No. 638,789. Patented Dec. 12, 1899.

J. J. WOOD.

ELECTRIC ARC LAMP.

(Application filed Aug. 25, 1898.)

(No Model.) 3 Sheets—Sheet 1.

FIG. 1.

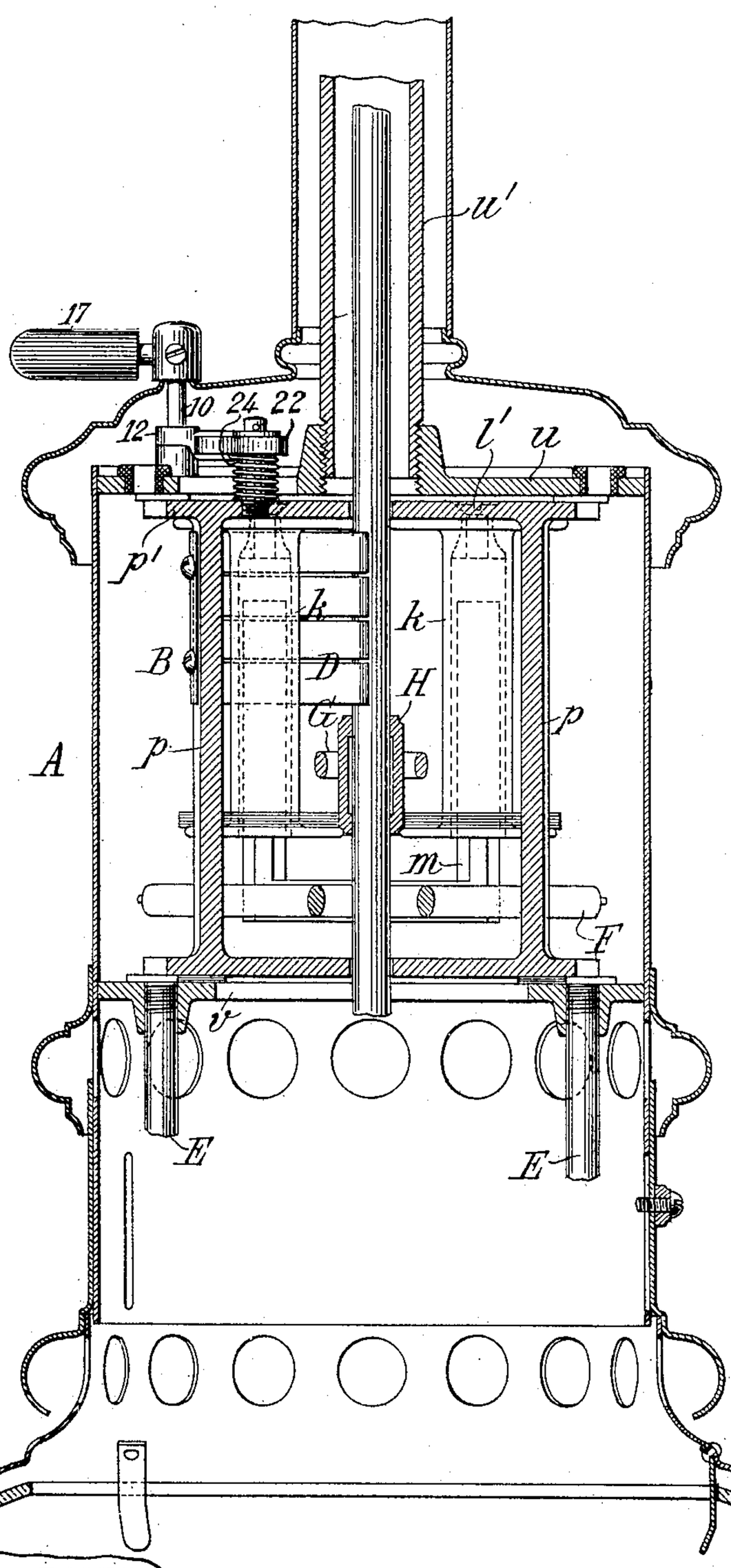


FIG. 12.

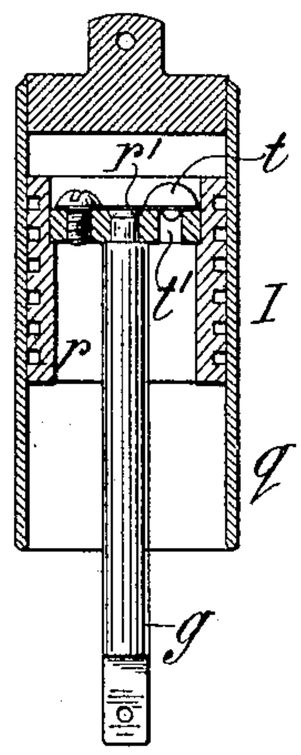


FIG. 13.

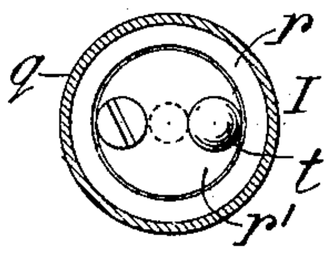
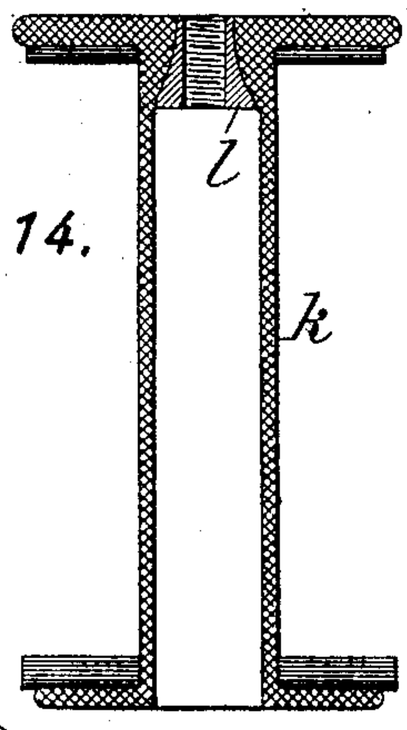


FIG. 14.



WITNESSES:
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René Bruine

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No. 638,789. Patented Dec. 12, 1899.

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(No Model.) 3 Sheets—Sheet 2.

FIG. 2.

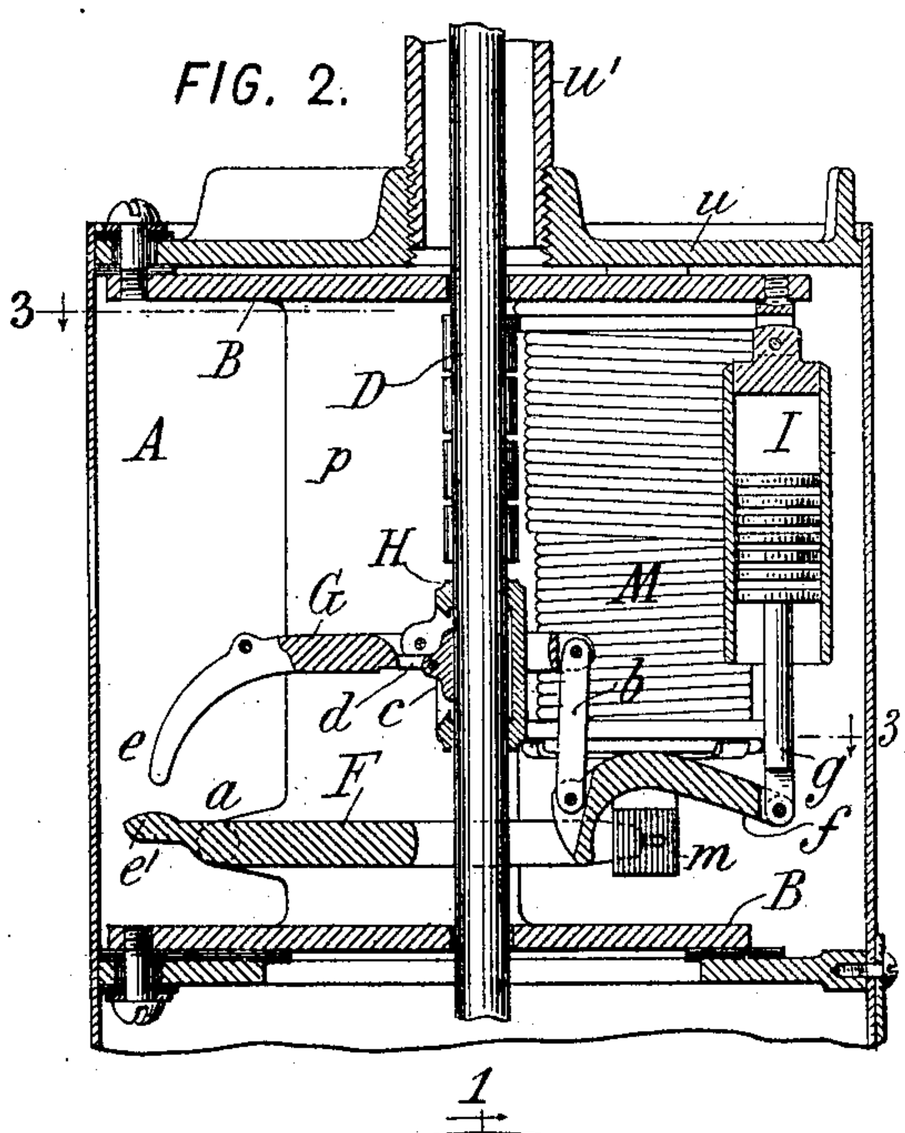

FIG. 4.

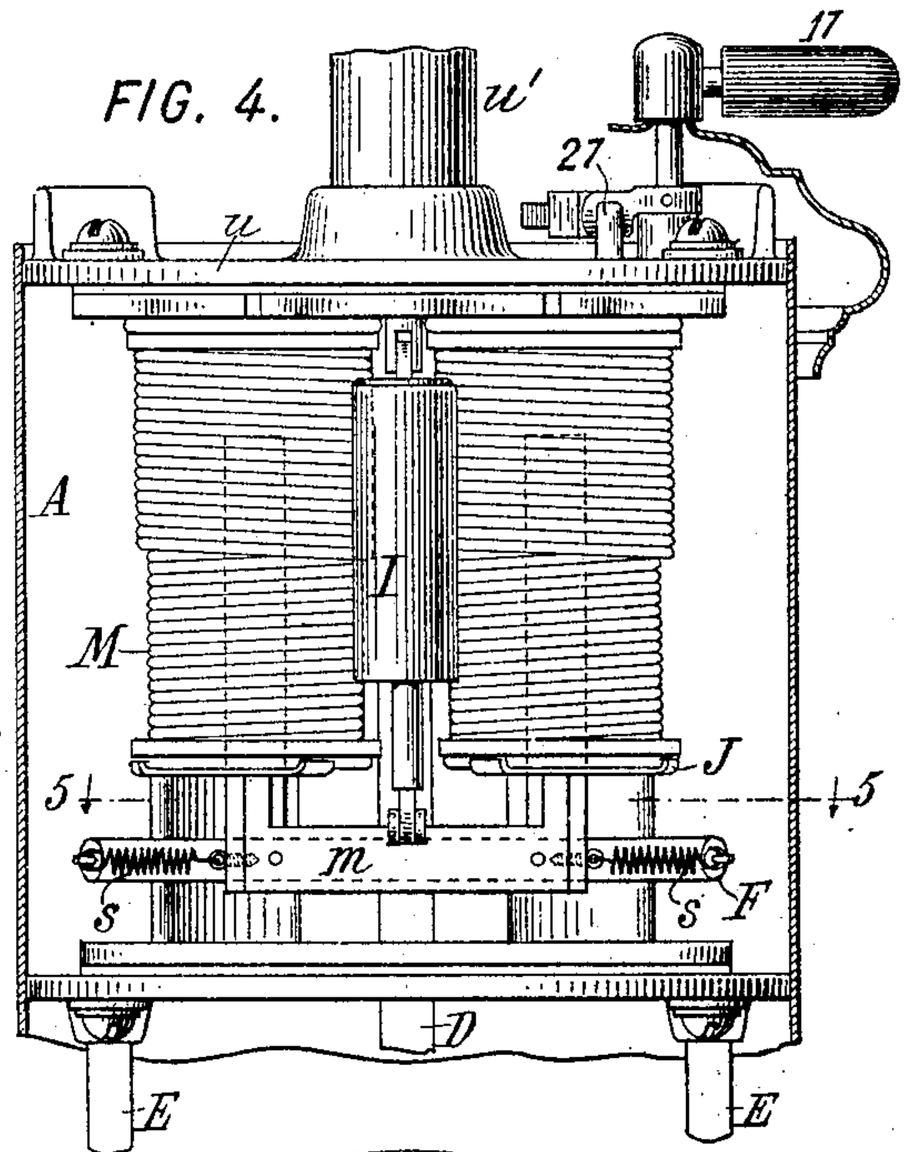

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FIG. 3.

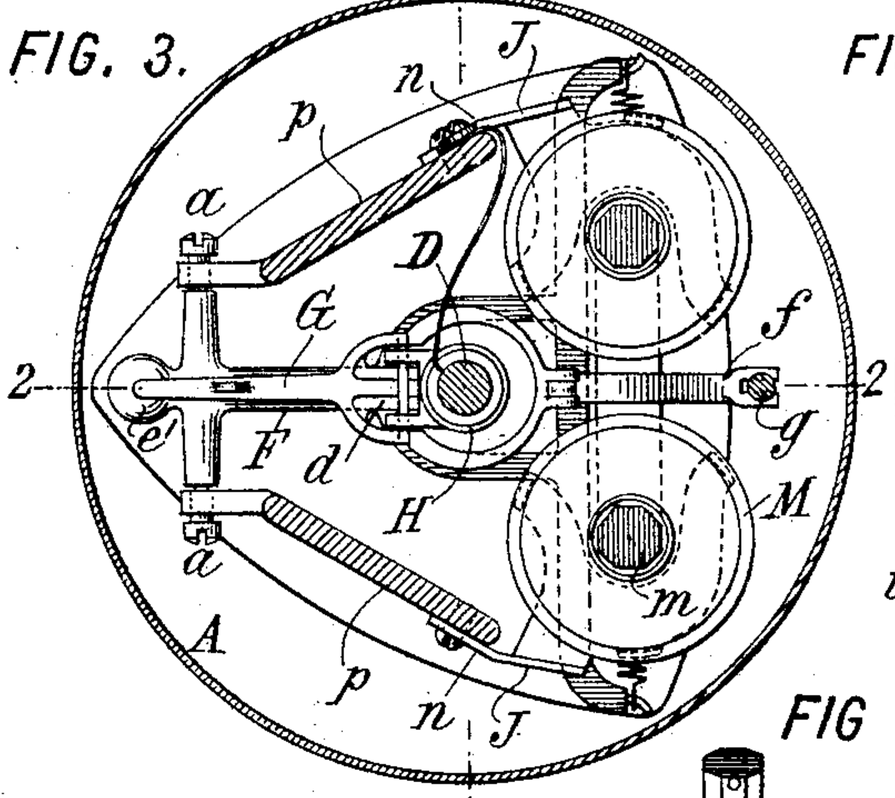

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FIG. 5.

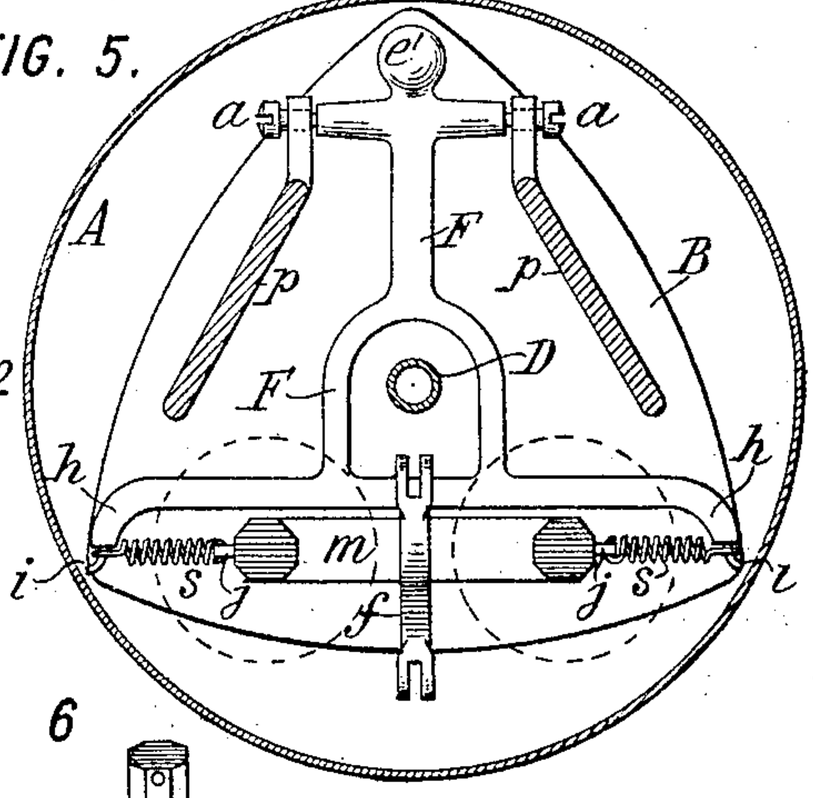


FIG 6

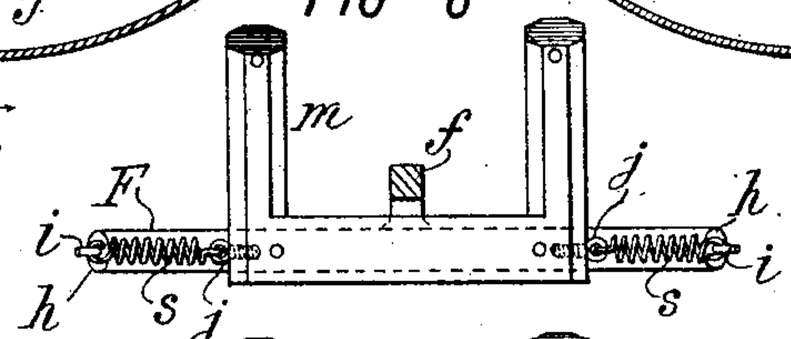
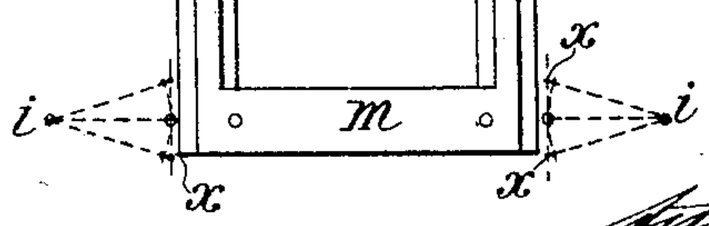


FIG. 7.



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J. J. WOOD.

ELECTRIC ARC LAMP.

(Application filed Aug. 25, 1898.)

(No Model.) 3 Sheets—Sheet 3.

FIG. 8.

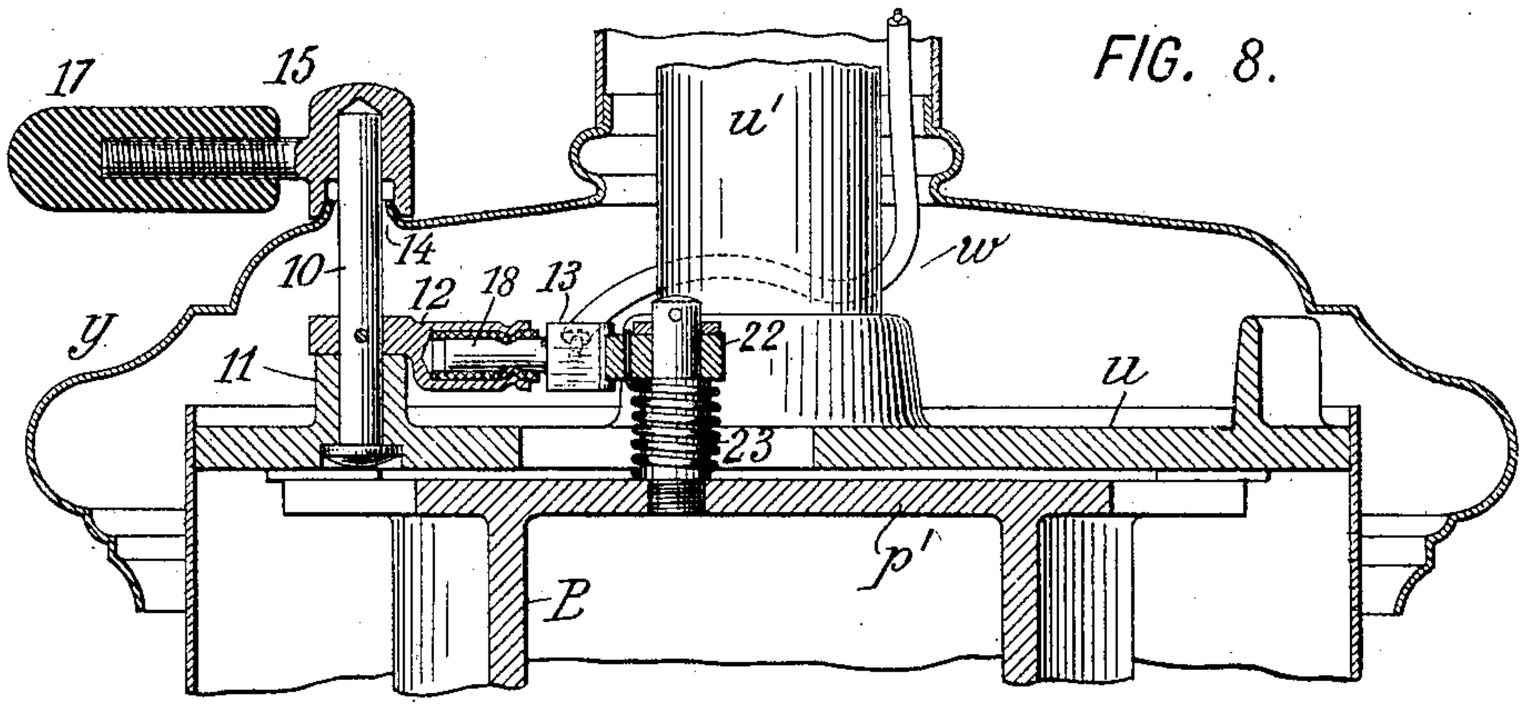


FIG. 9.

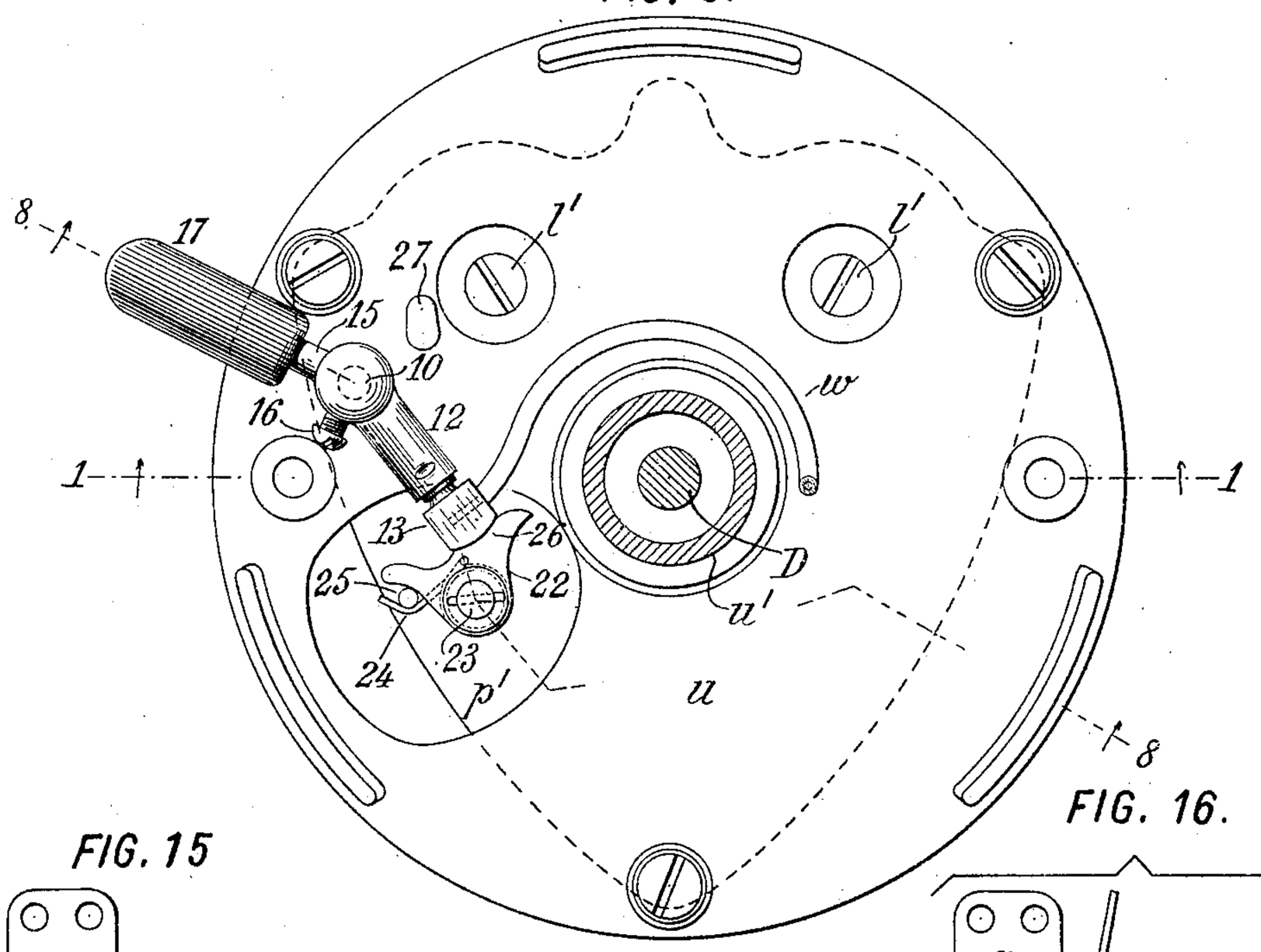


FIG. 10.

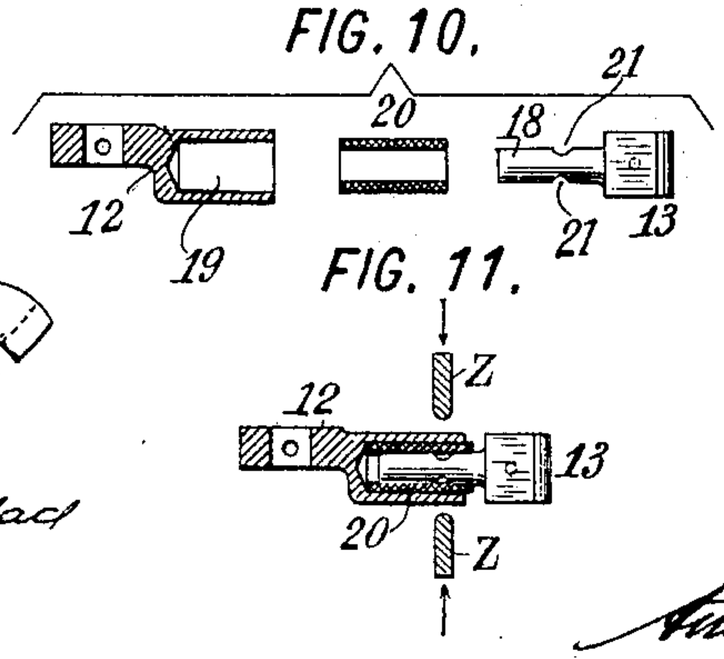


FIG. 11.

FIG. 15

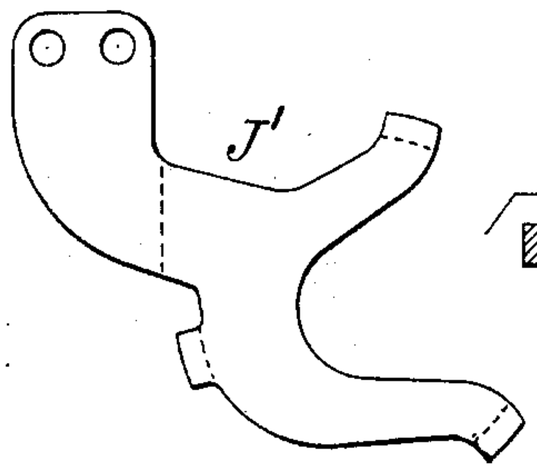
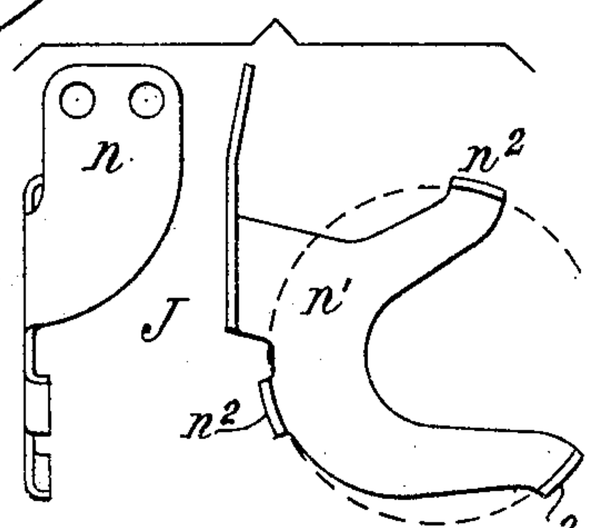


FIG. 16.



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UNITED STATES PATENT OFFICE.

JAMES J. WOOD, OF FORT WAYNE, INDIANA, ASSIGNOR TO THE GENERAL ELECTRIC COMPANY, OF NEW YORK.

ELECTRIC-ARC LAMP.

SPECIFICATION forming part of Letters Patent No. 638,789, dated December 12, 1899.

Application filed August 25, 1898. Serial No. 689,470. (No model.)

To all whom it may concern:

Be it known that I, JAMES J. WOOD, a citizen of the United States, residing in Fort Wayne, in the county of Allen and State of Indiana, have invented certain new and useful Improvements in Arc-Lamps, of which the following is a specification.

This invention relates to arc-lamps designed principally for alternating currents, although containing improvements applicable also to direct-current lamps. The improvements relate to the feed mechanism, the dash-pot, the switch, and the regulating-magnet.

One object of my invention is to adapt a clutch-feed mechanism to an alternating-current lamp. Prior to my invention it has been necessary to construct alternating-current lamps with a gear-feed. All attempts to make a clutch-feed mechanism operate in an alternating-current lamp have been unsuccessful, for the reason that the alternations of the current set up a vibration in the mechanism, causing the feed-rod to gradually slip through the clutch, so as to feed the carbons together prematurely. By my invention I suspend the armature or movable member of the regulating electromagnet or solenoid in such manner that its vibrations are not transmitted to the clutch, while its bodily movements under the control of the magnet are effectively transmitted to such effect that the mechanism acts in the same manner as though the magnet were traversed by a direct current. This I accomplish by supporting the armature in the armature-lever on springs which act at right angles to the direction of movement of the armature, so that the vibration transmitted to the armature by the alternating current loses itself in the springs and is not transmitted through them to the armature-lever. The springs are sufficiently stiff so that when the armature is moved bodily they pull the lever with it, and thereby draw the arc. The springs might be interposed at any point in the mechanism between the armature at one extreme and the clutch at the other.

I will proceed to describe my invention with reference to the accompanying drawings, which show one embodiment thereof.

Figure 1 is a vertical mid-section through the mechanism-case in the plane of the line 1 1 in Figs. 3 and 9. Fig. 2 is a vertical section through the mechanism-case in the plane of the line 2 2 in Fig. 3. Fig. 3 is a horizontal section in the plane of the line 3 3 in Fig. 2. Fig. 4 is an elevation of the mechanism, the case being in section in the same plane as Fig. 1, the view looking in the contrary direction thereto. Fig. 5 is a horizontal section in the plane of the line 5 5 in Fig. 4. Fig. 6 is a fragment of Fig. 4. Fig. 7 is a diagrammatic elevation of Fig. 6. Figs. 8 and 9 are views on a larger scale than the preceding, Fig. 9 being a plan of the top plate of the mechanism-case, and Fig. 8 a vertical section of the top portion thereof in the planes indicated by the line 8 8 in Fig. 9. Fig. 10 shows the three members of the switch-arm separated. Fig. 11 shows them assembled and shows the act of uniting them. Fig. 12 is a vertical section of the dash-pot. Fig. 13 is a horizontal section thereof, showing the plunger in plan. Fig. 14 is a vertical mid-section of one of the magnet-spools. Fig. 15 is a plan of the punching from which the magnet-spool bracket is bent. Fig. 16 shows an edge and plan view of this bracket.

Referring to the drawings, let A designate the mechanism-case; B, the frame supporting the mechanism; C, the globe; D, the feed-rod, which, as usual, carries the upper carbon, and E E the side rods, which, as usual, extend down within the globe and carry the lower carbon.

M is the regulating electromagnet or solenoid, the movable member or armature *m* of which is connected to the armature-lever F. This lever is pivoted at *a a* and is connected by a link *b* to a clutch-lever G, which may conveniently be arranged above it and to which is pivoted in the ordinary manner the clutch-sleeve H, which surrounds the rod D, and at one side of which is the clutch-shoe *c*, pivoted between two arms *d*, projecting into the annular portion of the lever G in the well-known manner. There is nothing new in this clutch, which is one commonly applied to continuous-current lamps. As the end of the lever G is raised by upward pressure through the link *b* it tilts this lever and presses the shoe *c* against one side of the rod, while drawing the sleeve H against the other side

thereof, so that the rod is firmly gripped between the sleeve and shoe, and consequently is lifted with the lever G. As the lever is lowered by the weakening of the magnet M the downwardly-turned end or tail *e* of the lever strikes an arm *e'* on the lever F, (or it might strike a fixed abutment,) so that the further lowering of the opposite end of the lever G by the link *b* releases the clutch and permits the rod D to slide down through it. The lever F has an arm *f*, which projects beyond the armature, and the end of which is connected in the usual manner to the stem *g* of dash-pot I. This clutch mechanism is not herein claimed, being claimed in my pending application, Serial No. 687,119, filed July 28, 1898.

The electromagnet M may be variously constructed; but it is preferable to employ a magnet of the solenoid type having its armature formed of a U-shaped core built up of iron laminæ, with its opposite legs inserted in the respective solenoid-coils.

The armature *m* is connected to the armature-lever F through the medium of springs *s s*, which constitute the sole connection between the armature and lever and are adapted to take up or absorb any vibration or trembling of the armature by reason of the current alternations, so as to avoid transmitting such vibration to the lever. This is preferably accomplished by two oppositely-acting or reciprocal springs pulling equally against each other in a direction perpendicular to the direction of movement or vibration of the armature, or, in other words, at right angles to the direction of pull of the electromagnet. Preferably the springs are coiled or helical springs, although this is not essential. Preferably the lever F is widely bifurcated adjacent to the armature by means of the arms *h h*, which extend laterally parallel with the armature and considerably beyond it, terminating in outwardly-turned pins or hooks *i i*, with which one end of each spring is connected, while the opposite end of the spring is joined to an eye *j*, screwed or otherwise united to the armature. The springs may, however, be very differently arranged in connection with different constructions of armature and lever without departing from my invention. The essential action of the springs is indicated in the diagram Fig. 7, in which, however, the amplitude of the vibration of the armature is greatly exaggerated. In fact the vibratory movement of the armature which occurs in vertical direction is so slight as to be almost or quite imperceptible. The amplitude of vibration is represented in this diagram by the dots *x x*. The vibratory movement carries the ends of the springs which are attached to the armature up and down along the vertical lines intersecting these dots. The opposite ends of the springs, which are attached at *i i* to the lever, constitute practically fixed points, the vibration being taken up by the lateral swing or flexure of the springs around these points. The springs exert a strong pull outwardly against the armature and tend to return the armature to mid-position. The vibratory movements of the armature, being exceedingly minute, do not materially elongate the springs, and as the vibrations occur equally to opposite sides of the medial line each opposite semivibration neutralizes the other before a diagonal pull can be communicated through the springs to displace the armature-lever, a result to which the inertia of the lever contributes. When, however, the armature, in addition to its vibratory movement, is moved bodily up or down, an unbalanced oblique pull is thereby communicated through the springs *s s*, distending these springs and causing them to exert tension in upward or downward direction against the armature-lever, which accordingly follows the bodily movement of the armature.

Practical use of the feed mechanism thus described has demonstrated that the clutch is uninfluenced by the vibration of the armature. With the usual unyielding pivotal connection between the armature and lever when used in an alternating-current lamp the vibrations of the armature are communicated through the lever to the clutch, the entire feed mechanism being subjected to such constant vibration or trembling as to cause the feed-rod to continually slip through the clutch, thereby bringing the carbons prematurely together. This result has practically ocndemned the use of clutch-feed mechanisms for alternating-current lamps, for which the relatively-complicated gear-feeds have heretofore had to be substituted. My invention greatly simplifies and cheapens the feed mechanisms of alternating-current lamps by enabling the use of a clutch feed.

Another feature of my invention relates to the construction and mounting of the magnet for alternating-current lamps. In such lamps ordinarily the magnet-spools on which the wire is wound are usually made of metal, and in order to reduce to a minimum the currents generated in the spools, and consequently the heat, the spools are ordinarily split. This, however, does not entirely avoid the loss, although it greatly reduces it. By my present invention I make the magnet-spools *k k* of insulating material, one being shown in section in Fig. 14. This enables them to be made without any split and avoids all internal or induced currents, such as are caused in a metallic spool. Instead of fastening the spool at one end only, as heretofore, I fasten it at both ends. In the upper end of the spool is inserted a metal nut *l*, preferably conical, as shown, and a screw *l'* is put through the top plate *p'* of the mechanism-frame B and screwed into the nut *l*. For bracing the lower end of the spool I provide a bracket J, (shown in Fig. 16,) which is

formed by bending up a punching J′ of the shape shown in Fig. 15 and which is bent on the dotted lines therein, so as to form a perforated base n by which to fasten it, and a bracket portion n', projecting beneath the lower head of the spool and bifurcated to leave the central bore of the spool unobstructed, and with three fingers n^2, turned up to partly embrace the bottom flange of the spool. These brackets J are shown in place in Figs. 2, 3, and 4. Their base portions n are fastened by screws to the two upright walls p p of the mechanism-frame B.

The dash-pot I is made, preferably, fifty per cent. larger in diameter than usual, and its piston is made a loose fit to prevent sticking. The dash-pot is provided with an inwardly-opening check-valve adapted to remain closed during the upward or arc-drawing movement, but to open or admit air during the downward or feeding movement. I prefer to have this check-valve carried by the piston or plunger, but it may be otherwise arranged. In Figs. 12 and 13, q is the dash-pot cylinder, and r the piston or plunger. The latter is formed of an externally-grooved tube with a disk forced tightly into it, to which the stem g is secured. On the metal disk lies a valve-disk r', of leather or other flexible material, which is fastened on at one side by a screw, and the other or free edge of which is weighted by a lead button t directly over an air-hole t'. During the upward movement the leather disk r' closes the hole t' and prevents escape of air from above the piston, except as the air slowly leaks around it. During the downward movement the valve-disk r' is free to lift, permitting air to pass up through the hole t'. The dash-pot thus resists the upward or arc-drawing movement and moderates this to a suitable slow movement, while it affords comparatively little resistance to the downward feeding movement, thereby admitting of a quick feed.

My invention also provides an improved construction of switch applicable to either continuous or alternating current arc-lamps. The mechanism-frame B is, as usual, included as part of the circuit leading from the switch to the feed-rod D and is insulated from the top and bottom plates u and v, respectively, of the mechanism-case. The leading-in wire w, which enters at the top of the lamp, as usual, and passes down between the outer shell and the suspension-tube or feed-rod housing w', terminates in one member of the switch, while the other member is mounted on the top plate p' of the mechanism-frame B, so as to make electrical connection therewith. Preferably it is the movable member of the switch which makes connection with the end of the wire w, this member being mounted on the top plate u. Referring to Figs. 8 to 10, the switch is preferably constructed with an oscillating post 10, turning in an upwardly-projecting boss 11, formed on the plate u and having pinned to it an arm 12, which carries an insulated contact-head 13. The post 10 has a head at its lower end which prevents its lifting, while the arm 12 restrains its downward movement. It is prolonged upwardly through a hole 14 in the sheet-metal shell or cap y, which incloses the top of the mechanism-case, and on its protruding upper end is fixed an arm 15, which may be attached by means of a set-screw 16, the arm carrying a handle 17, preferably of insulating material. The boss of the arm 15 is formed as an inverted cup which caps over the top of the post 10. The lower part of this cup is counterbored or enlarged, forming an annular flange. The margin of the hole 14 is upturned and projects within the flange of said cup, so that the latter incloses it and serves to prevent the entrance of rain. The contact-head 13 is of metal, and the end of the leading-in wire w is soldered into a hole in its side. The head 13 is united mechanically to the arm 12, while insulated therefrom, by constructing the one of these parts with a reduced neck or shank 18 and the other with a socket 19 with thin walls and providing a sleeve 20 of insulating material, preferably mica, to fit between them. The three parts are then united, as shown in Fig. 11, by thrusting the sleeve into the socket and forcing the shank into the sleeve, the insulating-sleeve being long enough to prevent metallic contact between the parts 18 and 19. The shank is notched on opposite sides, as shown at 21 in Fig. 10, and the parts are finally united by indenting the walls of the socket 19 at points coincident with these notches by applying pressure from opposite sides—as, for example, by means of two mutually-approaching jaws or parts z z, Fig. 11. The result of this indentation of the socket is to crimp the insulating-sleeve into the notches in the manner clearly shown in Fig. 8. This construction admits of an insulation of mica, thereby rendering the switch fireproof. I prefer to make the socket 19 of brass and as part of the arm 12, and to make the shank 18 integral with the head 13. I prefer also to make the shank and socket slightly conical, as shown in Fig. 10, so that the parts can be forced together to make a tight fit. The indenting of the socket into the notches effects a very firm and permanent union between the respective parts. The contact-head 13, with the arm which carries it, constitutes the movable member of the switch. Its stationary member is constituted by a rocking contact-shoe 22, which is pivoted on a stud 23, screwed into the top plate p' of the mechanism-frame B and having a spring 24 tending to press it constantly against a stop 25, projecting from the plate p'. The post 23 and stop 25 project up through a large hole in the top plate u, so as to avoid metallic contact with the latter. The shoe 22 has a cam-face on the side next

the head 13, which comprises a recess 26 for receiving the end of said arm when the switch is fully closed, in which position the tension of the spring 24 presses the shoe against the head in such manner as to retain the latter in said recess, so that to open the switch it is necessary to apply force to the operating-handle 17 to cause the head 13 to deflect the shoe 22 while escaping from said recess. The movement of the arm 12 in opening the switch is limited by a stop 27, consisting of an upwardly-projecting lug on the top plate *u*. The wire *w* is looped and sufficiently long to permit it to yield in following the movements of the arm.

I claim as my invention the following defined novel features, substantially as hereinbefore specified, namely:

1. In an arc-lamp for alternating currents, the combination with the feed mechanism and regulating-magnet, of a yielding medium interposed between the movable member of said magnet and said feed mechanism, adapted to communicate the bodily movements of said member while suppressing the communication of its vibration, and consisting of a spring arranged to exert stress perpendicularly to the direction of motion.

2. In an arc-lamp for alternating currents, the combination with a clutch-feed mechanism and the regulating-magnet, of means interposed between the movable member of said magnet and the clutch, adapted to communicate the bodily movements of said member while suppressing the communication of its vibration, and consisting of a spring arranged to exert stress perpendicularly to the direction of motion.

3. In an arc-lamp for alternating currents, the combination with the feed mechanism, the regulating-magnet and the armature-lever, of a spring interposed between the armature and said lever, arranged to exert stress perpendicularly to the direction of movement, and hence adapted to communicate the bodily movements of said armature while suppressing the communication of its vibration.

4. In an arc-lamp for alternating currents, the combination with the regulating-magnet, its armature and armature-lever, of interposed springs arranged to exert stress perpendicularly to the direction of movement of the armature.

5. In an arc-lamp for alternating currents, the combination with the regulating-magnet, its armature and armature-lever, of opposite springs connecting the armature and lever, arranged to pull against each other in a direction perpendicularly to the movement of the armature.

6. In an arc-lamp for alternating currents, the combination with the regulating-magnet M, its armature *m*, and armature-lever F formed with arms *h h*, of springs *s s* interposed between the arms of said lever and the armature and arranged to pull against each other in a direction perpendicularly to the movement of the armature.

7. In an arc-lamp for alternating currents, the combination with the mechanism-frame of the regulating-magnet, the latter having its coils wound on spools of insulating material, the upper ends of said spools having countersunk nuts fastened to the top plate of the mechanism-frame by screws passing through said top plate and entering into said nuts.

8. In an arc-lamp for alternating currents, the combination of the mechanism-frame, the regulating-magnet, the latter having its coils wound on spools of insulating material, the upper ends of said spools fastened to the top plate of the mechanism-case, and brackets fastened to said case and engaging the lower ends of said spools.

9. In an arc-lamp for alternating currents, the combination of the mechanism-frame having top and bottom plates and intervening uprights, the regulating-magnet, the latter having its coils wound on spools of insulating material, the upper ends of said spools fastened to said top plate, and brackets fastened to said uprights and having bifurcated portions extending therefrom beneath the lower ends of the respective spools, and each formed with upturned fingers engaging and centering the end of the spool.

10. In an arc-lamp for alternating currents, the combination of the mechanism-frame, having top and bottom plates and intervening uprights, the regulating-magnet, the latter having its coils wound on spools of insulating material, the upper ends of said spools having countersunk nuts fastened to the said top plate by screws passing through the top plate and entering said nuts, and brackets fastened to said uprights and engaging the lower ends of said spools.

11. In an arc-lamp, a switch comprising a swinging contact-arm, a rocking contact-shoe against which said arm rubs in closing or opening the switch, said arm and shoe forming the respective circuit-terminals, said shoe having a cam-face comprising a recess for receiving the end of said arm when the switch is fully closed, and a spring pressing against said shoe to resist its deflection during the movement of the arm to the open position, whereby the conducting contact-surfaces are held firmly seated together while the switch is closed.

12. In an arc-lamp, a switch comprising a swinging arm, and an insulated contact-head carried thereby, said arm and head formed the one with a notched shank and the other with a socket, with an interposed insulating-sleeve, the socket indented opposite the notch in the shank to crimp the insulation thereinto and hold the parts firmly together.

13. In an arc-lamp, a switch comprising a

swinging arm, and an insulated contact-head carried thereby, said arm and head formed the one with a conical notched shank and the other with a socket, with an interposed insulating-sleeve, the shank being forced into the socket and the latter indented opposite the notch in the shank to crimp the insulation thereinto.

In witness whereof I have hereunto signed my name in the presence of two subscribing witnesses.

JAMES J. WOOD.

Witnesses:
ROBERT W. SMYTH,
A. L. HADLEY.