(No Model.) 3 Sheets—Sheet 1.

F. M. LEWIS.

ELECTRIC ARC LAMP.

No. 538,023. Patented Apr. 23, 1895.

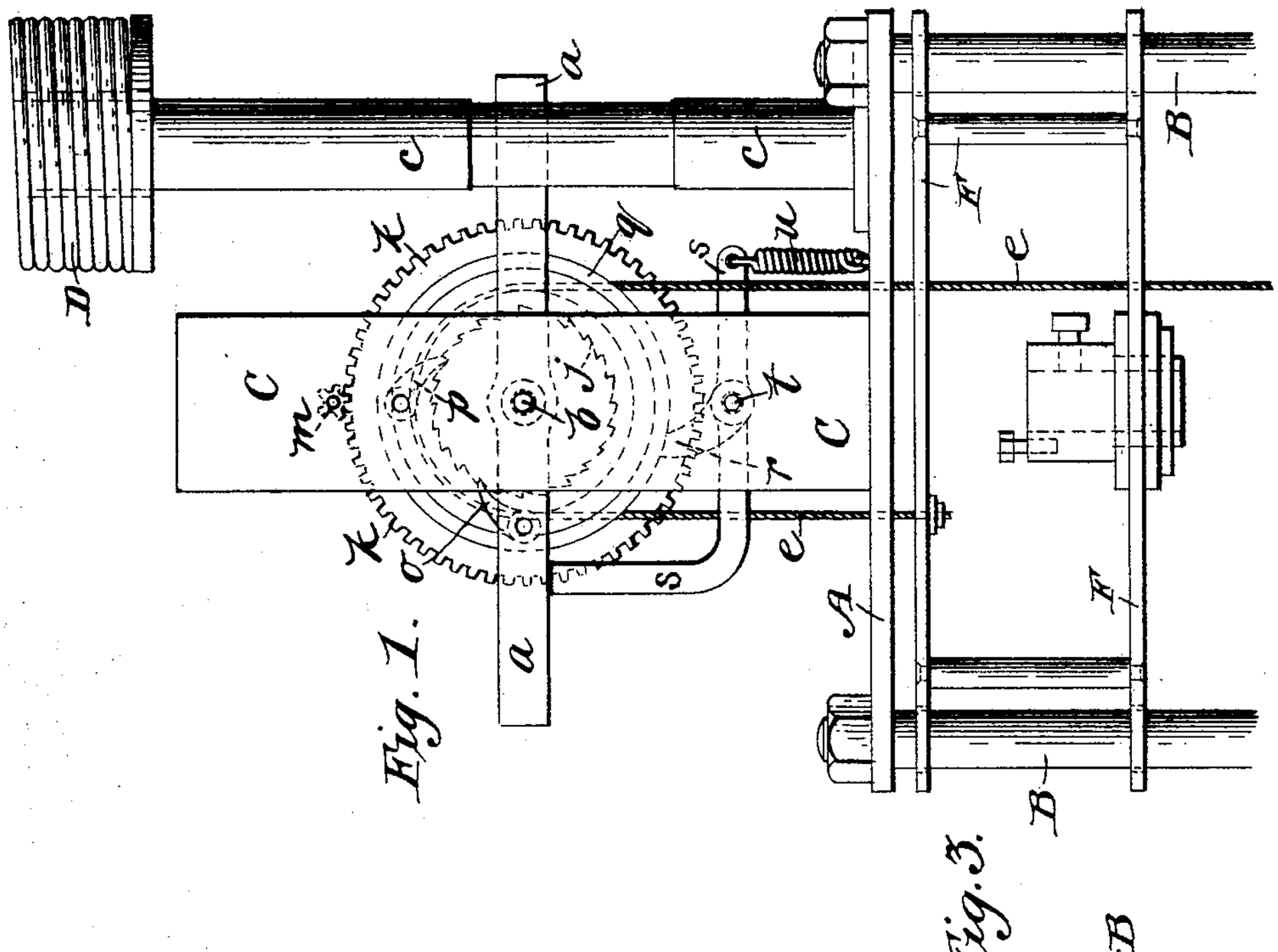


Fig. 1.

Fig. 3.

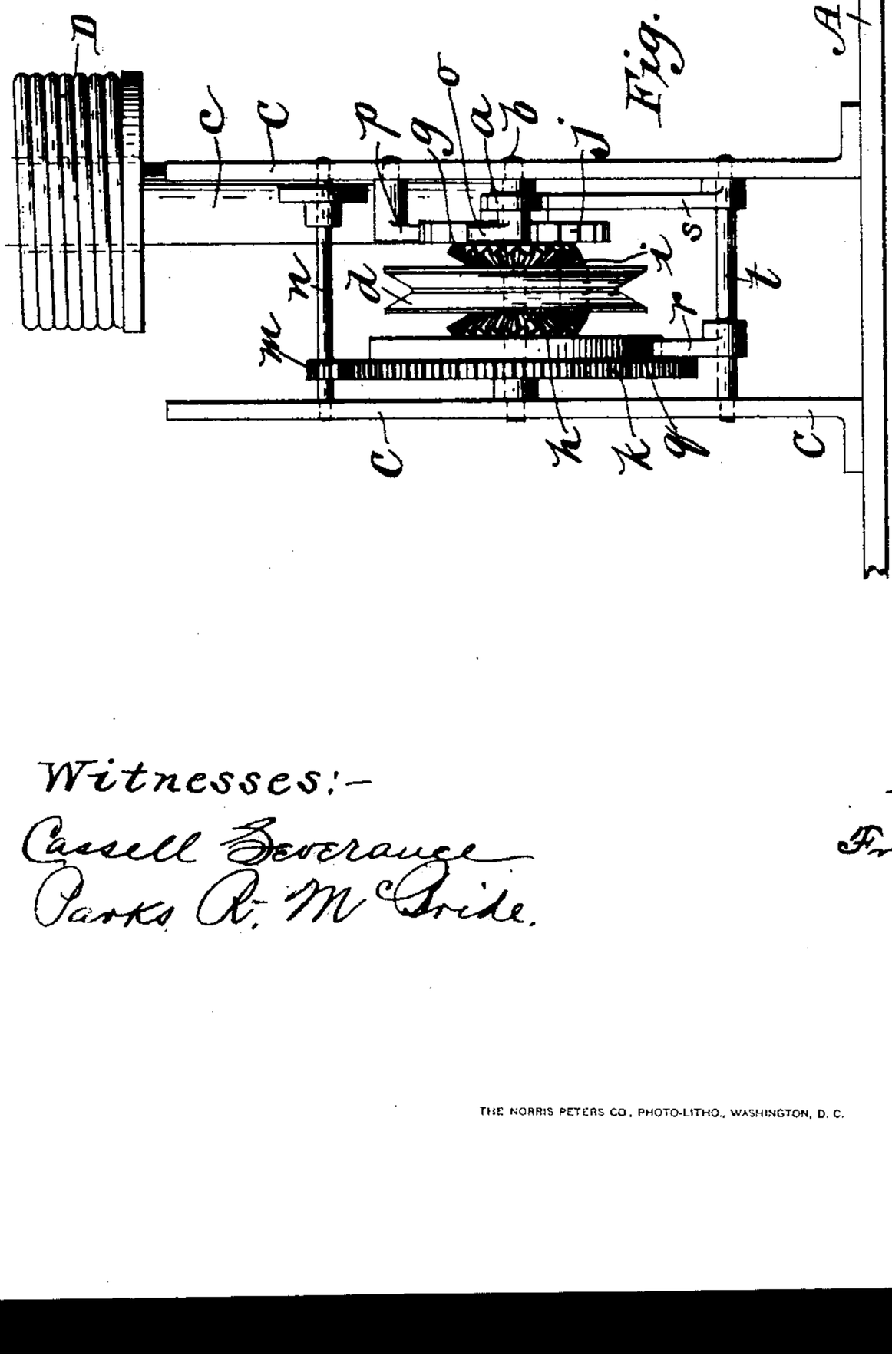
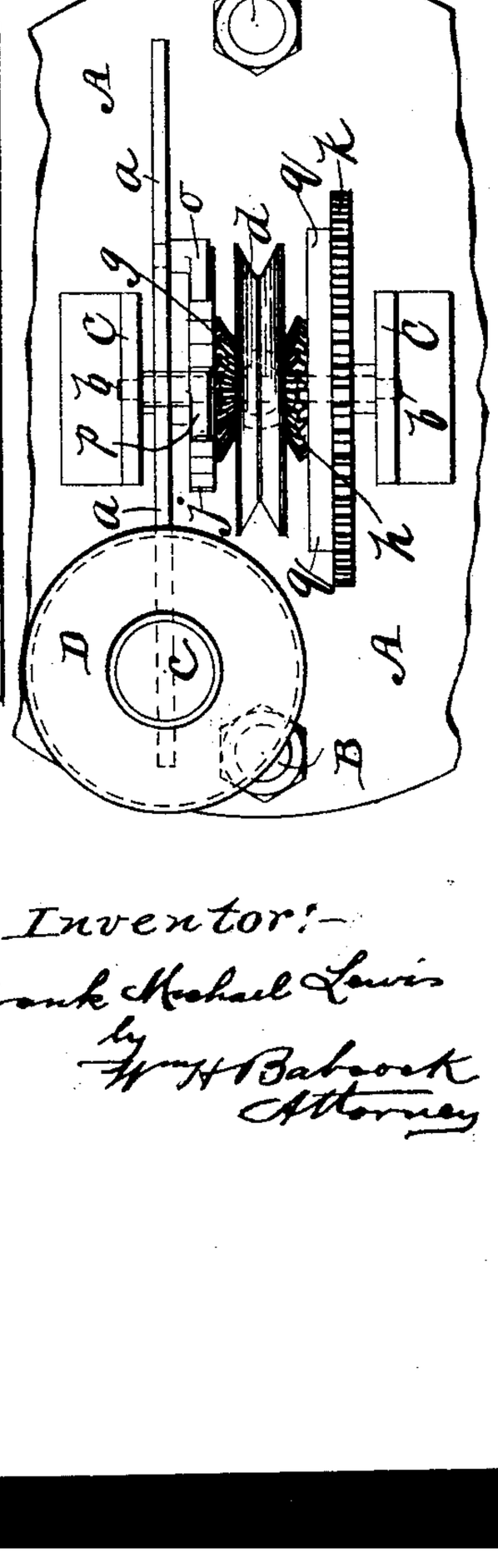


Fig. 2.



Witnesses:-
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Inventor:-
Frank Michael Lewis
by Wm H Babcock
Attorney

(No Model.) 3 Sheets—Sheet 2.

F. M. LEWIS.

ELECTRIC ARC LAMP.

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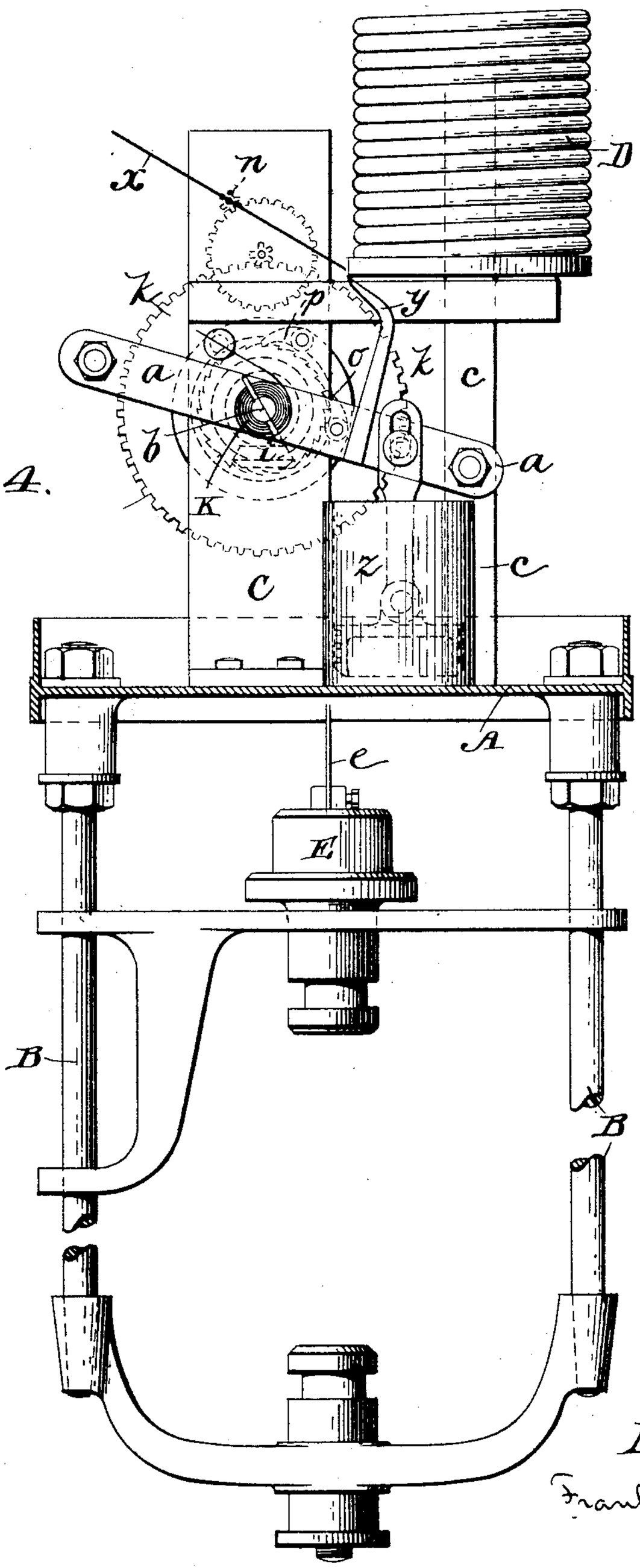
Fig. 4.



Witnesses.
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J. Clark Jefferson

Inventor:
Frank Michael Lewis

(No Model.) 3 Sheets—Sheet 3.

F. M. LEWIS.

ELECTRIC ARC LAMP.

No. 538,023. Patented Apr. 23, 1895.

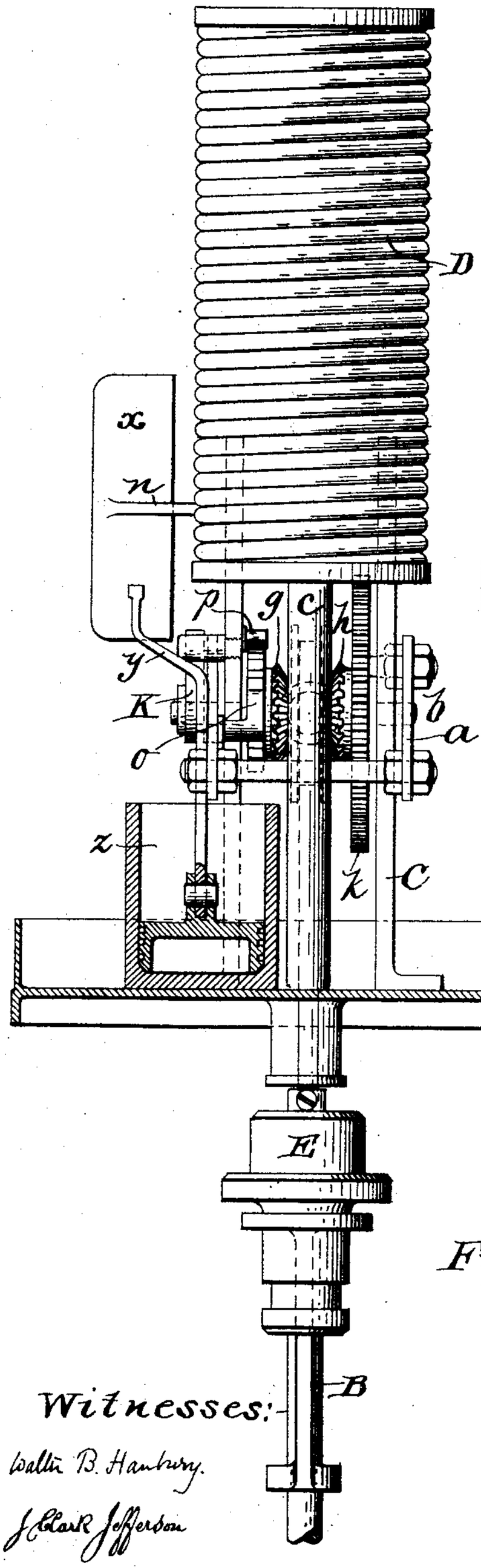

Fig. 5.

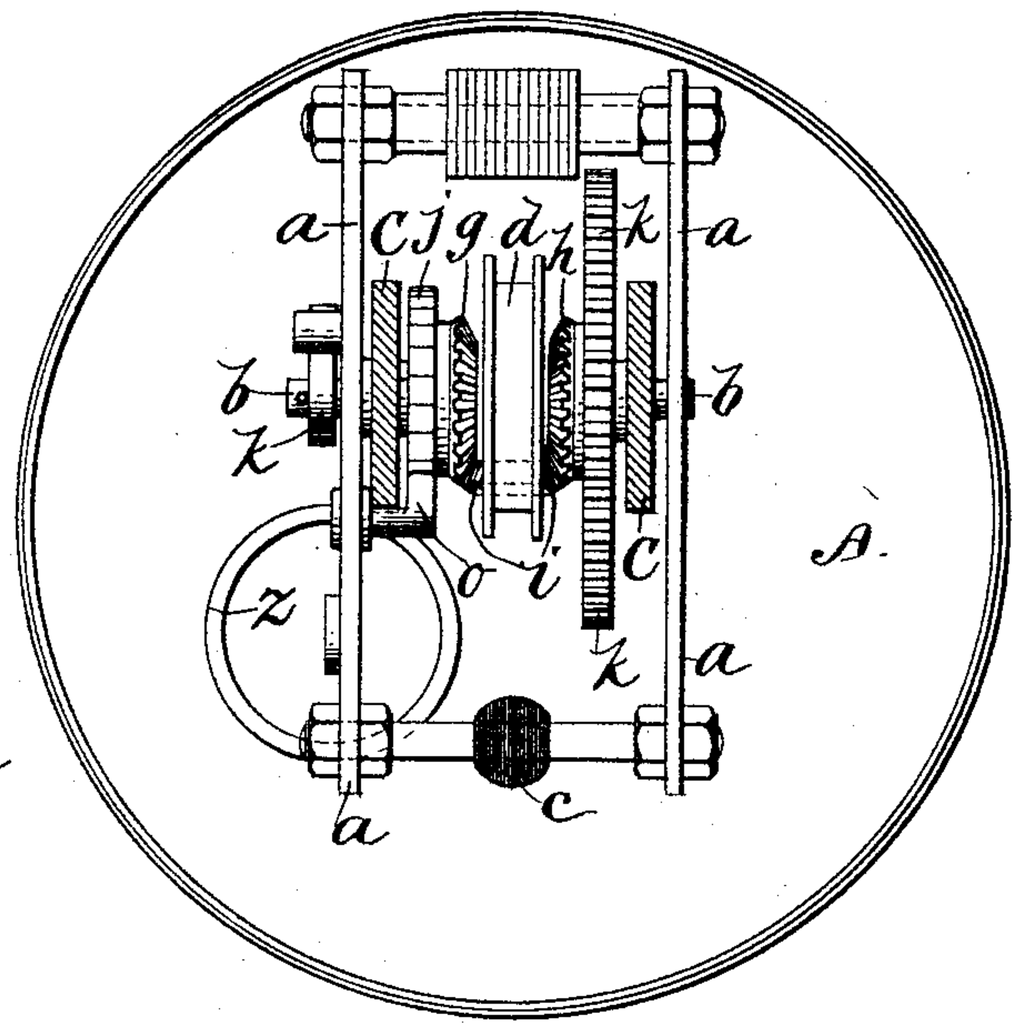

Fig. 6.

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UNITED STATES PATENT OFFICE.

FRANK MICHAEL LEWIS, OF LONDON, ENGLAND.

ELECTRIC-ARC LAMP.

SPECIFICATION forming part of Letters Patent No. 538,023, dated April 23, 1895.

Application filed October 12, 1894. Serial No. 525,677. (No model.) Patented in England December 4, 1893, No. 23,239.

To all whom it may concern:

Be it known that I, FRANK MICHAEL LEWIS, a subject of the Queen of Great Britain and Ireland, residing at Leinster Gardens, Hyde Park, London, England, have invented a new and useful Improvement in Electric-Arc Lamps, (for which I have obtained a patent in Great Britain, No. 23,239, bearing date December 4, 1893,) of which the following is a specification.

My invention refers to means for controlling the movement of one or both carbons in arc lamps, and has for its object to insure greater regularity in the feed as the carbons are consumed, to effect this with very small variation of the electromotive force across the terminals of the lamp, and to insure greater certainty of the striking of the arc (*i. e.* the movement of the carbons to the proper distance apart directly after contact).

My invention consists essentially in the introduction as part of the controlling mechanism of a rocking arm connected to the plunger of the solenoid and a differential or epicyclic train of wheels in such a manner that the feed of the carbons toward each other is effected through one side of the train, while the striking or moving apart of the carbons is effected from the opposite side of the train, the said rocking arm controlling the former (*i. e.* the feed) and operating the latter (*i. e.* the striking).

In order that my invention and its applicability to various kinds of arc lamps may be more readily and clearly understood I have annexed hereto the accompanying sheets of drawings, in which—

Figure 1 is a side elevation, Fig. 2 an end elevation, and Fig. 3 a plan, illustrating my invention as applied to a focusing arc lamp (*i. e.* in which both carbons are moved) and in which the solenoid winding is traversed by a shunt current across the lamp circuit. Fig. 4 is a side elevation, Fig. 5 an end elevation, and Fig. 6 is a plan, illustrating my invention as applied to a non-focusing arc lamp (*i. e.* in which only the top carbon is moved) having a wire or cord suspension for the top carbon and in which the solenoid winding is in the main circuit.

In all the views the same reference letter is used for the same or corresponding parts, so that both illustrations may as far as possible be described concurrently.

A is the lamp base from which the guide rods B are suspended and on which are mounted the side frames C for carrying the mechanism.

a is the before mentioned rocking beam, mounted loose on the end or ends of the main axle *b*, the latter being carried in bearings in the standards C. One end of the beam *a* is attached to the plunger *c* of the solenoid D. On the axle *b* is mounted the differential or epicyclic train of wheels. This consists of a central wheel *d* round which the wire or tape *e* passes to the top carbon holder E, Figs. 4 and 5; or to guide frames F carrying both carbon holders, of which only the top frame is shown in Fig. 1. The center wheel or drum *d* carries a small bevel (or crown) wheel *i*, which gears with two larger bevel (or crown) wheels *g* and *h*, mounted loose on the axle *b*. The wheel *g* is cast with or attached to the ratchet wheel *j*, and the wheel *h* with or to the large toothed wheel *k*, all being loose on the axle *b*. This toothed wheel *k* gears with the pinion *m* on the escapement wheel axle *n*, Figs. 1 and 2; or it may be geared to a fan axle also lettered *n*, Figs. 4 and 5, by means of intermediate axle and wheels.

The rocking beam *a* is provided with a pawl *o*, which engages with and moves the ratchet wheel *j* (so as to separate the carbons), when the plunger *c* of the solenoid in Figs. 1 to 3 moves downward; and in Figs. 4 to 6 moves upward. A second pawl *p* prevents the return of the ratchet wheel *j*, when the rocking beam *a* and pawl *o* move in the opposite direction.

In Figs. 1 to 3 a brake wheel *q* is attached to the wheels *h* and *k*, the movement of which is controlled by the brake block *r*, which is mounted on the cross shaft *t*. A double armed lever *s* is fixed on the cross shaft *t* near the opposite end, one arm of which is bent upward so as to come beneath and close against the under side of the rocking beam *a;* while the end of the opposite arm is attached to a spiral spring *u*, which latter is fixed by its lower end to the base A. This spring *u* constantly tends to keep the brake block *r* pressed against the brake wheel *q*, and the bent arm of the lever

s against the under side of the rocking beam *a;* while the upward movement of the solenoid plunger *c* causes the rocking beam *a* to depress the said bent arm and to take the brake block *r* off the brake wheel *q*.

In Figs. 4 to 6 which show the lamp mechanism provided with a fan *x* instead of an escapement, the checking of the feed is effected by means of the catch *y*, which is attached to the rocking beam *a*. When the plunger *c* is about in its lowest position, the catch *y* is clear off the fan *x* and allows this to rotate and the feed to take place. When the plunger *c* rises a slight distance, the catch *y* stops the rotation of the fan *x* and the feed of the carbon.

z is a dash pot, the piston of which is attached to the rocking beam *a* by means of a slotted link, and a pin passing through the slot and attached to the rocking beam *a*.

In Figs. 4 to 6 the center wheel *d* is keyed or fixed to the axle *b*, and a coiled spring K is fixed to the end of the axle *b* and to a stud in one of the standards C. This coiled spring serves to draw up the tape *e*, when the carbon holder E is pushed up for recarboning.

The operation of my lamp is as follows:

Referring first to Figs. 1 to 3, in which the solenoid winding is traversed by a shunt current, when no current is passing, so that the core or plunger *c* occupies its lowest position, the spring *u* presses the brake block *r* against the brake wheel *q*, and locks the feed side of the differential or epicyclic train. As soon as the current is switched on, the plunger *c* rises, and lifts its end of the rocking beam *a*, and depresses the opposite end; which pushes down the bent arm of the lever *s*, so as to take off the brake *r*, and allows the lamp to feed; the ratchet wheel *i* being kept stationary by the catch *o*. The solenoid winding being in shunt, the current traversing it weakens as the carbons approach, until it allows the core *b* to fall, and moves the rocking beam *a* so as to allow the brake *r* to stop the feed side of the train; while the pawl *o* rotates the ratchet wheel *j* so as to move the carbons apart. When the arc becomes too long, the increased strength of the current traversing the solenoid winding again raises the plunger *c*, and as just explained allows the lamp to feed.

Referring to Figs. 4 to 6 in which the solenoid winding is in the main current, when no current is passing through the winding, the core *c* of the solenoid occupies its lowest position see Fig. 4, the catch *y* being clear off the fan *x*, so that the feed gear is released and the weight of the top carbon holder feeds down the top carbon until it meets the lower carbon, or until the strength of the current begins to raise the solenoid plunger. During this time the catch *p* prevents the rotation of the ratchet wheel *j*. Directly after the plunger *c* begins to rise, it raises the arm or beam *a* at the corresponding end, so that the catch *y* stops the fan *x* and the feed side of the differential train, and at the same time the catch *o* rotates the ratchet wheel *j*, thus raising the top carbon holder, separating the carbons. When the arc grows too long, the plunger *c* falls, the catch *p* preventing a reverse movement of the ratchet wheel *j*, and on the plunger descending sufficiently far, the catch *y* again moves clear off the fan *x* and allows the lamp to feed, until the current again raises the plunger *c*.

It will be evident that the pulley or drum *d* may be replaced by a toothed pinion gearing into a rack or racks attached to the top of both carbon holders; further that the arrangement of the epicyclic gear shown is not the only arrangement possible, but other forms may be used. For example, the bevel wheels *g*, *h*, may be replaced by ordinary spur wheels, and the bevel pinion *i* by a horizontal shaft having an ordinary straight pinion wheel keyed at each end and engaging respectively with said spur wheels *g* and *h*.

The object of the epicyclic gear is to make the striking of the lamp independent of the feed, and this can be effected by an epicyclic gear so arranged that the striking is done from one side of the train and the feeding from the other side. The operation of the epicyclic wheel is the same as in any epicyclic gear, for example that which sometimes forms part of a tricycle. When both side wheels move at the same speed, the intermediate wheel does not move about its own axis. When one of the side wheels moves faster than the other the intermediate wheel turns in one direction or the other proportionally to their difference of rotation.

The chief practical advantage of the epicyclic gear in my lamp is that, the striking and feeding devices being independent though connected, the striking mechanism may at any time be pulled up farther in case of overfeeding. Another advantage is that when the feed has to be checked or stopped there is only the friction of the pivots of the walking beam *a* to be overcome, and not, as in many other lamps, the friction of the whole lamp mechanism. Moreover, with small fluctuations or irregularities in the current the pawl *o* merely rides up and down over the curved surface of a tooth and therefore does not keep moving the carbons apart, thus causing the light to be unsteady.

I am aware that prior to my invention differential or epicyclic gear has been proposed for arc lamps in combination with two solenoids and two plungers, or with two electric controlling devices. I do not therefore claim the general use of differential or epicyclic gear in connection with arc lamps; but

What I do claim as my invention, and desire to secure by Letters Patent, is—

1. In arc lamps the combination of a rocking beam connected at one end with the plunger of a solenoid, a differential or epicyclic gear, the carbon holders and their suspension devices connected with the said center wheel, a ratchet wheel on one side of said gear acted upon by a ratchet pawl connected to said

rocking beam, a toothed wheel on the opposite side of said gear, connected directly or indirectly with an escapement, fan or other feed checking or steadying device, and a stop or brake device acting on the feed gear, such device or feed gear being controlled by the movement of the said rocking beam or of the solenoid plunger.

2. In arc lamps the combination of a rocking beam *a* carrying a pawl *o* and connected at one end with the plunger *c* of a solenoid D, a differential or epicyclic train of wheels *d*, *i*, *g*, *h*, of which *d* may be a rack pinion or a pulley, a fixed pawl *p*, a ratchet wheel *j* at one side of said train of wheels, a toothed wheel *k* at the opposite side of said train of wheels and connected with a fan or escapement axle *n*, and means for releasing and stopping the feed gear consisting of a brake wheel *q*, block *r* and lever *s*, actuated by the aforesaid beam *a* and spring *u*, or of a catch *y* attached to the rocking beam *a*, all substantially as set forth.

3. In arc lamps the combination of a rocking beam *a* carrying a pawl *o* and connected at one end with the plunger *c* of a solenoid D, a differential or epicyclic train of wheels *d*, *i*, *g*, *h*, of which *d* may be a rack pinion or a pulley, a fixed pawl *p* and a ratchet wheel *j* and toothed wheel *k*.

4. In arc lamps the combination of a single solenoid D and plunger *c*, a rocking beam *a* and a differential or epicyclic train such as *d*, *i*, *g*, *h*, for the purpose of enabling the striking and the feeding movements to take place independently of each other.

5. In arc lamps the combination of a single solenoid D and plunger *c* with a differential or epicyclic train of wheels such as *d*, *i*, *g*, *h*, so that the movement of the plunger in one direction effects the striking of the arc through one side of the train, while the movement of the plunger in the opposite direction releases the feed gear through the opposite side of the train.

FRANK MICHAEL LEWIS.

Witnesses:
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