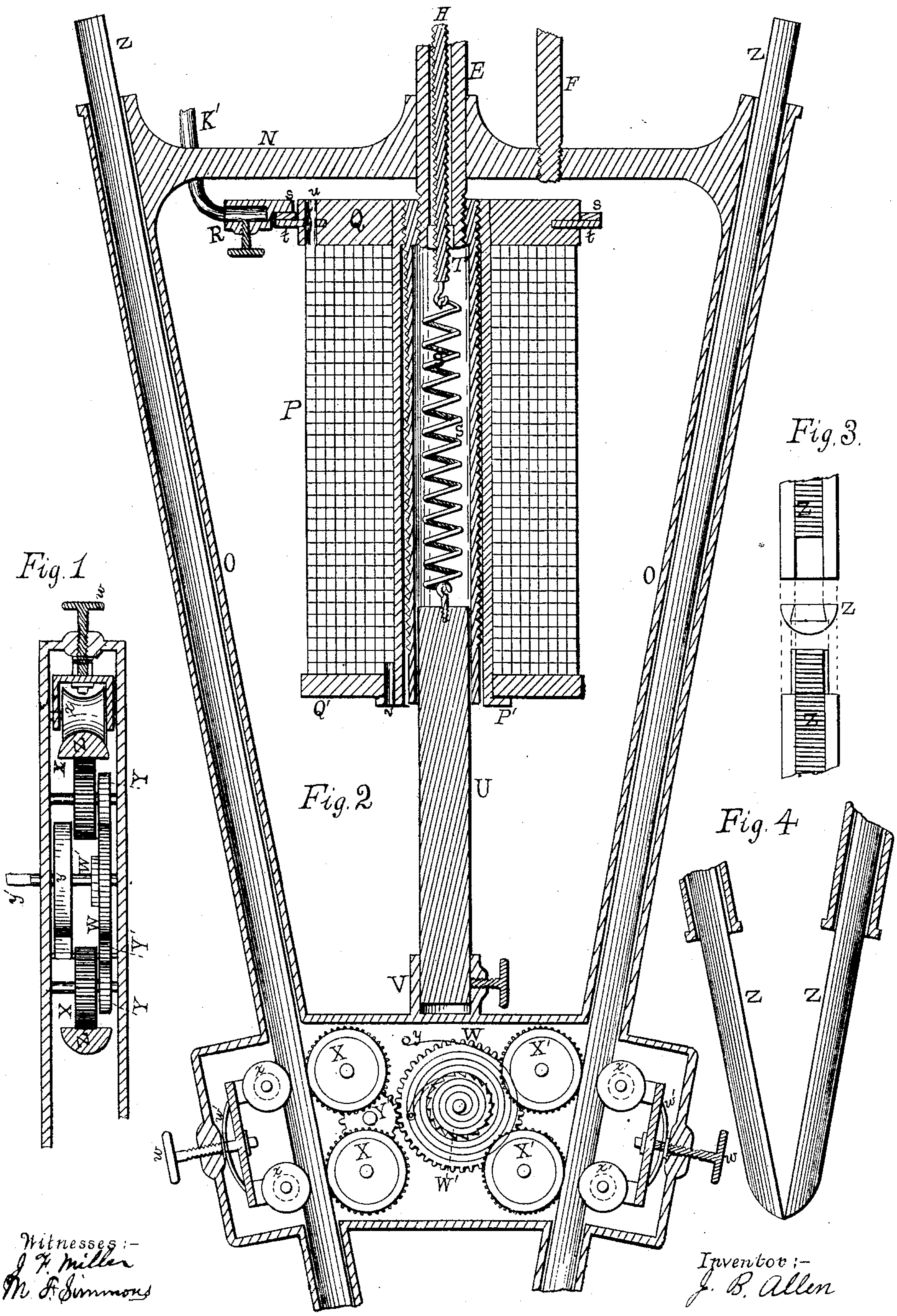
(No Model.) 2 Sheets—Sheet 1.

J. B. ALLEN.

ELECTRIC ARC LAMP.

No. 275,345. Patented Apr. 10, 1883.



Witnesses:—
J. F. Miller
M. F. Simmons

Inventor:—
J. B. Allen

(No Model.) 2 Sheets—Sheet 2.

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Fig. 5.

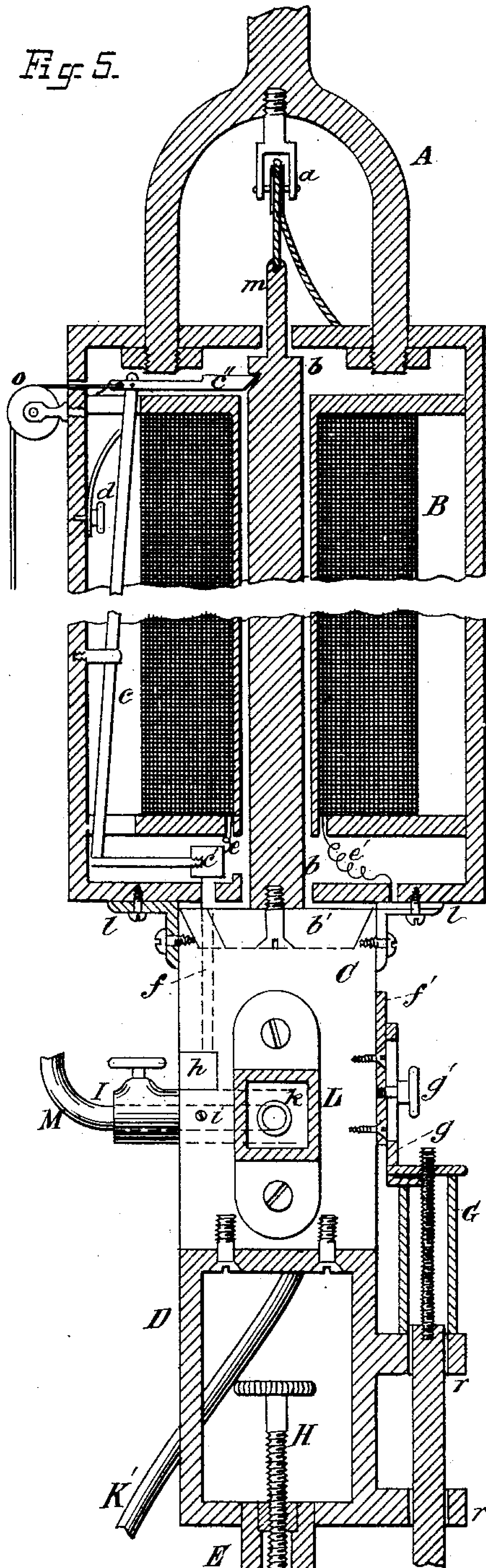


Fig. 9.

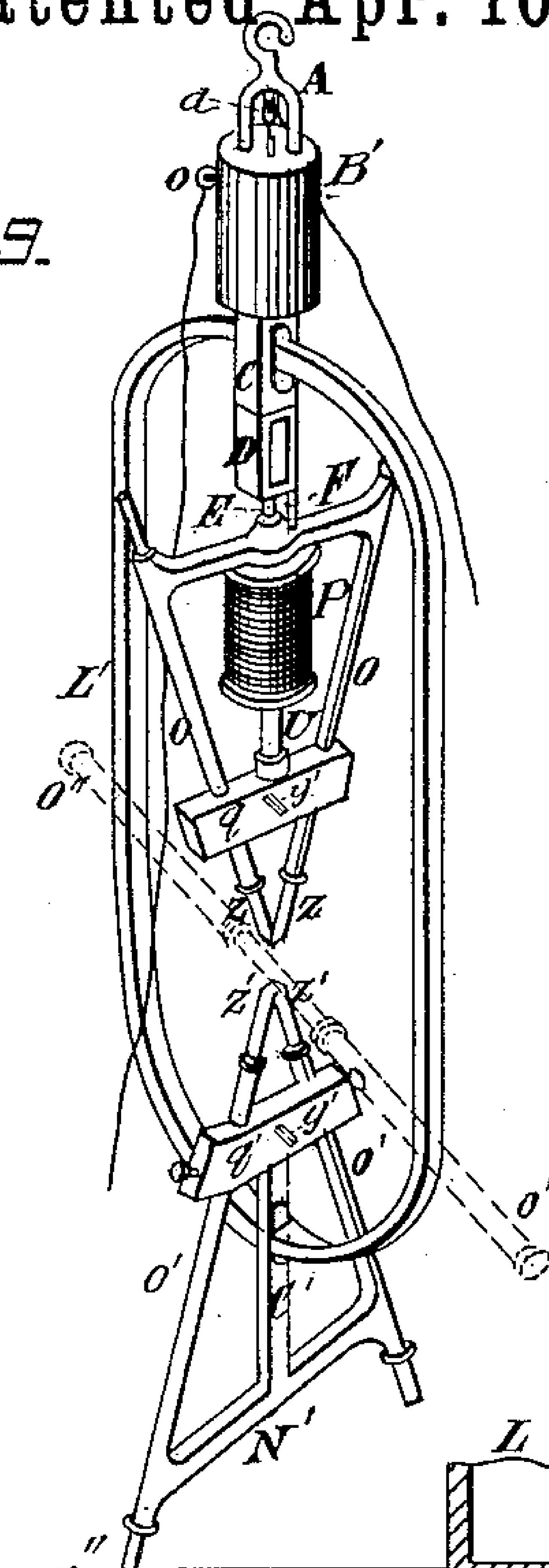


Fig. 10.

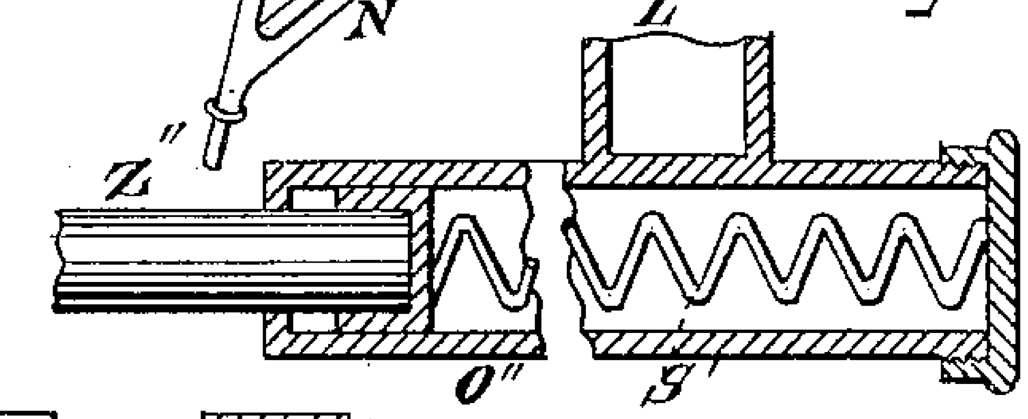


Fig. 6.

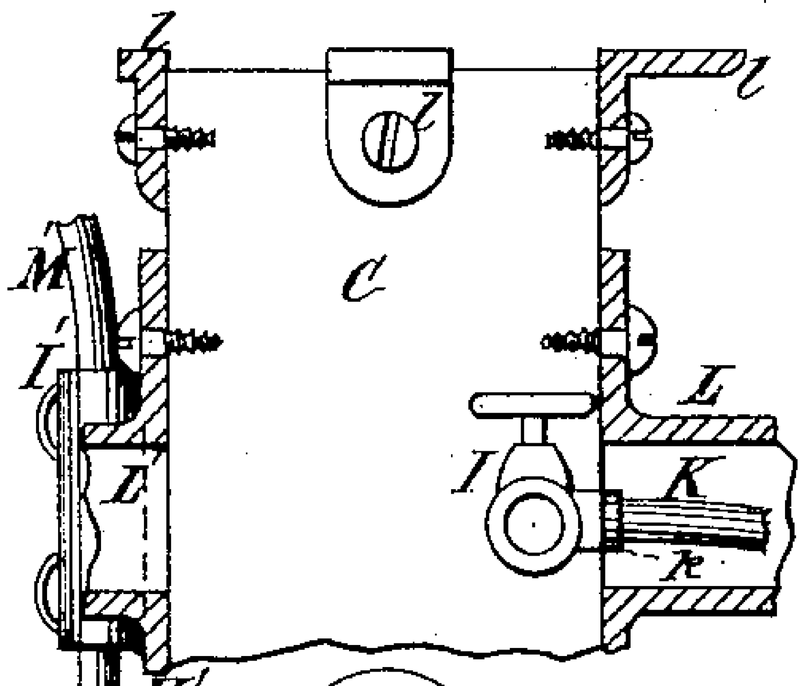


Fig. 7.

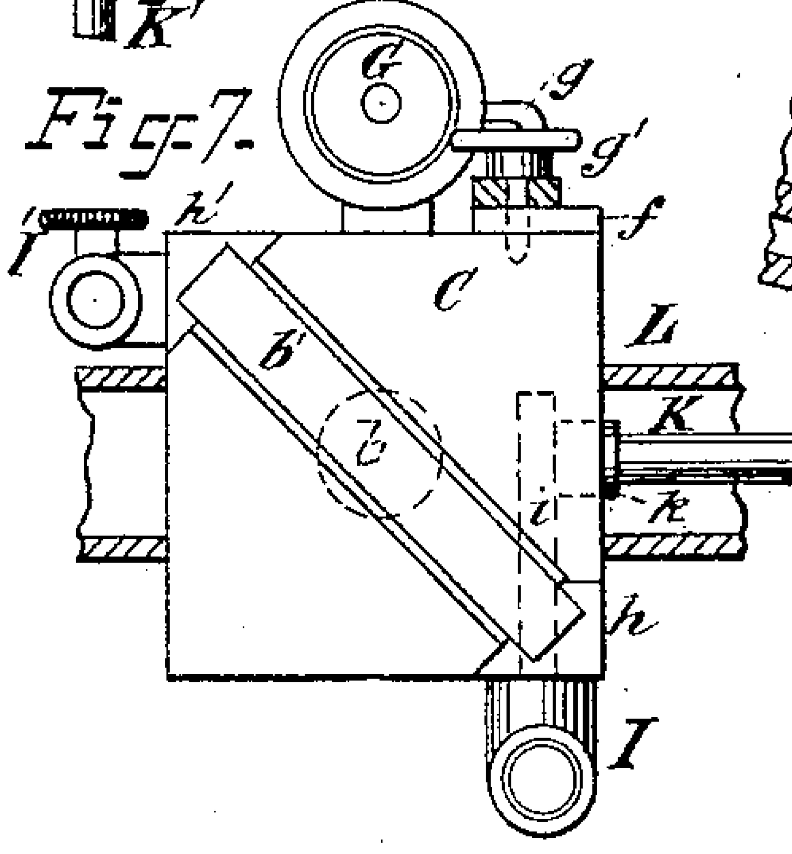
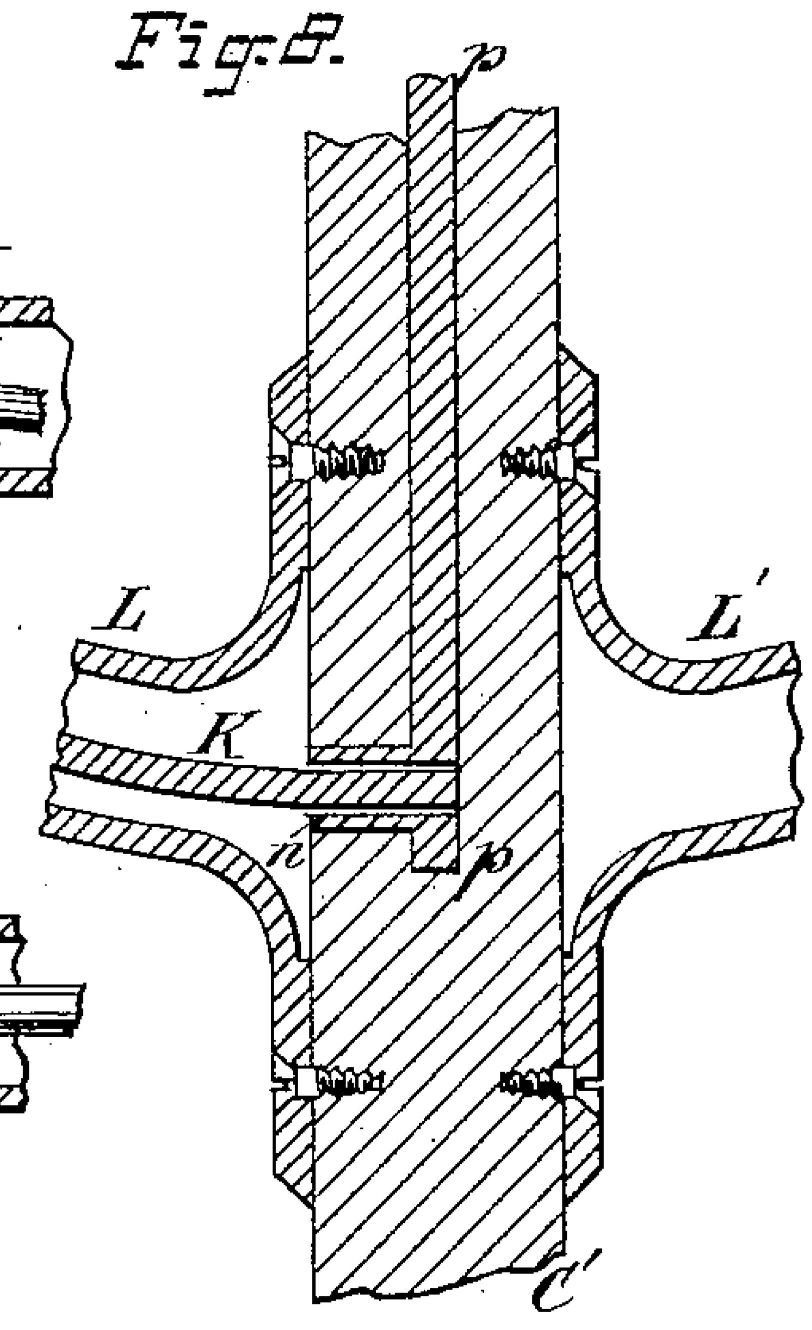


Fig. 8.



ATTEST:

J. A. Hurdle

Thos. Toomey

INVENTOR:

J. B. Allen

by H. C. Townsend

Atty.

N. PETERS. Photo-Lithographer. Washington, D. C.

UNITED STATES PATENT OFFICE.

JOSEPH B. ALLEN, OF SPRINGFIELD, ILLINOIS.

ELECTRIC-ARC LAMP.

SPECIFICATION forming part of Letters Patent No. 275,345, dated April 10, 1883.

Application filed April 27, 1882. (No model.)

To all whom it may concern:

Be it known that I, JOSEPH B. ALLEN, a citizen of the United States, residing at Springfield, in the county of Sangamon, State of Illinois, have invented a new and Improved Electric Lamp.

The following specification contains a full description of my new lamp.

In the accompanying drawings similar letters of reference indicate corresponding parts in all the figures.

The object of my invention is to secure a constant and regular feeding of the carbon electrodes, and to so regulate the distance between the electrodes as to secure a uniform and steady light, to facilitate the placing of fresh carbons, and to secure a more complete consumption of the same, and to combine such a shunt, cut-out, and connections as will render the lamp safe and easy to control.

Figure 1 is a top view, in my electric lamp, of the mechanism for feeding the carbons. Figs. 2 and 4 show in vertical sections positions of carbons, face of feeding mechanism, hollow helix, spring, and soft-iron core in the same. Fig. 3 is an end section and side view of carbons. Fig. 5 is a vertical section in my lamp, showing helix for shunt-circuit and the arrangement by which the same is effected; also for cut-out, and showing, also, the adjusting-screws for regulating lamp. Figs. 6, 7, and 8 show a side view, a top view, and a vertical section of pieces of insulating material C and C′, showing position of cut-out in the same, and how binding-posts and arms of the lamp are fastened to the same, and how connections are made through the same. Fig. 9 is a perspective view of my lamp complete. The dotted lines in Fig. 9 show an arrangement by which the lower carbons may be placed horizontally. Fig. 10 is a sectional side view of the hollow cylinder for holding the carbons, and the spring therein for moving the same, used when the lower carbons are placed horizontally.

A is the piece by which the lamp is suspended, and is fastened to the top plate of the cylinder B′, as shown in Fig. 5.

B′ is a hollow metal cylinder fastened to the insulating-piece C by the angle-plates *l l l*, Figs. 5 and 6. C, of any suitable insulating material, secured to B′, as shown, is also fastened to D by screws, Fig. 5.

D is a metal box, its top fastened firmly to C and its bottom to E. D has two open faces, and between its sides the head of the screw H moves freely, Fig. 5.

E is a square bar of metal, through which passes the adjusting-screw H, Figs. 2 and 5. E passes through a square opening in the cross-piece N, Fig. 2. N moves freely up and down upon E, as will be more fully described hereinafter in this specification.

F is a metal rod screwed into the cross-piece N, Fig. 2, and passes up through the guides *r′* and *r*, fastened to the sides of D, Fig. 5, and in which it moves freely. F terminates in a screw. To the nut G, working upon this screw, a hollow cylinder is attached, which incloses the screw and rests upon the guide *r*, Fig. 5. As will be readily seen, by screwing this cylinder down upon *r* by the nut G, F will be drawn up through *r′* and *r*, and F, being fastened to the cross-piece N, Fig. 2, which moves freely up and down upon E, will be drawn up at the same time, and with N the entire triangle carbon-holder, which is bound together at the top by N. In this manner the distance between the electrodes is adjusted when the lamp is not burning. As will be seen by reference to Fig. 9, the lower triangular carbon-holder is stationary. Therefore as the upper one is drawn up by turning G in the manner shown the points of the electrodes will be separated. G will be so adjusted as to allow the points of the electrodes to just touch when the current is not passing.

To the lower end of the bar E is screwed a hollow metal cylinder, T, Fig. 2. This cylinder has a screw-thread cut on its outer surface for nearly its entire length. Onto this cylinder T is screwed the helix P by threads in the upper part of the metal barrel of the helix. Thus the helix P can be screwed up or down upon the cylinder T. In the hollow cylinder T is a spring, S, fastened at its upper end to the screw H, and at its lower end to the soft-iron core U, which moves freely in the cylinder T, Fig. 2. The lower end of the core U is fastened firmly at V to the triangle carbon-holder. Since N moves freely up and down upon E, and E is stationary, the whole triangle is therefore suspended to the screw H by the spring S and the core U, and H can be so adjusted that the tension upon S will just balance the triangle, so that when a current passes through the helix P the magnetic force will draw up U, and with it the entire triangle, thus separating the electrodes the proper distance for the arc, Figs. 2 and 9.

The magnetic force exerted by the helix P upon the core U can be increased or diminished by screwing the helix down or up upon the cylinder T, Figs. 2 and 9, thus having more or less of the soft-iron core in the helix, and thus, as will be readily seen, the distance between the electrodes and the length of the arc for a given current can be regulated by adjusting the helix P so as to take in more or less of the soft-iron core U.

The pieces of insulating material to which the binding-posts and the arms of the lamp are fastened are shown at C and C′, Figs. 5 to 9, C being at the top part of the lamp, Figs. 5 and 9, and C′ at the bottom, Figs. 8 and 9. The binding-posts I and I′ are fastened at diagonal corners of C, Figs. 6 and 7. The hollow arms L and L′, fastened to opposite faces, in the manner shown in Figs. 5 to 9, connect the two parts of the lamp.

Connections are made in the following manner: One wire, M, from the machine is fastened at the binding-post I, Fig. 5. From I a metal piece, *i*, (shown by the dotted lines in Figs. 5 and 7,) passes through a mortise in the piece C and extends a little beyond the center of the arm L. Directly in the center of the arm L, Fig. 5, through a hole in the piece C, a small hollow metal cylinder is screwed into the piece *i*. This small cylinder projects a short distance from the side of C, as shown at *k*, Figs. 6 and 7. Into the cylinder *k* is fastened one end of the conductor K, which is covered with insulating material, so as to prevent connection with the metal arm L, Figs. 6 and 7. K, passing down through L, (for the position of L see Fig. 9,) is fastened at its other end in the metal cylinder *n*, screwed into the metal strip *p*, Fig. 8. This metal strip *p* passes up through the insulating-piece C′, and connects directly with the metal box *q*′, Fig. 9, and this directly with the carbons. Thus the current is brought to the lower electrode. The current to the upper electrode enters by the wire M′ at the double binding-post I′, Fig. 6. From the lower part of this binding-post I′ the conductor K′, Fig. 6, passes down, as shown in Figs. 5 and 2, and enters the binding-post R, Fig. 2. R is fastened to a metal disk, *s*, which passes entirely around the head Q of the helix P. *s* moves freely upon another metal disk, *t*, which passes some distance into Q. Passing through Q, and screwed through the metal disk *t*, is a small metal cylinder, *u*, Fig. 2. With *u* one end of the wire of the helix is connected. The other end of the wire is connected with the metal cylinder *v* at the bottom of the helix, and *v* to the flange P′ of the metal barrel of the helix, and this is screwed upon the metal cylinder T, this to the metal bar E, and this connects, through N, to the metal carbon-holders O O, and thus the current is brought to the upper electrode, Fig. 9. By means of the disks or rings *s t* a shifting connection is obtained which permits the helix to be turned in the act of adjustment without deranging the connecting-wire. The entire current for producing the light passes through the helix P, Fig. 2.

I use in my lamp two carbons for each electrode. These are preferably half-cylinders, but may be made of any convenient shape—square or flat bars. The ends of each pair of carbons Z Z and Z′ Z′, Fig. 9, meet at a point about two inches from the ends of the metal guiding-tubes O O and O′ O′, Figs. 2, 4, and 9. The feeding mechanism for moving these carbons is shown in Figs. 1 and 2. X X and X′ X′ are notched rollers. The notches in these rollers fit corresponding notches in the faces of the carbons, Fig. 3. Thus the rollers are prevented from slipping on the carbons. The rollers are moved by the gearing W Y′ and Y Y, or a large cog-wheel, W, a pinion, Y, under each roller, and a fifth pinion, Y′, all moved by the clock-spring *y*, working with a ratchet-wheel, W′, and wound up at *y*′. As will be readily seen, this gearing moves both carbons at the same time and at exactly the same rate, and, further, renders it impossible for one carbon to move without the other moving at the same time. Thus one carbon cannot slip past the point of the other. When the carbons have moved until their ends meet, Figs. 4 and 9, they will cease to move until the point of contact is burned away in producing the light. The instant this point of contact is burned away they will be moved forward again—or, in other words, the carbons of each electrode will be moved forward just as fast as their points are consumed. This motion is uniform and steady. The friction-rollers *x x* and *x*′ *x*′, Figs. 1 and 2, fitting the carbons, as shown at Z, Fig. 1, can be so adjusted by the screws *w w* and the springs *w*′ *w*′, Figs. 1 and 2, that the carbons will always move easily.

The ends of the carbons are dovetailed to fit each other, Fig. 3. By this arrangement a fresh carbon can be put in place at any time before the end of the one already in passes beyond the feeding mechanism. The only precaution necessary in doing this is to hold the projecting end of the lower carbon firmly, so that when the upper carbon is pushed down to make the parts of the dovetail fit, the lower carbon will not move down. Fresh carbons can be put in place while the lamp is burning, provided a pair of pinchers are used to hold the lower carbon. By fitting the carbons together in this way it is rendered practicable to burn nearly the entire carbon. While I prefer to join the carbons in this manner, yet it may be done by a dowel-pin of steel in the ends, or by making the ends smaller, so that they will fit into a thin metal connection. For this a very light shell of copper is preferable, which need not be over one inch long, thus passing a half an inch over the end of each carbon. This latter mode of connection is used in the smaller-sized lamps, the carbons for which are too small to allow the dowel-pin or dovetail fitting.

Instead of notches in the rollers X and X′, Figs. 1 and 2, tires of rubber or any suitable material may be used, in which case the faces of the carbons may be left smooth.

I do not limit myself to the arrangement of suspending one triangular carbon-holder over a lower stationary one. The lamp will work equally well if turned up side down. The only difference in the working of the lamp in this case will be that the screw H and spring S will be adjusted in the reverse direction.

One of the arms of the lamp, Fig. 9, may be left off and the lamp suspended by the center of the other arm, so that the triangles will be horizontal. The position of the cylinder B′ and the piece C, containing the shunting arrangement and cut-out, can be changed to correspond to any change in the position of the triangular carbon-holders.

Instead of employing a triangular frame for the lower stationary carbon-holder, it is sometimes preferable to place them horizontally, as shown by the dotted lines, Fig. 9. O″ O″ are metal cylinders fixed to the arms L and L′. The points of the carbons projecting from these cylinders meet directly below the ends of the upper carbons, Z Z. As these horizontal carbons meet directly below the upper electrode they are equally consumed in producing the light, and are moved forward by a spring, S″. (Shown in Fig. 10.)

The shunt-circuit and cut-out employed in my lamp are shown in Figs. 5 and 7.

B′ in Fig. 5 is a vertical section of a hollow metal cylinder. B is a helix of fine wire, and having a resistance somewhat greater than that of the lamp. *b b* is a soft-iron core passing through the helix in the manner shown. This core moves freely in the barrel of the helix and extends down through an opening in the metal cylinder B′, Fig. 5. *b′* is a piece of metal fastened to the bottom of *b* by a screw, as shown. The ends of *b′* are sloping. The position of this piece of metal *b′* is diagonally across the insulating-piece C, Fig. 7, which is mortised to receive *b′* and *b*. This mortise extends down into C to the bottom of *h*.

h and *h′*, Figs. 5 and 7, are pieces of metal connected directly with the binding-posts I and I′, and slanting so as to fit perfectly the ends of *b′*. As will be clearly seen, whenever *b* and *b′* drop so the two ends of *b′* rest upon the two pieces *h* and *h′* the current will pass directly from the binding-post I, Fig. 7, through the metal piece *b′* to the other connection at the binding-post I′, Fig. 7, and the lamp will thus be cut out of the circuit.

The dotted lines *f*, Fig. 5, represent a thin strip of metal which passes up from *h* on the side of the mortise. To the upper end of *f* one of the wires, *e*, of the helix B is fastened. This wire is well insulated. The other wire, *e′*, of the helix passes down through a hole in the bottom of B′, and is fastened to a metal strip, *f′*, on the side of C, Fig. 5. *g* is another metal strip fastened against *f′* by the binding-screw *g′*. *g* has a slot in it, so it may be moved up and down, Figs. 5 and 7. *g* extends down to a point just below the head of the screw-cap G, where it bends out at right angles and comes under the rim of G.

There is one current (say the +) through the wire M and the binding-post I, through the metal pieces *h* and *f*, Fig. 5, to one wire of the helix B, Fig. 5. This same is the current of the lower electrode. In the upper triangle is the other or — current. As already shown, the metal rod F, Fig. 5, is connected with the upper triangle, Fig. 2, and, as described, while the lamp is burning, F and G are moved up a certain distance. Now, while G is up it does not touch the arm of the metal strip *g*, which comes, as shown, just under the rim of the cap G. So as long as the lamp is burning all right there is no connection through the helix B; but should the lamp go out suddenly from any cause—such as the breaking of the carbons, for instance—the triangle, and with it F and G, will at once drop, so connection will be made between G and the strip *g*, which will touch when G is down, Figs. 5 and 7. Thus the high-resistance helix will be thrown into the circuit and the core *b* will be magnetized. This acting upon the soft-iron armature *c′*, Fig. 5, will, through the lever *c*, draw back the catch *c″*, thus releasing the core *b*, which will then drop down with the metal piece *b′* and make connection between I to I′, as described, and thus shunt the current.

The lamp may be cut out of the circuit when desired by pulling the cord which passes over the wheel *o*, Fig. 5, and is fastened to the end of the catch *c″*, thus drawing *c″* back and allowing the core to drop, as shown. The lamp may be thrown into circuit by pulling up the core by the cord which passes over the wheel *a*, Fig. 5, and is fastened to a projection of the core *m*. The spring *d* will throw the catch in place.

Having thus fully described my invention, I claim as new—

1. The combination, substantially as described, of an electrode composed of two carbons converging at an acute angle and meeting at their points, a feeding mechanism for both carbons of said electrode, composed of a spring-driven cog-wheel geared with the feeding-rollers of each carbon, so that neither carbon can move alone, a frame supporting the feeding mechanism, and the converging guide-tubes for the carbons, and an electro-magnet in the main circuit for actuating said frame, so as to regulate the distance between said electrodes and the opposite electrode.

2. The combination, substantially as described, of the frame N, supporting the converging guide-tubes, the core or armature connected to the frame, the feed-wheels connected

with a common wheel and supported from the frame, and the guide E for said frame.

3. The combination, substantially as described, of the movable frame N and the converging guide-tubes, the guide E, the electro-magnetic coil P, supported from the guide, and the movable core connected to the frame.

4. The combination, with the frame N, supporting two or more converging carbon-carriers, of the hanging support E, the helix supported thereby and vertically adjustable, as described, and the core for said helix, connected to the frame supporting the carriers for raising said frame bodily when attracted within the helix.

5. The combination, substantially as described, of the converging carbon-carriers, the frame therefor, the magnet-core supported by a spiral spring, and means, as described, for adjusting the spring.

6. The combination, with a compound electrode composed of two or more carbons converging and impinging at an acute angle, of feed-rollers, one for each carbon, and a common spring-actuated motor for said rollers.

7. The combination, substantially as described, of a circuit-closer operated by the main-circuit magnet of the lamp, a branch circuit controlled thereby and containing an electro-magnet, a shunt or cut-out circuit closer, and a catch or detent controlling the same and actuated by the branch-circuit magnet.

8. The combination, substantially as herein described, of a main-circuit coil or magnet, a branch-circuit coil whose circuit is controlled by the main-circuit coil or magnet, a loose core for said branch-circuit coil, set vertically and normally upheld by a catch or detent, an armature which operates said detent to release the core, and circuit-closing devices connected to the loose core and closing when the core drops, and a short circuit for the current of the lamp, so as to cut said lamp out of circuit.

9. The combination, with the coil or helix mounted on a screw-threaded support, so that it may be adjusted longitudinally by turning, of the contact rings or disks *s t*, one connected to the helix and the other to the conductor conveying current thereto.

10. The combination, in an electric lamp, of a shunt-circuit closer, an electro-magnet in a normally-open branch circuit for controlling said circuit-closer, and means for completing said branch circuit, operated by the main-circuit magnet of the lamp, all as shown and described, so that during normal operation of the lamp all of the current passes through the arc, and none is diverted into the magnet controlling the safety-circuit excepting upon abnormal increase in the length of arc.

In testimony whereof I have hereunto subscribed my name this 15th day of April, A. D. 1882.

JOSEPH B. ALLEN.

Witnesses:
JOHN F. MILLER,
MILTON F. SIMMONS.