon the removal of the upward pressure the eccentrics immediately re-engage the bars, and again hold the globe stationary.

Various other modes of making the globe movable independently of the frame will of course suggest themselves. Thus the globe may be counterbalanced by weights hung from pulleys affixed to the frame of the lamp; or the side bars may be provided with ratchet-teeth, and spring-pawls may be pivoted in the sleeve L, to which the globe is suspended. In the latter case the pawls will of course be provided with outwardly-projecting arms, so that the ratchets may be sprung out of engagement with the teeth to permit the globe to fall. By this construction it will be observed that the carbons and carbon-holders are entirely inclosed, though very accessible. From this it results that the carbon-holder is protected from exposure to the weather, and is not so apt to become coated with dirt; the arc is not exposed to gusts of wind, which cause it to flicker; the escape of sparks or ignited particles of carbon is prevented, and the side rods commonly employed are dispensed with.

I am aware that a lamp in which the carbons and their holders, together with portions of the feed-controlling mechanism, are inclosed, and thus protected from the weather, is not new, and this I do not claim broadly.

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

1. In an electric lamp, the combination of a movable armature or its equivalent, a carbon-holder, a clamp or clutch surrounding the same and adapted to be raised by the armature, and a stop or rest in the line of downward movement of the clamp, the said clamp or clutch being constructed and arranged to operate in conjunction with the parts specified as a lever, in which the mechanical advantage in favor of the power required to release it from the carbon-holder is several times greater than that of the power which causes it to bind the same, substantially as and for the purpose set forth.

2. In an electric lamp, the combination of a

movable armature or its equivalent, a carbon-holder, a clamp or clutch surrounding the same and connected with the armature at one end, and a stop or rest in the line of downward movement of the clamp, the perforation in the clamp being closer to the point of connection with the armature than to the point of contact with the stop or rest, substantially as and for the purpose set forth.

3. A clamp or clutch for electric lamps, consisting of a perforated plate, C, having an ear or extension, c^2, for connection with the movable armature, and a tail-piece or elongation, c^3, substantially as set forth.

4. An electro-magnet the two opposite poles of which occupy parts of the same plane, in combination with an armature-bar flexibly supported in a parallel plane in front of one pole and partially in front of the other pole, and having an endwise movement induced by an increase in the attractive force of the magnet, during which there is an increase in the distance of the plane occupied by the armature-bar from the plane occupied by the poles of the magnet.

5. In an electric lamp, an armature having an endwise path of movement across the magnetic field in front of one pole and into and across a portion of the field in front of the other pole, in combination with an electro magnet or magnets provided with both vertical and horizontal adjusting devices, substantially as and for the purpose set forth.

6. In an electric lamp, a plate sustaining the feed mechanism and a casing or hood inclosing the same, in combination with a tube attached to the plate and inclosing the upper carbon holder and carbon, a frame depending from said tube and supporting the lower carbon, and a globe or shade connected with the frame and surrounding the source of light, as set forth.

7. The combination, with the casing containing the feed mechanism of an electric lamp, of a tube surrounding the carbon-holder, a frame depending from the tube and supporting the lower carbon, and a globe or shade carried by the frame and adjustable vertically thereon, as set forth.

8. In an electric lamp, the combination, with the casing containing the feed mechanism, of a slotted tube, H, and shield h, surrounding the carbon-carrier B, substantially as and for the purpose set forth.

9. The combination, with the box D′, inclosing the feed mechanism, and casing H, depending therefrom, of a frame, I I′, and a globe supported by said frame and vertically adjustable thereon, as set forth.

10. The sleeve L, provided with devices for the suspension therefrom of the glass shade K, and with the weighted eccentrics M, in combination with the side bars, I and I′, of the frame, substantially as and for the purpose set forth.

11. An electric-lamp frame consisting of a box or cover inclosing the feed mechanism, a casing surrounding the gravitating carbon-carrier and provided with a door for permitting access to the same, a support for the lower carbon, and a globe-holder connected to the said casing, these parts being constructed and combined in substantially the manner hereinbefore set forth.

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Witnesses:
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