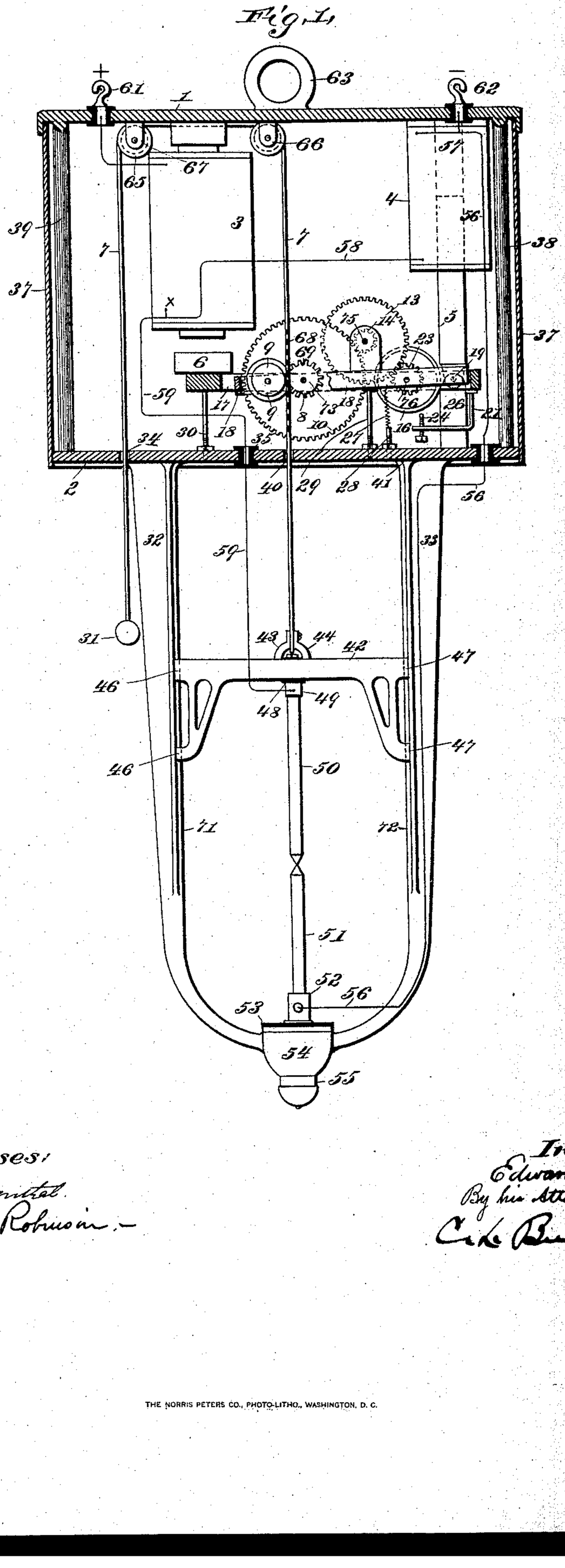
(No Model.) 2 Sheets—Sheet 1.

E. R. KNOWLES.

ELECTRIC ARC LAMP.

No. 485,327. Patented Nov. 1, 1892.

Fig. 1.



Witnesses:
Max Loewenthal.
Lewis J. Robinson.

Inventor:
Edward R. Knowles.
By his Attorney
C. L. Burkinshaw

(No Model.) 2 Sheets—Sheet 2.

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Fig. 2.

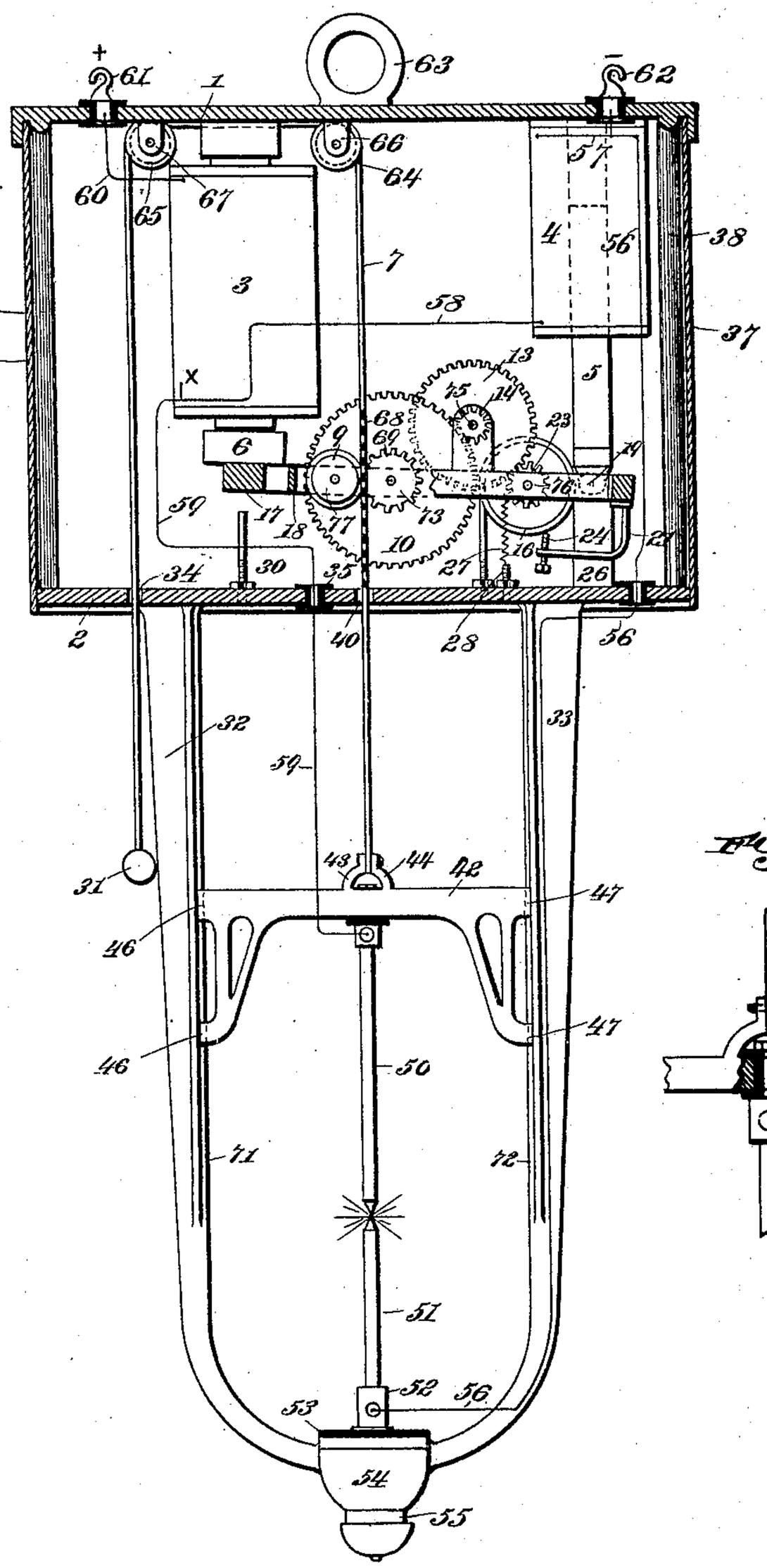

Fig. 3.

Fig. 4.

Fig. 5.

Fig. 6.

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UNITED STATES PATENT OFFICE.

EDWARD R. KNOWLES, OF MIDDLETOWN, CONNECTICUT.

ELECTRIC-ARC LAMP.

SPECIFICATION forming part of Letters Patent No. 485,327, dated November 1, 1892.

Application filed November 24, 1891. Serial No. 412,916. (No model.)

To all whom it may concern:

Be it known that I, EDWARD R. KNOWLES, a citizen of the United States, and a resident of Middletown, in the county of Middlesex and State of Connecticut, have invented certain new and useful Improvements in Electric Lamps, of which the following is a specification.

My present invention relates to improvements in electric-arc lamps of the class which are universal in their application—that is to say, lamps which are practically and efficiently operative on either an "arc," an "incandescent," or an "alternating" current, as commonly known, or, in other words, what is electrically known as "direct" and "alternating-current" circuits; and it consists in certain novel parts and combinations of parts specifically pointed out in the claims including this specification.

My invention is not limited to the structure shown, as various modifications may be made without departing from its spirit and without exceeding the scope of the claims.

In the accompanying drawings, forming part of this specification, in the several figures of which like parts are similarly designated, Figure 1 is a side view in elevation of the lamp mechanism when out of action, the lamp case and frame being partly broken away and partly in section. Fig. 2 is a similar view illustrating the mechanism when in action. Fig. 3 is a detail view of the upper-carbon-supporting band or chain. Figs. 4 and 5 are detail views showing modifications of the same, and Fig. 6 is a detail view of the method of fastening the upper-carbon-supporting band or chain to the upper-carbon holder from the guide.

I will now describe the construction of the electric-arc lamp shown in the accompanying drawings, which contains in total combination all the novel features of my present invention, each in one of the many forms in which it may be practically employed and that the form which I at present prefer to employ.

The frame of the lamp is composed of a top plate 1, supported from a base-plate 2 by rods 38 39, and the whole is inclosed by a shell 37, these parts together forming what I shall designate as the "case" of the lamp.

Attached to the base-plate 2 are the side rods 32 33, which are united together at their lower ends to form the base 54, which carries the lower-carbon holder 52 and the globe-supporting tube 55. The lower-carbon holder 52 is insulated from the base 54 by a plate of insulating material 53. The inner edges 71 and 72 of the side rods 32 33 are parallel one to the other and serve as guides for the cross-head 42. The cross-head 42 is made of metal and is provided at its ends with bearings 46 46 and 47 47, which embrace the guides 71 and 72 and slide thereon and serve to keep the cross-head 42 in a horizontal position and the axis of the upper carbon 50 central and in a vertical line with the axis of the lower carbon 51. The upper carbon 50 is held by the carbon-holder 49 and is insulated from the cross-head 42 by the insulating-piece 48.

43 and 44 is a clamp, by means of which the flexible band or ribbon 7 is attached to the cross-head 42. This flexible ribbon or band, which will hereinafter be more fully described, passes up through an opening 40 in the base-plate 2 of the case and over two pulleys 64 and 65, attached to the top plate 1 of the case by suitable supports 66 and 67, and then down through the opening 34 in the base-plate 2 of the case, terminating in a ball or weight 31. As shown by this arrangement, whenever it is desired to place new carbons in the lamp by pulling on the terminal ball or weight 31 the cross-head 42 can be lifted to a sufficient height to permit of the insertion of the carbons, the terminal weight or ball serving to keep the ribbon or band taut and straight. This form of flexible ribbon takes the place of the rod or gear ordinarily used in lamps of this description and enables me to dispense with all projecting tubes or horns above the top of the lamp-case, and also enables me to make the lamp-case exceedingly short and compact.

61 and 62 are terminal binding posts or hooks attached to the top plate 1 of the case and suitably insulated therefrom, and 63 is an eye from which the lamp may be suspended, if so desired. The flexible band 7 is made of a strip of very thin sheet metal and is perforated with a series of holes 68 68 at regular intervals along its axis from end to end, as shown in Fig. 3. The flexible band 7 may

also be corrugated and without holes, as shown in Fig. 5, or it may consist of a flat-link chain, each link 69 being pivoted to its neighbor by a pivot 76 and so constructed as to leave openings 68 between each link, as shown in Fig. 4, the object in each case being the same—viz., to provide a flexible rack which may be bent or turned in any desired direction and yet engage with the teeth of a suitably-arranged sprocket or gear wheel or pinion 8, as shown in Figs. 1 and 2.

Within the lamp-case above described is contained the operating parts of the lamp, which I will now describe.

3 is an electro-magnet of low resistance and connected in series with the main circuit by binding-posts 61 and 62 and the carbons 50 and 51, the complete circuit being terminal 61, wire 60, magnet 3, wire 59, carbons 50 and 51, wire 56, and terminal 62.

4 is a solenoid electro-magnet of high resistance and is connected between a point X, which is the inner terminal of the low-resistance magnet 3 and the negative terminal of the lamp, the complete circuit being point X, wire 58, magnet 4, wire 57, and terminal 62.

6 is the armature of magnet 3 and is attached to one end of a frame 17, which is pivoted at the other end at 19 to a support 26. The position of the armature 6 is regulated by raising or lowering the stop 30. Inside frame 17 is placed another frame 18, which is pivoted at 73 in frame 17 and has attached to its other end the movable core 5 of solenoid-magnet 4. The position of frame 18 is regulated by raising or lowering stop 29. The pivot on which frame 18 is free to move is the axle 73 of the sprocket-wheel or pinion 8, which passes through frame 18 and is journaled in frame 17. Upon axles 73 is also placed a gear-wheel 10, which meshes with a pinion 14, whose axle 75 is journaled in frame 18. Axle 75 carries a gear-wheel 13, which meshes with a pinion 23, whose axle 76 is journaled in frame 18, and this axle 76 also carries a friction-wheel 16. By this arrangement it will be seen that any movement of armature 6 will move with it frames 17 and 18 and all the train of gear-wheels and pinions already described, and that any movement of magnet 5 will move with it only frame 18, pinion 14, gear 13, pinion 23, and friction-wheel 16, the axle of sprocket-wheel 8 and gear 10 being fixed in frame 17 and frame 18 and its train of gears and pinions revolving around it as a pivot or center. The flexible band or ribbon 7 has its perforations 68 in mesh with the projections or teeth 69 of the sprocket or gear wheel 8, and is prevented from slipping off and away from them by a roller 9, whose axis 77 is pivoted in frame 18, and which is so set that the teeth 69 of wheel 8 come into contact with its periphery.

27 is a spring attached at one end to frame 18 and at the other end to the tension-regulator 28, by means of which it can be made to give stronger or weaker pull, as may be desired. This spring acts to keep frame 18 in contact with stop 29 unless it is lifted by the action of magnet 4 upon its core 5.

On the end of frame 17 is the bent arm 21, provided with a friction-screw 24, which may be adjusted through an opening 41 in the base-plate 2.

When the lamp is out of action, the position of the parts is as shown in Fig. 1, frame 18 being supported by stop 29 at such a height that the friction-wheel 16 clears the friction-screw 24 and the train of gearing is free to turn; but when the lamp is in action, as shown in Fig. 2, the raising of frame 17 permits the friction-wheel 16 to come in contact with friction-screw 24, thereby preventing friction-wheel 16 from turning and locking the train of gears and preventing them from turning unless frame 18 is lifted by magnet-core 2, in which case friction-wheel 16 is free to revolve.

When a current of electricity is passed through the lamp, magnet 3 is energized and attracts its armature 6, thereby lifting frame 17 and with it frame 18 and all the train of gears and pinions, at the same time allowing friction-wheel 22 to come into contact with friction-screw 24, thereby locking the train of gears and preventing them from revolving. When frame 17 is lifted, it carries with it the perforated flexible band or chain 7, which is in mesh with pinion-wheel 8, thereby lifting cross-head 42 and separating the carbons 50 and 51 and starting the electric arc. As the carbons burn away and the arc increases in length, its resistance increases and more and more current is shunted through magnet 4 until it is energized sufficiently to draw up its core 5, thereby lifting frame 18 and the train of gearing and freeing friction-wheel 16 from friction-screw 24, thereby permitting it and the train of gearing to revolve and cross-head 42 to descend until the distance between the carbons is normal, whereupon core 5 descends and friction-wheel 16 is again brought in contact with friction-screw 24, thus preventing any further motion of the gearing. This operation is repeated so long as the lamp is in action, and when the current is cut off or ceases to pass through the lamp the parts again resume the position which they had at first.

In the foregoing specifications I have referred to some of the modifications which may be adopted in practicing my invention; but I have not endeavored to describe all the modifications which might be employed, the object of this specification being to instruct persons skilled in the art to practice the several novel features of my invention in the forms at present preferred by me and to enable them to understand its nature, and I desire it to be distinctly understood that mention by me of a few modifications is not intended in any way to exclude others not referred to, but which are within the spirit and scope of my invention.

Many of the combinations and details illustrated and above described are not essential to the several features of my invention separately and broadly considered. All this will be indicated in the concluding claims, as in any given claim, the omission of an element or of the particular features of the elements mentioned is intended to be a formal declaration of the fact that the omitted elements and features are not essential to the invention therein covered.

Having thus described a mechanism embodying in preferred form all the several features of my present invention in combination, what I claim, and desire to secure by Letters Patent, is—

1. In an electric lamp, a frame movable to establish the arc, a main magnet, an armature therefor by which the movement of the arc-establishing frame is controlled, a train of gearing terminating in a friction-wheel, a supporting-frame therefor pivoted in and carried by the arc-establishing frame, a magnet in a derived circuit for controlling the movement of the gearing-frame, a friction-screw carried by the arc-establishing frame for the purpose of controlling the movement of the friction-wheel, and a vertically-moving perforated flexible ribbon or band engaging with the train of gearing and supported on the frame of the lamp.

2. In an electric lamp, a frame movable to establish the arc, a main magnet, an armature therefor by which the movement of the arc-establishing frame is controlled, a train of gearing terminating in a friction-wheel, a supporting-frame therefor pivoted in and carried by the arc-establishing frame, a magnet in a derived circuit for controlling the movement of the gearing-frame, a friction-screw carried by the arc-establishing frame for the purpose of controlling the movement of the friction-wheel, and a vertically-moving perforated flexible ribbon or band engaging with the train of gearing and supported on the frame of the lamp, substantially as described.

3. In an electric lamp, a train of gearing, a frame for supporting the same, a vertically-moving perforated flexible ribbon or band engaging with the train of gearing and supported on the frame of the lamp, and a roller pivoted in the gearing-frame and in contact with the perforated flexible band or ribbon, whereby it is kept in engagement with the train of gearing and prevented from slipping therefrom, substantially as described.

4. In an electric lamp, as a means for raising, supporting, and feeding the upper carbon, a vertically-moving perforated flexible ribbon or band supported on the frame of the lamp, one end of said ribbon or band being attached to the upper carbon or a frame carrying the same and the other end passing out through the base of the lamp-frame and terminating in a ball or weight, substantially as described.

5. In an electric lamp, as a means for raising, supporting, and feeding the upper carbon, a vertically-moving perforated flexible ribbon or band supported on the frame of the lamp, one end of said ribbon or band being attached to the upper end of said carbon or a frame supporting the same and the other end passing out through the base of the lamp, substantially as described.

Signed at Middletown, in the county of Middlesex and State of Connecticut, this 24th day of October, A. D. 1891.

EDWARD R. KNOWLES.

Witnesses:
MAX LOEWENTHAL,
CHAS. E. DUSTIN.