(No Model.) 3 Sheets—Sheet 1.

J. J. WOOD.

ELECTRIC ARC LAMP.

No. 303,245. Patented Aug. 5, 1884.

Fig. 1.

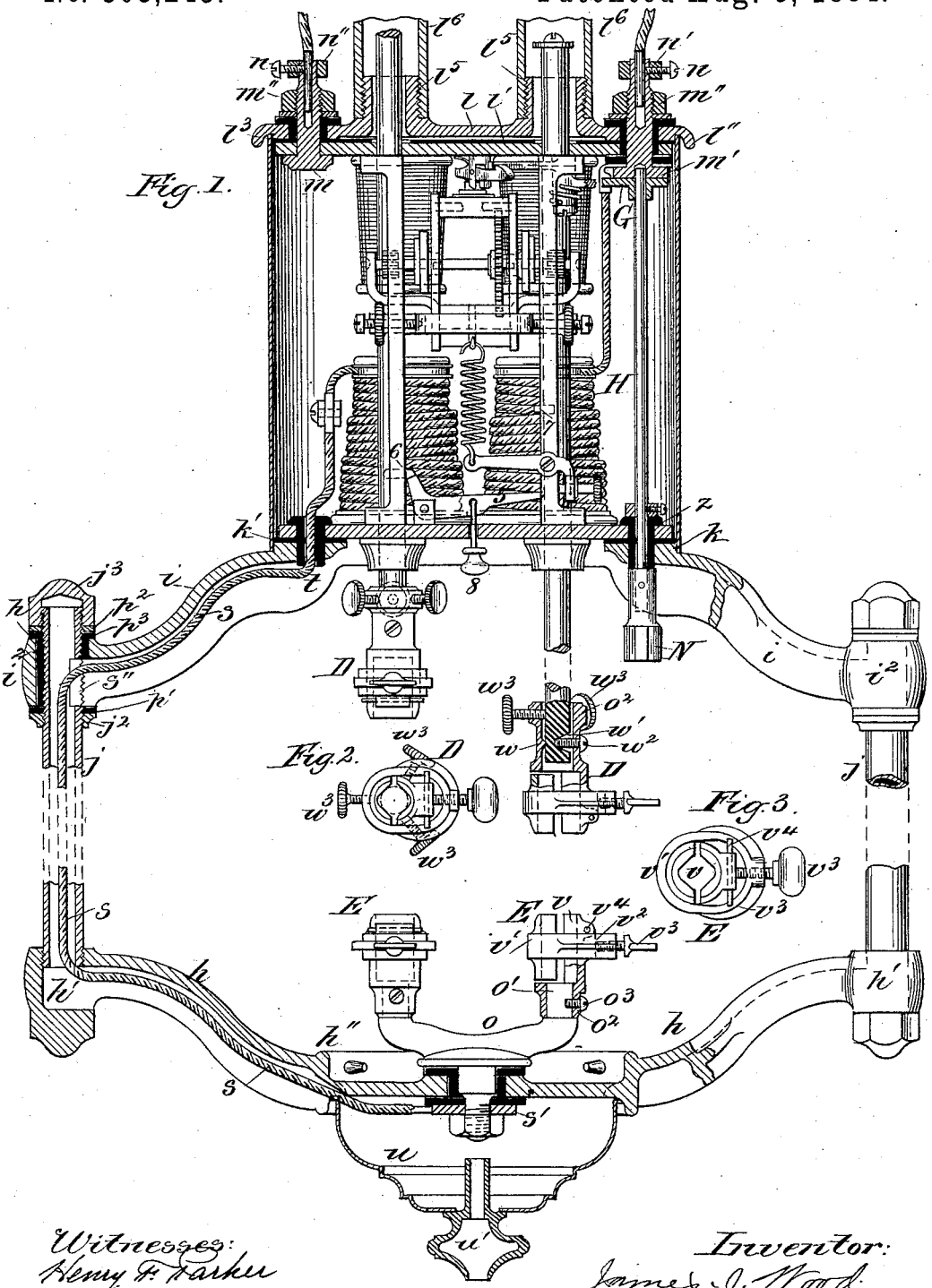

Fig. 2.

Fig. 3.

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Fig. 4.

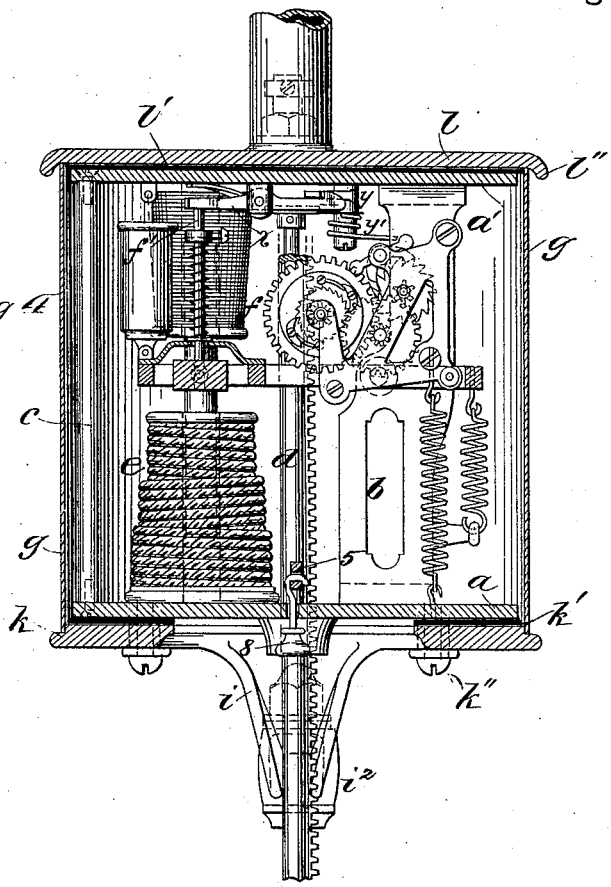

Fig. 5.

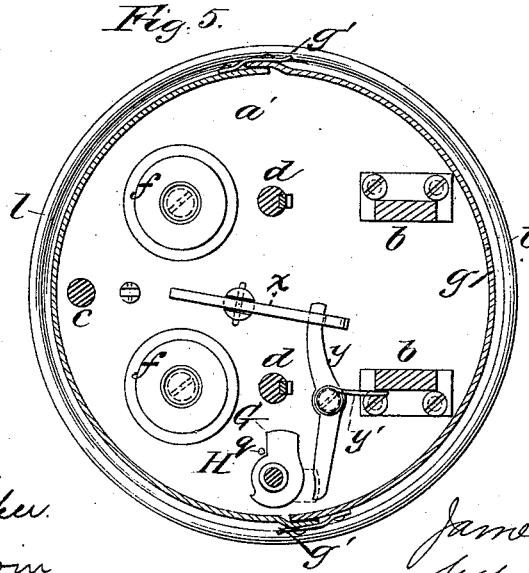

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Fig. 6.

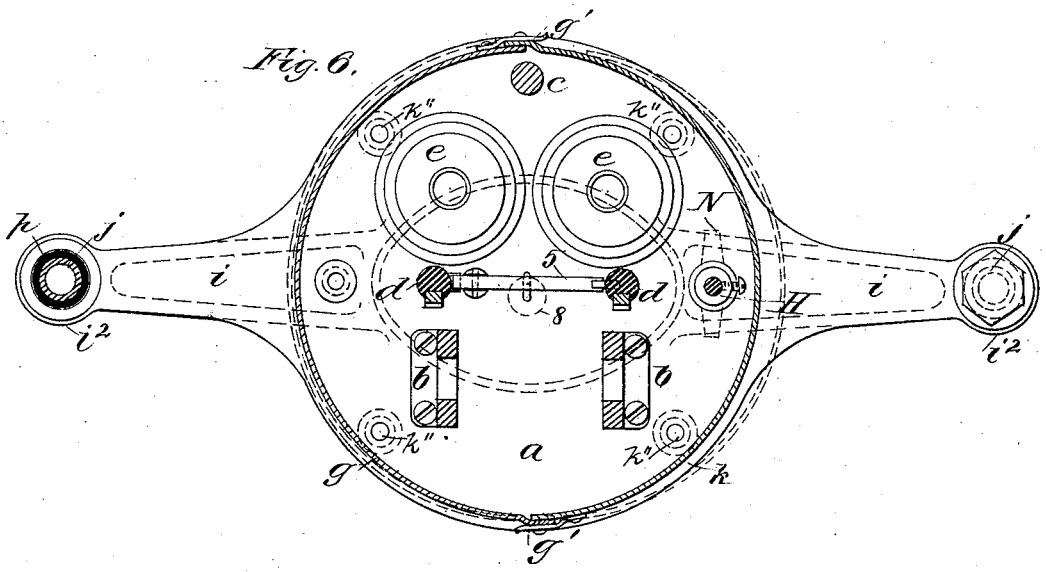
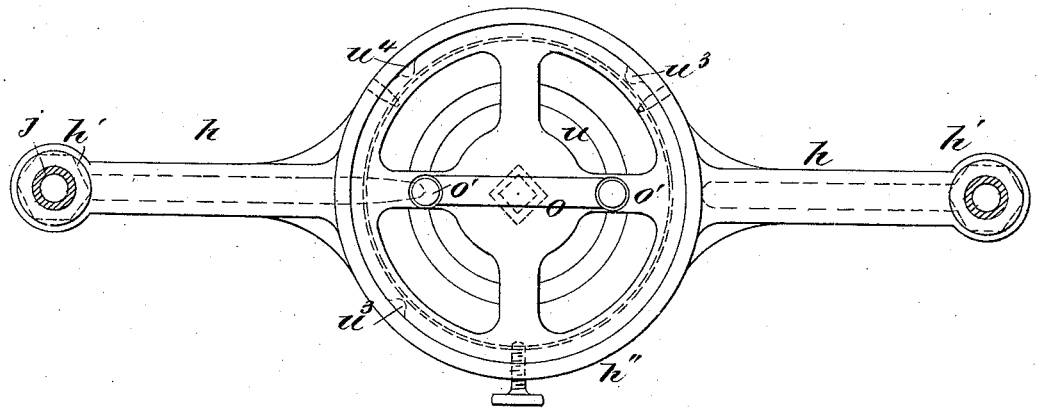


Fig. 7.



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UNITED STATES PATENT OFFICE.

JAMES J. WOOD, OF BROOKLYN, NEW YORK.

ELECTRIC-ARC LAMP.

SPECIFICATION forming part of Letters Patent No. 303,245, dated August 5, 1884.

Application filed October 16, 1883. (No model.)

To all whom it may concern:

Be it known that I, JAMES J. WOOD, of Brooklyn, Kings county, New York, assignor to THE FULLER ELECTRICAL COMPANY OF NEW YORK CITY, have invented certain new and useful Improvements in Electric Lamps, of which the following is a specification.

My present improvements apply more especially to electric-arc lamps for outdoor use; and one of the main objects is to protect the mechanism against the incursion of wet, and also to so insulate the exterior of the lamp from the circuit-connections that the exterior of the lamp may be handled with impunity and without danger of shock, which will be possible only by simultaneously seizing the two binding-posts or the two carbon-holders.

One leading feature of my invention, therefore, lies in the special manner of this insulation.

My invention also lies in an overhanging eaved head on the lamp-frame, with a casing fitting in under the same, whereby the wet is better shed from the frame and prevented from getting into the mechanism; also, in the special construction of the casing, the special construction of the carbon clamps or holders, the special construction of the binding-posts, and in other details.

A prominent novel feature also lies in the peculiar construction and arrangement of the hand-switch for voluntarily cutting the lamp out of circuit, and of the automatic safety-switch which acts in conjunction therewith, as hereinafter fully set forth.

In the drawings annexed, Figure 1 presents a front elevation, partly in section, of my improved lamp. Fig. 2 is an inverted plan of one of the upper-carbon clamps, and Fig. 3 is a plan view of one of the lower clamps. Fig. 4 is a sectional side elevation of the mechanism case or upper portion of the lamp. Fig. 5 is an inverted plan of the upper head of the said case and Fig. 6 a plan of the lower head. Fig. 7 is a plan of the lower cross-bar of the harp holding the lower-carbon shade, &c.

Insulation is shown by solid black shading.

The lamp here illustrated is of the duplex form—that is, provided with two successive sets of carbon-holders and carbons, the second set of which goes into action after the first set is exhausted, such as shown in the former patent granted to me June 12, 1883, No. 279,472—and the general regulating mechanism of the lamp, apart from the novel features before noted, is substantially the same as shown in that patent and in other previous patents granted to me. This mechanism being therefore well known and fully illustrated in the drawings, no special description of the same will be here necessary for the understanding of experts in the business.

The mechanism frame of the lamp consists, as usual, of the two circular metallic plates *a' a*, respectively, at top and bottom of the lamp-head, which are rigidly joined by the two standards *b b* and the rod *c*, as shown fully in Figs. 1, 4, and 5. The two upper-carbon holders *d d* slide through these plates *a a'*, and are in metallic connection therewith, and the holders are engaged, in the usual manner, with the usual mechanism between the heads, as illustrated. In this mechanism *e* indicates the main or separating magnet, which is in direct circuit with the arc, and *f* the minor or feeding magnet, which is in a shunt around the arc, according to the now generally adopted practice. *g* indicates the cylindrical case which surrounds the head-plates *a a'*, and incloses the mechanism of the lamp. *h* indicates the lower cross-bar of the harp of the lamp, which supports the lower-carbon holders and carbons, and the shade or globe around the arc. *i* indicates the upper cross-bar of the harp, and *j j* the upright rods of the harp, which extend from the ends of the upper bar to the ends of the lower bar, as usual, the harp being thus suspended from the lower head-plate, *a*, of the lamp, as usual.

Now, heretofore in lamps of this class the head-plates *a a'* formed the external plates or heads of the lamp-frame, and the upper cross-bar, *i*, of the harp was cast integral with the lower head-plate, *a*. In my present improvement, however, the head-plates *a a'* are internal insulated plates electrically isolated from the external heads or frame-work of the lamp, as will be noted from Fig. 1, and it will also be seen that the upper harp-bar, *i*, is cast separately from the head-plate *a*, and is furnished

with a circular rim or plate, *k*, a little larger in diameter than the head-plate *a*, (see Figs. 1 and 6,) which rim *k* underlies the plate *a;* but a circular sheet or disk, *k'*, of gelatinized fiber or other insulator is interposed between the rim and the plate *a*, and the three are rigidly secured together by four screws, *k''*, (see Figs. 4 and 6,) which screw into the plate *a*, and are insulated at the neck and head from the harp, rim, or plate *k*, as shown best in Fig. 4. The harp-plate *k* is formed with a central oval opening, (shown in section in Figs. 1 and 4, and by dotted lines in Fig. 6,) and the insulating-plate *k'* is formed with a similar opening, and the carbon-holders descend through said openings without making contact with the harp-plate, as shown in said figures. Now, over the upper head-plate, *a'*, is placed an external metallic covering or roofing plate, *l*, and between the two is placed an insulating-plate, *l'*, and the three plates are rigidly held together by the two binding-posts *m m'*, (see Fig. 1,) which posts, as will be noted, are so constructed as to serve as bolts to hold said plates together, and also as clamps or sockets for the circuit-wires. Each of the binding-posts, as will be noted, is formed with a head on the lower end like a bolt, and with a stem, which passes up through the plates, which is threaded at about its middle to receive nuts *m''*, whereby the plates are clamped firmly between the heads and nuts, as shown. The head of the positive post *m* is in direct metallic contact with the plate *a'*, but is insulated, as shown, from the roofing-plate *l*, while the negative post *m'* is insulated from both plates, as illustrated well in Fig. 1. The stems of these bolt-like binding-posts project some distance above the nuts *m''*, and are bored with vertical holes or sockets to receive the circuit-wires, in which they are held by binding-screws *n*, which screw through a strengthening-collar, *n'*, which encircles the slender tips of the posts, the tips of the screws passing through corresponding holes in the sides of the posts, as shown in Fig. 1.

The roof-plate *l* is formed, as seen in Fig. 1, with the tubular necks l^5, through which the carbon-holders rise without making contact therewith, and over which necks are screwed the usual inclosing and suspending tubes, l^6. This roofing-plate *l* is also formed, as shown well in Figs. 1, 4, and 5, with overhanging caved edges *l''*, and with a rim, l^3, under said overhanging edge, which is of a little larger diameter than the top plate, *a'*, and of the same diameter as the rim *k* on the harp plate or bar *i*, and the inclosing-casing *g* fits closely around the said rims b^3 *k* without making contact with the head-plates *a a'*. The upper edge of the casing therefore fits in under the caved edges *l''*, which thus overhang the top of the casing like the eaves or cornice of a roof, preventing the rain or wet getting into the case, but shedding it freely from the overhanging edges, as will be understood.

Referring to Fig. 5, it will be seen that the casing *g* is made in two half-cylindrical sections lapping at the joints, and fastened by hooks *g'* at each joint, so that it can thus be readily clasped around the rims l^5 *k* under the caves of the roof-plate, and as easily removed when required.

Referring to Figs. 1, 6, and 7, it will be seen that the arms of the harp-bars *i* and *h* are cast with hollow or grooved under sides, being thus in cross-section like an inverted **U**, and that the rods *j j* are tubular, usually wrought-iron pipe. The ends of the arms on the upper bar, *i*, are cast with hollow hubs i^2, into which the grooves on the under side of the arms are continued, as illustrated. The arms of the lower bar, *h*, are also cast with hollow hubs *h'*, but with nut-like terminals, as shown, and the underlying grooves are also continued into the hollows of said hubs, as shown in Fig. 1. Now, the upper ends of the tubular rods *j* are threaded and pass through an insulating-sleeve, *p*, in the hubs i^2, a collar, j^2, at the lower end of the thread, abutting against an insulating-washer, *p'*, which abuts against the hub, while a cap-nut, j^3, is screwed over the upper end of the thread down against a washer, p^2, and an insulating-disk, p^3, which abuts against the top of the hub, thus securing the harp-rods firmly to the upper harp-bar by an insulated connection, as will be understood. The lower ends of the rods *j* are also threaded, but only for a short length, and screwed directly into the hub of the lower bar, as shown on the left of Fig. 1, and the nut-like terminals *h'* on the bottom of the hub simulate and correspond to the cap-nuts j^3 at the top, and thus impart a finished appearance to the harp.

The lower-carbon clamps E (see Fig. 1) are fastened on the forked stand *o*, which is secured to the center of the shade-holding ring *h''* of the harp-bar *h* in about the usual manner shown, and is fully insulated therefrom, as represented. Now, a concealed and covered or insulated wire, *s*, connects at one end metallically to a washer, *s'*, which is clamped to the stem of the forked stand *o*, as shown in Fig. 1, and this wire is conducted along the grooves in the under side of the left arm of the harp-bar, turns into the hub on the end thereof, rises through the left tube *j*, and thence out of a lateral opening, *s''*, cut through the top of the same, and thence into and along the groove of the upper harp-arm, *i*, and finally rises through an insulating-thimble, *t*, socketed through the plates *a k*, and connects to one end of the coils of the main magnet *e*, the opposite end of which connects to the negative post *m'*, as usual.

The course of the current through the lamp and the effect of the insulations shown will now be readily understood and appreciated. Referring therefore to Fig. 1, it will be seen that the current will enter by the positive post *m*, pass thence to the head-plate *a'*, thence through the same to the uprights *b e*, to the

lower plate, *a*, and to the upper-carbon holder *d* and from thence to the upper carbon, crossing the arc to the lower carbon, and from thence to the lower-carbon stand *o*, thence through the concealed wire *s* to the magnet *e*, and, finally, off by the negative post *m'*. It will therefore be seen that by the insulated construction set forth substantially the entire external frame-work of the lamp is insulated from the circuit—that is, the roof-plate *l*, the case *g*, the harp-bars *i h*, and rods *j*—and hence these parts may be handled with impunity without receiving a shock; or any of these parts and one of the carbon-holders may be grasped simultaneously without receiving a shock, which will be only possible where the positive and negative carbon-holder or the positive and negative binding-post are grasped simultaneously—a contingency which would hardly ever be likely to occur in the efforts of novices, and practically never in the case of electricians or experienced persons. Hence, by this means, the handling and operating of the lamp is rendered exceedingly safe, either for novices or experts, and slight adjustments of the carbons or holders may be made without requiring to switch out the lamp and without danger of receiving a shock. Furthermore, in case wires or other conductors fall about or come in contact with the exterior of the lamp in outdoor or indoor use, they will not conduct away any current or cause any sparking, heating, or ignition, as might otherwise occur, with incendiary effect. In case, also, a fire occurs about or in premises supplied with electric lights, the firemen, who are not usually experts in electricity, can handle and remove the lamps without danger of receiving shocks, as has heretofore occurred with serious effects.

In former constructions of lamps it will be noted that the head-plate *a'* formed the external or roof plate of the lamp, and the lower plate, *a*, and harp-bar *i* were cast in one, and both situated in the circuit, whereas the lower carbon was in connection with the lower harp-bar and with the rods *j*, which were, however, insulated from the upper harp-bar, while an insulated wire connected the top of the harp-rods with the magnet *e*, so that therefore the case *g* and the external top plate of the lamp and the upper harp-bar, *i*, were in a positive part of the circuit, and the lower harp-bar and rods in the negative part, so that many chances were thus offered for receiving a shock, which are entirely obviated by my improvements.

Referring to Fig. 1, it will be noted that the lower-carbon stand *o* is not only insulated at its base from the harp-bar *h*, but that the harp-rods *j* are also insulated at the top from the upper harp-bar, *i*; hence in case the insulation of the stand *o* becomes carbonized from the heat, and therefore useless, as sometimes occurs, the upper insulation will still remain effective, thus covering all contingencies by this double insulation.

Referring to Figs. 1 and 7, it will be seen that the forked carbon-stand *o* rises from the center of an open-paneled grating within the shade-holding ring *h''*, and below this grating, within the lower edge of the ring, is placed a removable cup, *u*, which catches the carbon dust or ashes falling from the carbon points, and thus prevents the same from falling on and soiling objects over which the lamp may be suspended. This cup has a hollow knob, *u'*, at the base, having a tubular neck, which rises a short distance within the cup, and hence while dust or solid matter will be retained in the base of the cup when the lamp is used indoors, yet rain or water running into the cup when the lamp is used outdoors will readily flow out through the hollow knob *u'*. The upper edge of the cup *u* is held in the base of the shade-ring by a form of bayonet-fastening, consisting, as shown by dotted lines in Fig. 7, of two projections, u^3, on the ring *h''*, and one notch, u^4, on the rim of the cup, so that the cup can thus be readily fastened in place or removed by a simple tilting and rotary motion, as will be readily understood.

The carbon-clamps, as shown in Fig. 1, are of somewhat novel construction, as will be now described. It will be seen that the lower clamps, E, are not formed solid on the forked stand *o*, as heretofore, but that the stand terminates with necks or tenons *o'*, each of which fits into a sleeve, o^2, on the base of the clamp, which sleeve is secured to the neck by a set-screw, o^3. Consequently, if the clamp should become damaged or burned at any time by the arc being allowed to burn down too close to the clamp, the damaged clamp can thus be simply removed and replaced by a new one without requiring to remove the entire stand, as heretofore. The lower clamps, E, as shown in Figs. 1 and 3, consist of a fixed jaw, *v*, integral with the sleeve o^2, and having a V-shaped clamping-face. This jaw is confronted by the movable jaw *v'*, having a similar clamping-face, which together form a square-shaped socket for the carbon, as seen in Fig. 3, and this movable jaw is formed with a loop or bail, v^2, which encircles the fixed jaw, and through the bail is screwed the binding-screw v^3, which bears on the fixed jaw, and by turning which one way or the other the jaws are closed or opened to grasp or release the carbon. The lower end of the movable jaw rests on the top of the sleeve o^2, and a pin, v^4, is driven through the upper jaw above the bail v^2, and thus holds the two jaws in engagement, preventing the movable jaw from rising out of place. The upper-carbon clamps D are of the same construction as the lower clamps, as fully shown in Figs. 1 and 2, except that their sleeves o^2 are longer and larger, and these fit over the ends of the carbon-feeding rods *d d*. The bore of these sleeves is larger than the rods, and on one side thereof is a slight spur or pivotal protuberance, *w*, which bears on one side of the rod, while the

opposite side of the rod is bored with a conical socket-hole, w', in which the point of a screw, w^2, passing through the opposite side of the sleeve is socketed. Through the top of the sleeve three adjusting-screws, w^3, pass at equidistant radial positions and bear on the carbon rod; hence this connection of the clamp with the rod forms a very simple and effective form of ball-and-socket or universal joint, so that by adjusting the screws w^3 the clamp may be tilted slightly in any direction, so as to bring the point of the upper carbon in true line with the lower carbon, as will be readily understood.

The safety-switch or cut-out device in this lamp is substantially the same as that shown in my former patent, No. 261,289, of July 18, 1882, except in the construction, location, and operation of the hand-switch.

Referring to Figs. 4 and 5, y indicates the safety-switch lever, which is substantially identical with that in my former patent, except that in this case it is a lever of the first order, and pivoted wholly beneath the head-plate a'. This switch-lever, when set open against the stress of its spring y', as shown in Figs. 4 and 5, is engaged by the hooked end of the trigger-lever x in precisely the same manner shown in my former patent. Now, the hand-switch is indicated at G in Figs. 1 and 5, which, instead of being in the form of a knobbed crank-arm, as heretofore, is in the form of a cam-hub affixed on the upper end of a vertical rock-shaft, H, (see Fig. 1,) which is stepped at its upper end in the base of the negative binding-post, and passes at its lower end through an insulating bearing-sleeve, z, through the base of the lamp-frame, and is provided on its protruding end with a non-conducting T-shaped head or manipulating-handle, N, so that the manipulating knob or handle of the hand-switch is thus in convenient position below the lower head-plate of the lamp beneath the harp-bar i, as shown. Now, the outer arm of the switch-lever y has a convex face, adapted to fit against either the hub or the projecting wing of the cam G, as will be understood from the full and dotted lines in Fig. 5. The rock-shaft H and its cam G have a limited rotary motion, being limited by the stop-pin q, as shown in Fig. 5, to about one-quarter of a revolution.

In the position of parts shown in Fig. 4 it will be seen that the safety-switch is set open and there engaged by the trigger-lever x, and that the hand-switch is also set open as the wing of the cam G is turned to one limit of its motion away from the contact-face on the safety-switch y. It will therefore be seen that as the safety-switch is in contact with the head-plate a it is hence of positive polarity, whereas the cam G of the hand-switch, being in connection with the negative binding-post m', is of negative polarity, so that, hence, if the safety-switch y and hand-switch G come into contact, a short circuit will be established between the two terminals of the lamp, and the lamp will be thus cut out of circuit. Now, these parts will be automatically brought into contact whenever the arc becomes abnormally long, in the same manner shown in my former patent, and illustrated in Fig. 4—that is, by the abnormal rise of the armature of the magnets e f, which will force the pin f' against the inner end of the trigger-lever x, thus tripping this lever and releasing the safety-switch lever y, which will at once fly into contact with the hub of the cam or hand-switch G by the action of its spring y', thus automatically switching the lamp out of circuit. If, after this release of the safety-switch, the hand-switch be rotated, the wing of the cam will sweep against the contact end of the lever, as shown by dotted lines in Fig. 5, and thus again move it out into its set position, where it will be engaged by the trigger, as before, but the lamp will still remain manually cut out while the wing of the cam is in contact with the lever. When, however, the hand-switch is rotated back again to the normal or open position, as shown by full lines in Fig. 5, it will leave the safety-switch y held by its trigger, and breaking contact therewith, will thus open the switch and put the lamp again into circuit, as will be readily understood; hence the automatic movement of the safety-switch toward the hand-switch will always cut the lamp out of circuit, as will also the manual movement of the hand-switch toward the safety-switch, whereas this movement of the hand-switch also serves to open and set the safety-switch, after which the retreating movement of the hand-switch leaves the safety-switch set, and opens both switches in substantially the same manner claimed in my former patent. In this improvement, however, it will be seen that the contact and automatic parts of the switch are all inclosed within the lamp-case, and only the manipulating-knob of the hand-switch is on the exterior of the lamp, and the knob being a non-conductor and the exterior of the lamp being insulated, there is no possibility of receiving a shock in manipulating the switch.

As before remarked, the lamp here shown is duplex, with two sets of carbon-holders, as shown best in Fig. 1. The succeeding carbon-holder is held off the actuating mechanism in the manner shown in my Patent No. 279,472, June 12, 1883, by means of the trip-lever 5, the short arm of which engages with a projection, 6, on the said holder, while the long arm projects into the path of a projection, 7, on the leading holder, so that hence, when the leading holder arrives at the end of its stroke by the consumption of its carbon, the lever 5 will be tipped and the succeeding holder released, and thus allowed to go into action. I formerly arranged this trip-lever under the upper head-plate; but I now arrange it on the lower head-plate, and connect to the lever a pendent knob, 8, preferably of insulating material,

which hangs below the head between the carbon-holders, and by pulling which the second holder can be manually released and allowed to descend, when it is desired to bring it down, which is frequently required to be done.

It will be noted that many of the improvements herein described will apply equally well to motors when arranged in circuit, like arc lamps. In fact, an arc lamp may itself be considered an electric motor, as well as an electric light, and I shall therefore consider an electric motor as the equivalent of an electric lamp, so far as some of my improvements are concerned.

What I claim is—

1. An electric lamp having its mechanism case or frame formed with the internal metallic head-plate *a'*, placed in the circuit, and the external roof-plate, *l*, placed over the same and insulated therefrom and from the circuit.

2. An electric lamp constructed with the internal head-plate *a*, arranged in the circuit, and the outer plate, *k*, having the arms *i*, fastened to and insulated from the former, and formed with a central isolating opening to permit the projection of the carbon-holder from the inner plate, substantially as herein set forth.

3. An electric lamp having its mechanism frame constructed with the inner metallic heads, *a a'*, and outer metallic heads, *l k*, with intervening insulating-plates *l' k'*, and an inclosing-case, *g*, fitting between said outer heads and out of electric contact with the inner heads.

4. In an electric lamp, the combination, with the mechanism case, of the recessed or grooved harp-bars *i h*, having hollow hubs *h' i²* on the ends, into which the grooves are continued, in combination with the tubular rod or rods *j*, fastened at each end in said hubs, and the covered and concealed wire *s*, passing through said tubular rod and grooves from the lower-carbon holder to the upper magnet or mechanism.

5. The combination, with the trigger *x*, safety switch lever *y*, and hand-switch G, arranged in relation with each other and with the magnet mechanism, substantially as set forth, and all placed within the inclosed case of the lamp, with the manipulating knob or handle of the hand-switch placed on the exterior of the case.

6. The combination, with the rotary switch-cam G, with the contact-lever *y*, and other necessary co-operative parts, of the rock-shaft H, connected with said cam, and the rotary manipulating-knob N, fixed to said rock-shaft.

7. In an electric-arc lamp, the removable dust-cup *u*, placed below the lower carbons, with its hollow knob *u'*, substantially as and for the purpose set forth.

8. The forked carbon-stand *o*, having necks or tenons *o²*, in combination with detachable carbon-clamps having sleeves adapted to fit onto said necks, substantially as and for the purpose set forth.

9. A carbon-clamp formed with the fixed jaw *v*, having the retaining-pin *v¹*, with the movable jaw *v'*, having the encircling-bail *v²*, and clamp-screw *v³*, arranged and operating substantially as and for the purpose set forth.

10. The combination, with the carbon-carrier rod *d*, having the tapering socket-hole *w'*, of the carbon-clamp having a sleeve to encircle the rod and the radial adjusting-screws *w³*, bearing thereon, with a pivotal seat, *w*, on one side of said sleeve and a pin or screw, *w²*, on the opposite side projecting into said socket-hole, substantially as and for the purpose set forth.

11. In an electric lamp of the kind described, the combination, with the carbon-holders *d d*, having the projections 6 7, of the trip-lever 5, pivoted on the lower head-plate, *a*, with the pull-knob 8 depending below said plate and connecting with said lever, substantially as and for the purpose set forth.

12. In an electric lamp, the combination, with an overhanging roof-plate, *l*, of the inclosing-case *g*, fitting under said plate and made in two sections lapping together and fastened together by detachable hooks or catches, substantially as set forth.

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