

J. D. F. ANDREWS.
ELECTRIC ARC LAMP.

No. 266,337.

Patented Oct. 24, 1882.

Fig. 1.

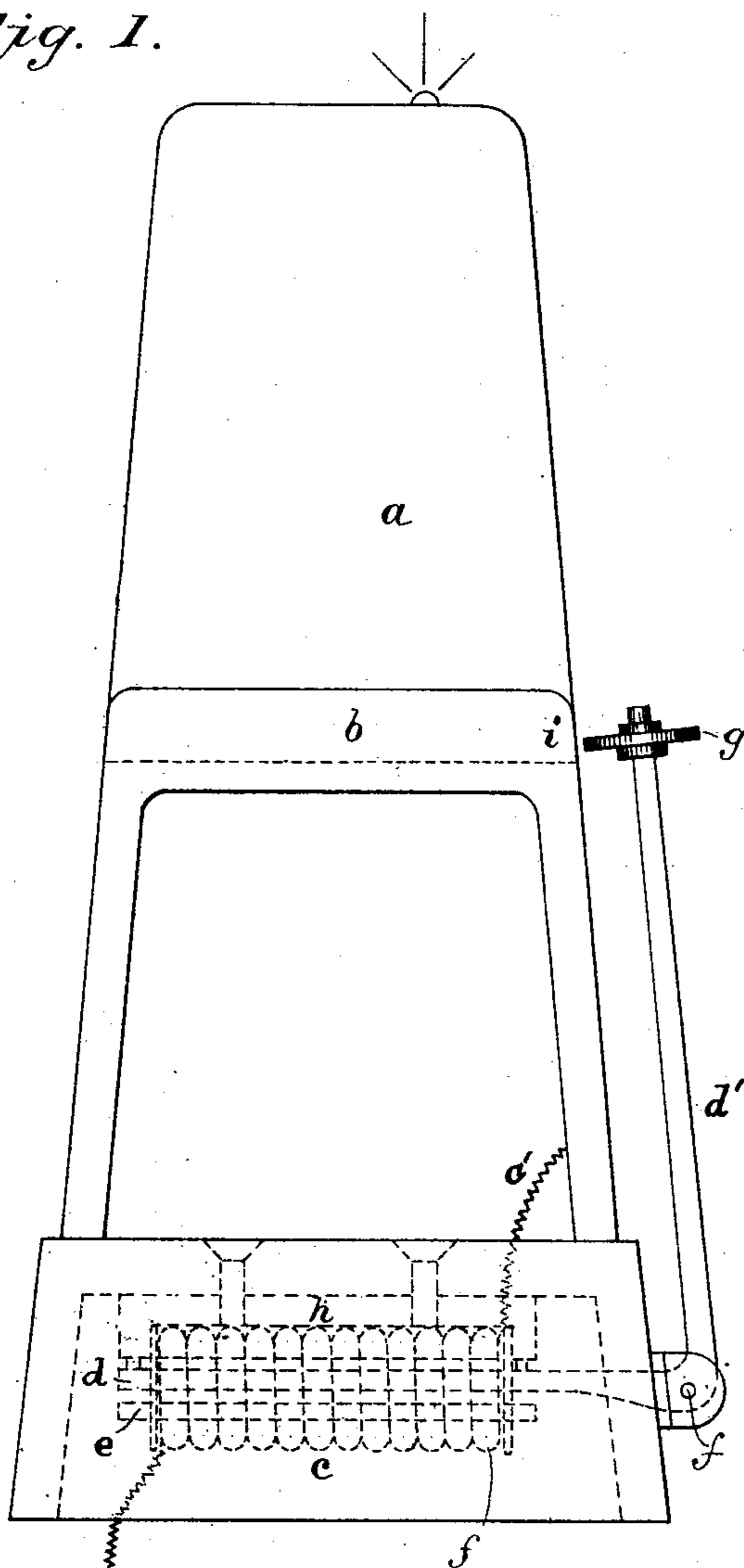


Fig. 2.

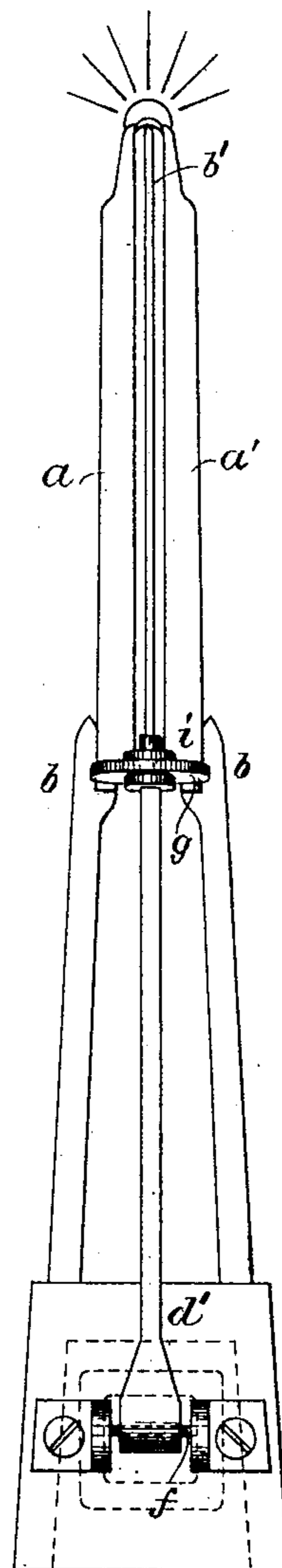
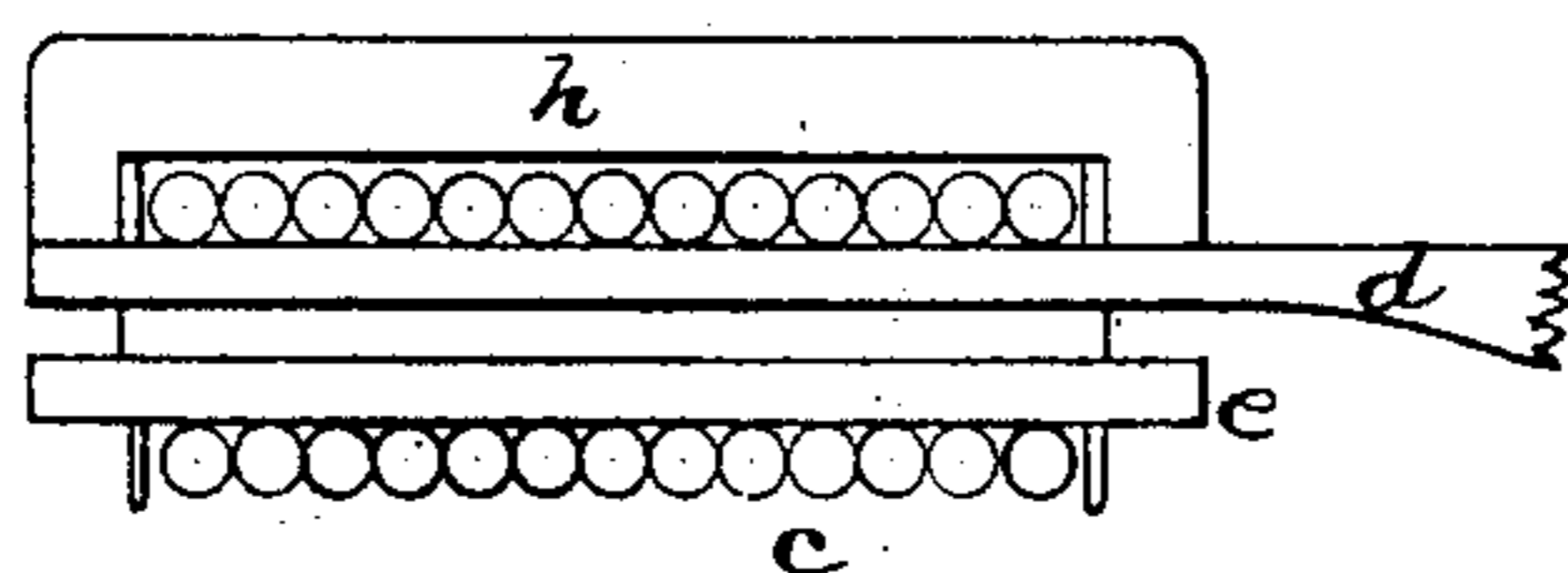


Fig. 3.



WITNESSES

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(No Model.)

2 Sheets—Sheet 2

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Fig. 4.

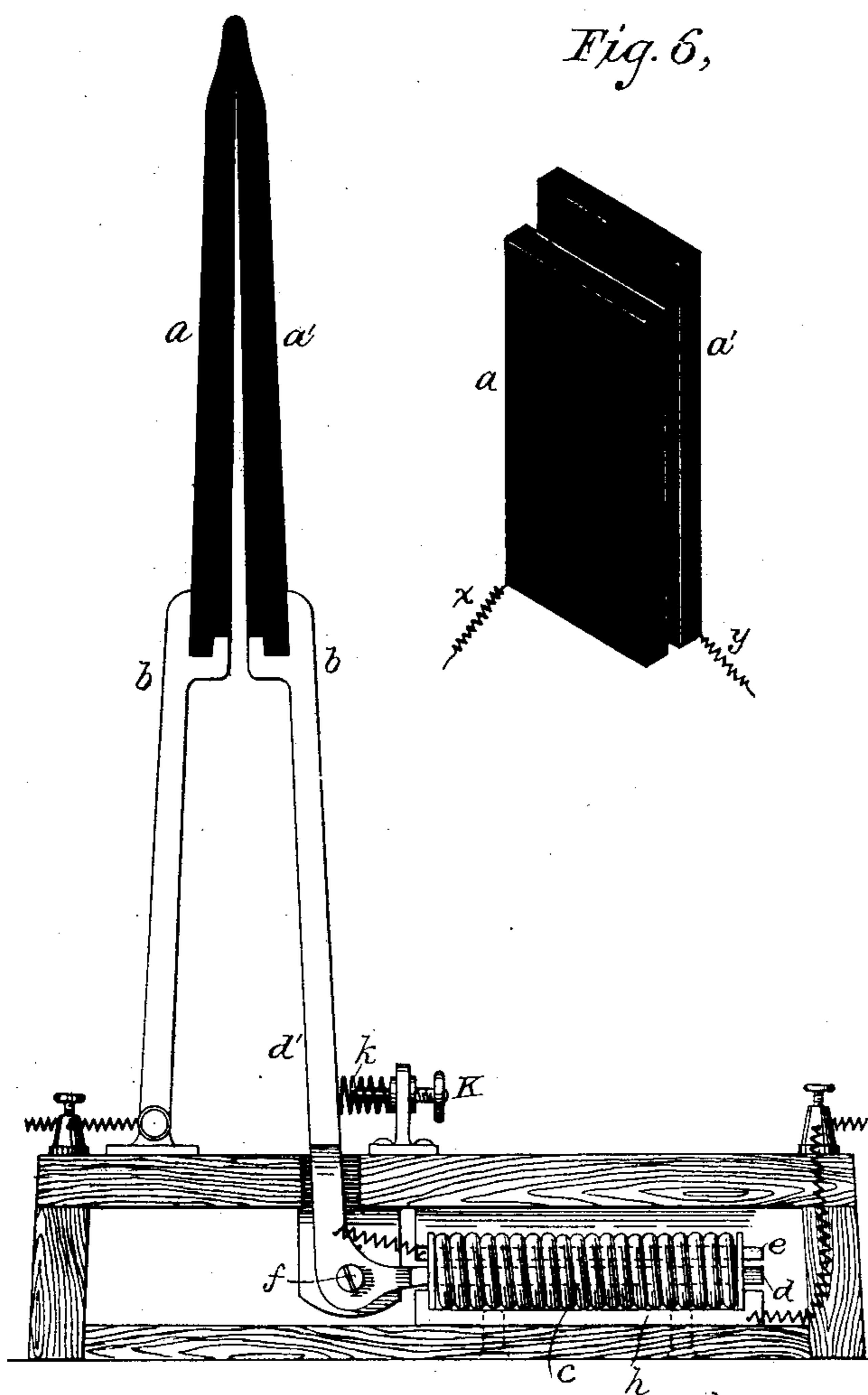


Fig. 6,

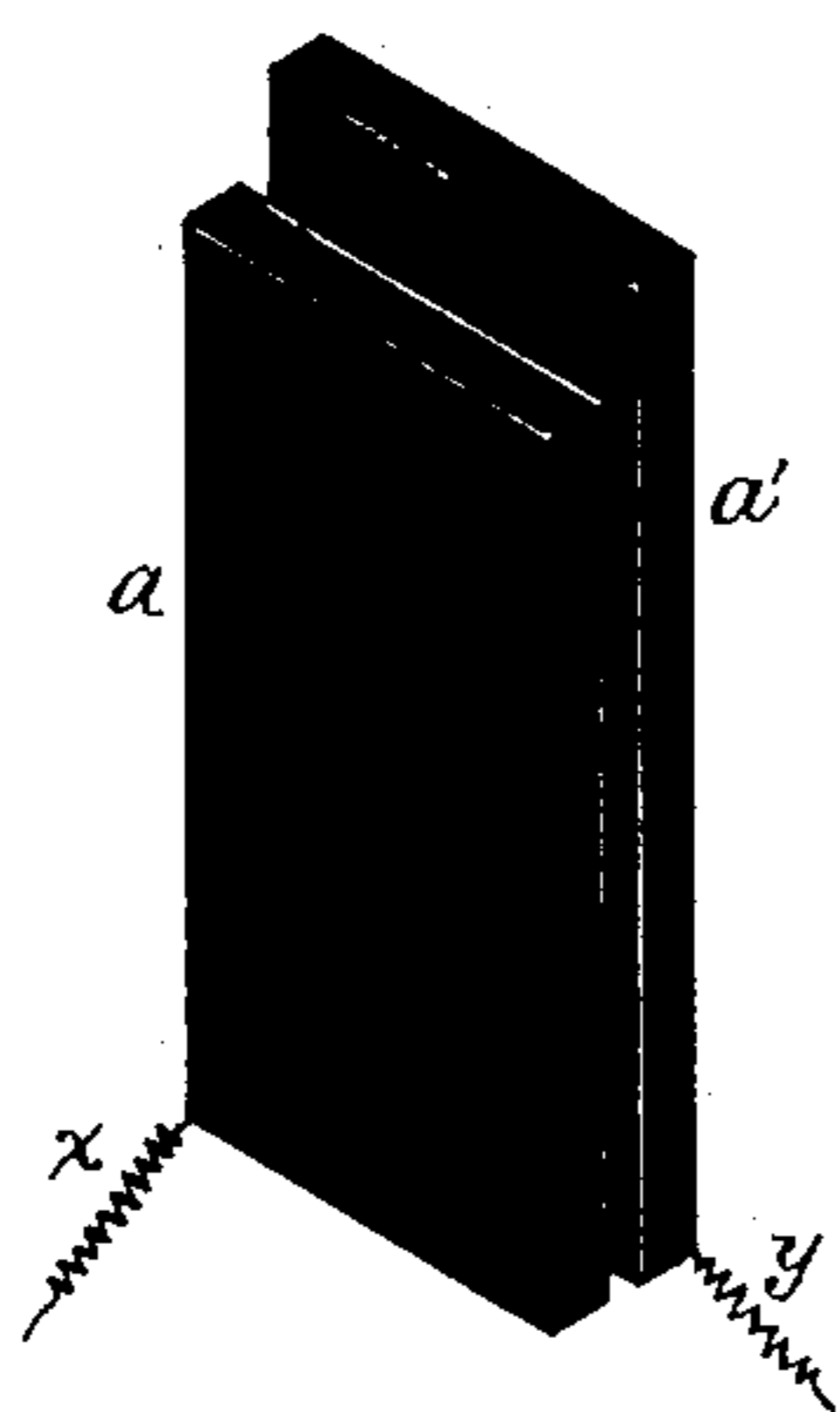


Fig. 5,

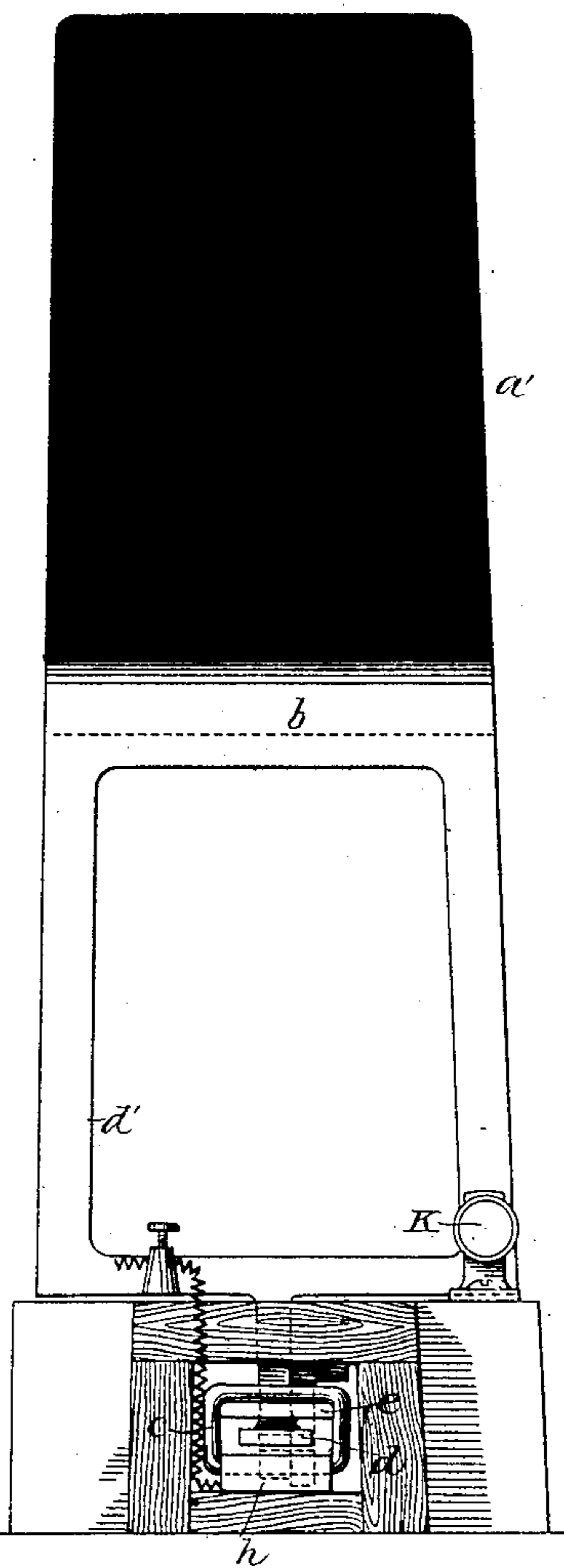
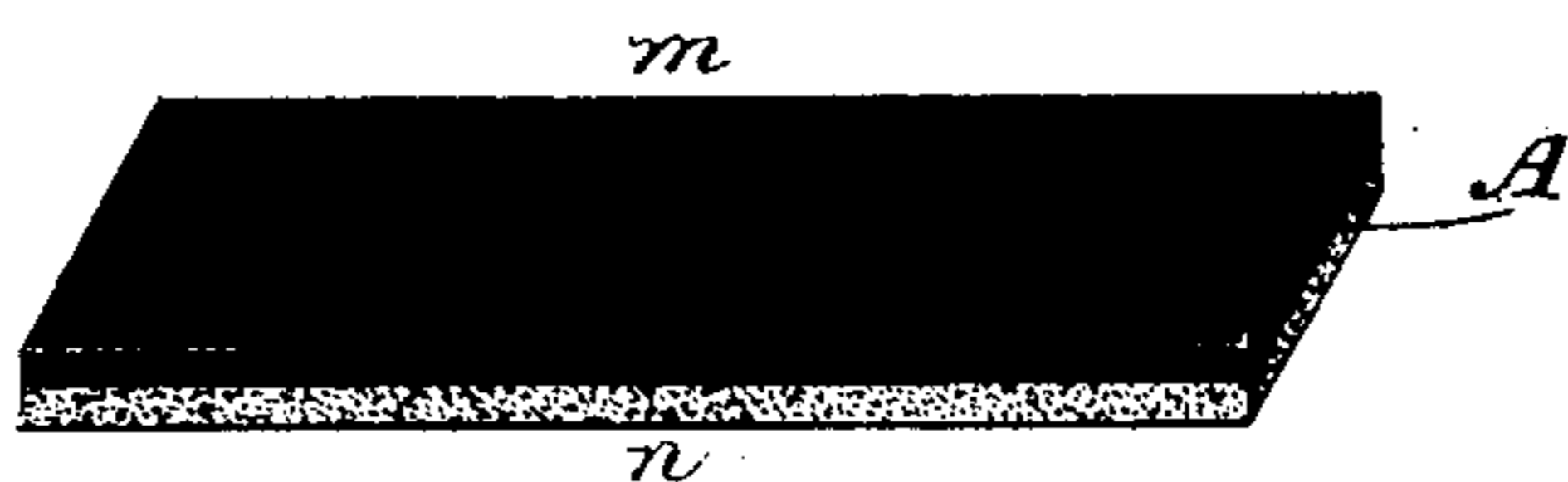


Fig. 7,



Witnesses;
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By his Attorneys
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UNITED STATES PATENT OFFICE.

JOSEPH D. F. ANDREWS, OF CHARLTON, COUNTY OF KENT, ENGLAND.

ELECTRIC-ARC LAMP.

SPECIFICATION forming part of Letters Patent No. 266,337, dated October 24, 1882.

Application filed August 25, 1881. (No model.) Patented in England June 11, 1879, No. 2,321, and in France December 10, 1879, No. 134,073.

To all whom it may concern:

Be it known that I, JOSEPH DAVENPORT FINNEY ANDREWS, of Charlton, in the county of Kent, England, a subject of the Queen of Great Britain, have invented certain new and useful Improvements in Electric-Arc Lamps, of which the following is a specification.

In the accompanying drawings, Figure 1 is an end or edge view, and Fig. 2 a side or front view, of my improved lamp, showing the automatic lighter; Fig. 3, a sectional detail view of the coil and split core of my automatic lighter. Fig. 4 is an end view of a modification in which the automatic-lighter-operating devices are applied to actuate one of the electrodes of the lamp to automatically light it, and Fig. 5 is a front view of the same. Fig. 6 is a perspective view of two carbon plates of different lengths, showing the manner of connecting them in circuit; and Fig. 7 is a perspective view of a carbon-plate electrode.

The first part of my invention relates to the electrodes of the lamp. I employ two plates or disks of carbon, which constitute the electrodes. They are placed parallel face to face a short distance apart, either with or without an insulating material or with or without an insulated carbon plate or disk between them. The electrodes being connected in electric circuit, the luminous arc presents itself at some point on their edges and slowly travels back and forth, burning them and the insulating material or insulated carbon plate or disk between them. This feature of my invention is illustrated in Figs. 1 and 2, where $a a'$ are carbon-plate electrodes placed face to face and mounted in the jaws $b b$ of an electric lamp. b' is the insulated carbon plate, which may or may not, as above mentioned, be placed between the electrodes. When the circuit is completed by suitable means at some point i across the edges of the electrodes the voltaic arc is established and the lamp lighted. The arc will now slowly travel up the edges of the plates to the top, where it moves about, burning the plates away evenly. The insulated carbon plate or disk between the electrodes is made very thin, and its purpose is to prevent any tendency of the arc to descend between the plates. When insulating material is placed

between the electrodes it will be consumed as the electrodes are burned. As above indicated, the electrodes may be burned with nothing between them. By this arrangement the inner side of each electrode is protected from the atmosphere and the outside exposed. The edges therefore always retain the chisel or beveled shape shown in the drawings, and consequently the arc is comparatively short and emits but little violet light. This is also true where even very thick plates are used. The electrodes, being of such broad dimensions, have a very low resistance and will burn for a great length of time.

Where the lamp is to be worked with an alternating current the carbon plates may be of equal thickness; but when the current is constant the positive plate is made thicker than the other to allow for its more rapid consumption.

When the light is required to be evenly diffused in all directions I make both plates of the same length; but when the illumination is required principally in one direction one of the plates—preferably that forming the positive pole—is made longer than the other, and in this case, in order to prevent the arc from traveling about on the face of the longer plate, it is found advantageous to make the connection with the plates at opposite ends, thus causing the arc to remain at the edge of the carbon. This last feature is illustrated in Fig. 6, where the wires x and y are shown as connected at opposite ends of the two plates.

In order to secure a greater steadiness of light, I construct the plate-electrodes of a number of layers of carbon of different densities and form. Usually I take two layers—one of plumbago or charcoal made slightly impure by the introduction of a small quantity of magnesia, slate, or clay, and the other a pure carbon made from ground coke in the usual way. This is illustrated in Fig. 7, where a carbon-plate electrode, A , is shown, consisting of two layers, $n m$, of different densities.

In constructing the lamps to burn in parallel circuit I usually make both the carbon plates fixed and light them, or complete the circuit between the carbons by an electro-magnetic lighter in circuit with the lamps and

automatically operated by the current that supplies the lamps. This automatic electric lighter constitutes the second part of my invention, and is illustrated in Figs. 1, 2, and 3.

5 It consists of an electro-magnet in circuit with the carbons of the electric lamp, the core of which magnet is split into two or more longitudinal sections, *d e*, one of which is pivoted to the frame of the lamp, and has attached to
10 its prolonged arm a piece of some conducting material, which it causes to bear on the edge of each electrode when no current is passing through the circuit. The other sections are firmly attached to the frame of the lamp.

15 On passing a current through the helix of the magnet the circuit between the lamp-electrodes is completed through the conductor resting against their edges; but at the same time the core is magnetized the split sections repel
20 each other, the carbon-lighter is thrown out of contact with the carbon-electrodes, and the lamp is lighted. In this position it will be held until the current ceases to flow through the helix, when the core will be demagnetized,
25 the sections fall together, and the lighter be again caused to close the circuit between the electrodes of the lamp. To complete the circuit I use a small piece of carbon or other material conducting well and offering a resistance
30 equal, or nearly so, to the arc.

Referring to the drawings, *c* is the coil or helix of an electro-magnet, having one terminal, *c'*, connected to carbon plate *a*.

d e are sections of the split core. Section *e*
35 is firmly attached to the bobbin of the coil *c* and section *d* to one arm of the iron lever *d'*, which is pivoted at *f*.

g is a piece of carbon secured to the upper end of lever *d'* by a clamp or other suitable
40 means. The armature of section *d* consists of an iron strip, *h*, which firmly secures coil *c* to the base of the lamp.

The operation is as follows: When no current passes through the lamp sections *d* and
45 *e* of coil *c* are demagnetized and rest against each other. This brings carbon *g* in contact with the edges of each of the carbon plates *a a'* at *i*, and a closed circuit is established through coil *c* and between the electrodes *a a'*.
50 On passing a current through this closed circuit sections *d e* of coil *c* become similarly magnetized. Section *d* is repelled by fixed section *e* and attracted by armature *h*, toward which it moves, throwing carbon *g* out of contact with
55 the edges of the electrodes *a a'*. The circuit having previously been completed across the edges of the electrodes, the voltaic arc presents itself at *i* as soon as the carbon *g* is removed and the lamp is lighted. The voltaic arc now
60 travels slowly up the plates to the top, where it moves about, burning the plates away evenly. The sides of the plates are cut away obliquely to prevent the too quick ascension of the arc to the top, which is liable to cause extinguish-
65 ment.

As long as the arc is maintained across the

plates and the circuit is uninterrupted the lighter is held away from the electrodes by the mutually-repulsive action of sections *d* and *e* and the attraction of armature *h*; but as soon
70 as the arc fails or the circuit is in any wise broken sections *d* and *e* fall together, carbon *g* returns by gravity to its position in contact with the edges of the electrodes, and the lamp is ready for relighting. It is obvious that if the
75 circuit is broken only by the failure of the arc across the electrodes the lamp thus automatically relights itself.

In Figs. 4 and 5 I have illustrated a modification of this part of my invention, in which
80 the carbon-lighter *g* is dispensed with and the carbon-holder of electrode *a'* is clamped to lever *d'* of section *d* of the split core of the magnet. The other parts are in all respects similar to those shown in Figs. 1 and 2. When
85 no current is passing through the line sections *d* and *e* repose against each other and carbon *a'* is in contact with carbon *a*, closing the electric circuit through coil *c* and electrodes *a* and *a'*. On passing a current through the circuit
90 sections *d* and *e* are magnetized, section *d* is repulsed by *e* and attracted by armature *h*, to which it moves, electrode *a'* is moved out of contact with *a*, and the electric arc established between them. On the cessation of the
95 current the circuit between the carbons is closed in a way similar to that already described, ready for the relighting of the lamp. *K* is a set-screw, having a coiled spring, *k*, against it, which limits the motion of electrode
100 *a'* and determines its distance from the other electrode and the length of the arc.

The right to apply for a patent upon the electro-magnet *per se* herein shown and described is reserved, in order that, if it is deemed neces-
105 sary and expedient for the protection of the invention, another application may be hereafter filed.

What I claim as my invention is—

1. In an electric lamp, broad plate-electrodes
110 placed parallel face to face, substantially as set forth.

2. In an electric lamp, the plate-electrodes placed parallel face to face, one being shorter than the other, substantially as and for the
115 purpose set forth.

3. The plate-electrodes consisting of layers of carbon differing in purity, substantially as set forth.

4. The electric lighter, substantially as here-
120 in described, which consists in the combination of the helix, its split core, the pivoted lever, and the carbon attached thereto.

5. The combination, substantially as herein described, of the helix, its split core, the piv-
125 oted lever, the carbon attached thereto, the iron strip or armature, and electrodes of an electric lamp.

6. The combination, substantially as herein described, of the helix, its split core, the piv-
130 oted lever, the carbon attached thereto, and electrodes of an electric lamp.

7. The combination of the plate-electrodes
placed parallel face to face, the carbon-lighter
g, which establishes the arc at the sides of the
plate-electrodes below their upper edges, and
5 the electro-magnet and the mechanism for
operating the lighter, substantially as set forth.
In testimony whereof I have hereunto sub-

scribed my name this 20th day of June, A. D.
1881.

J. D. F. ANDREWS.

Witnesses:

HORATIO DAIN,

WM. H. W. JEFFERIES.