(No Model.) 3 Sheets—Sheet 1.

C. E. BALL.

ELECTRIC ARC LAMP.

No. 260,925. Patented July 11, 1882.

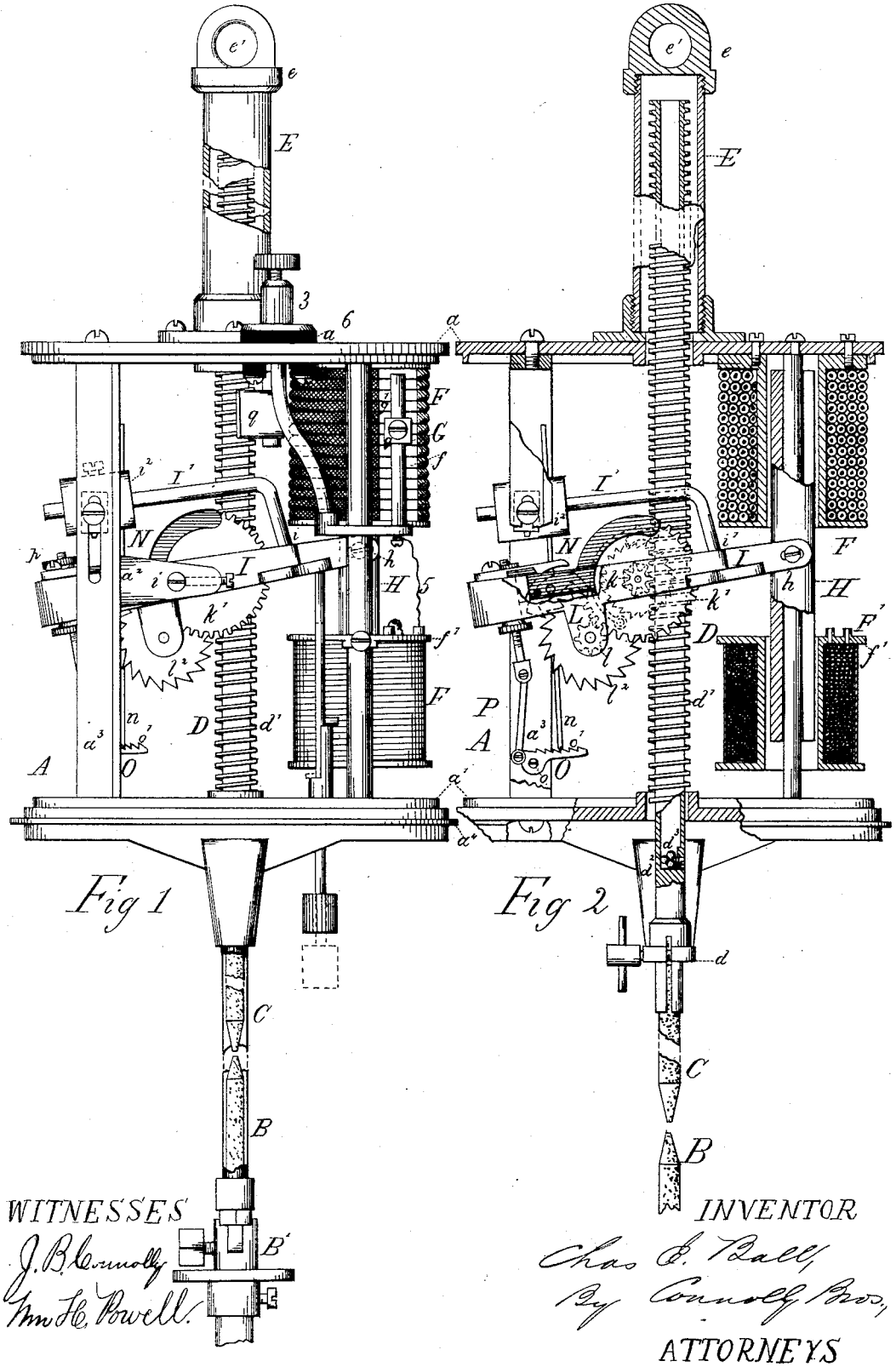

Fig 1

Fig 2

WITNESSES

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(No Model.) 3 Sheets—Sheet 2.

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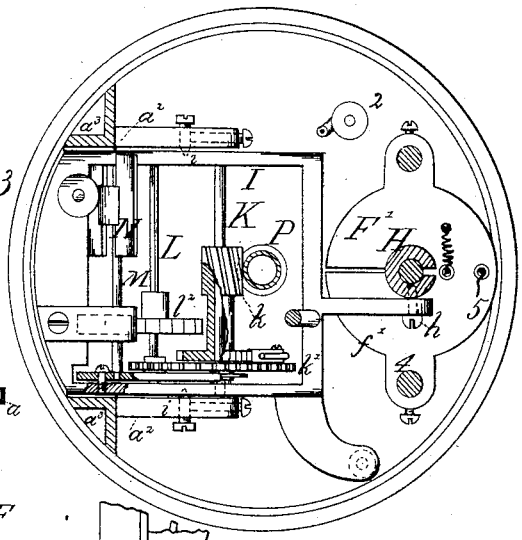
Fig 3



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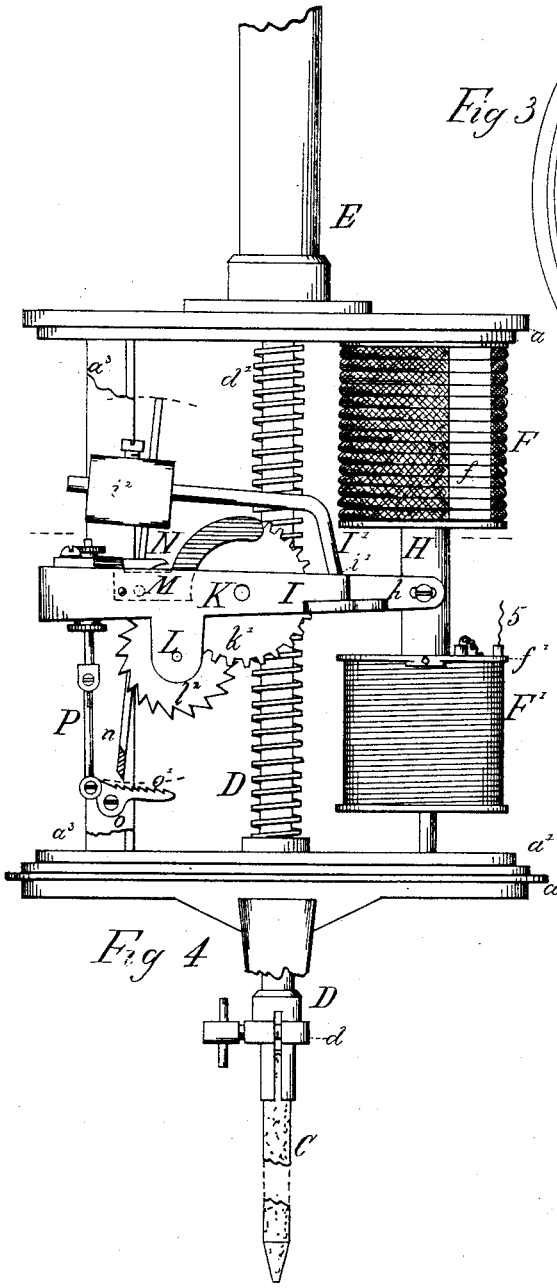
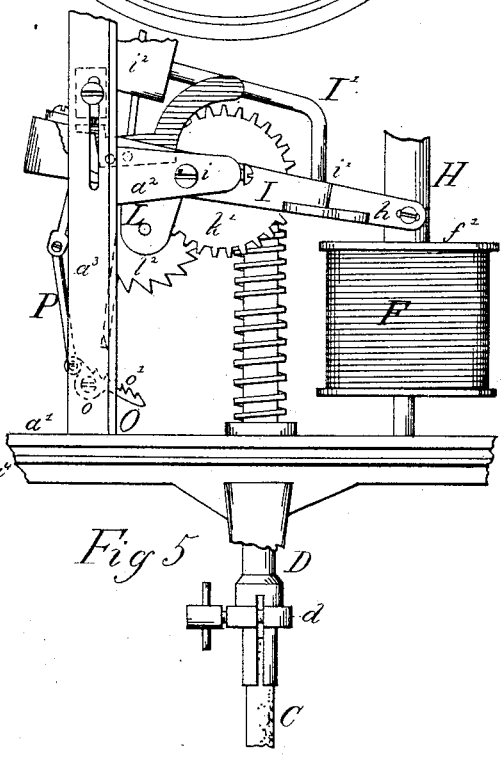


Fig 5



WITNESSES

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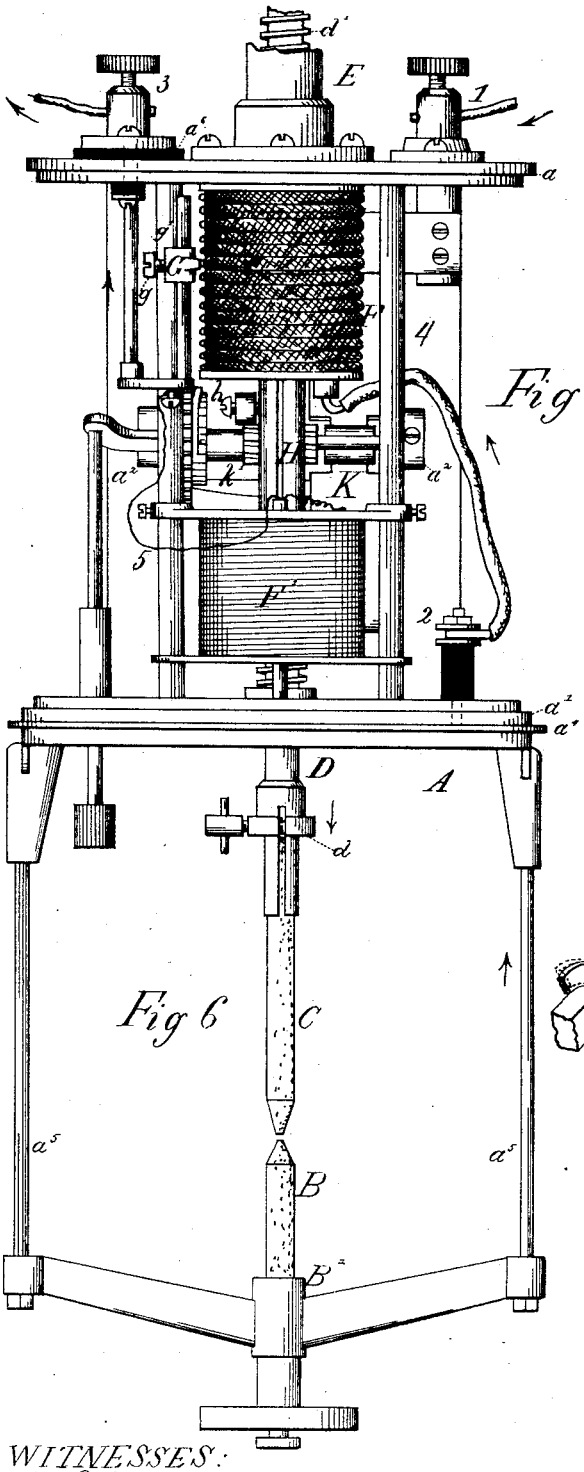

Fig 6

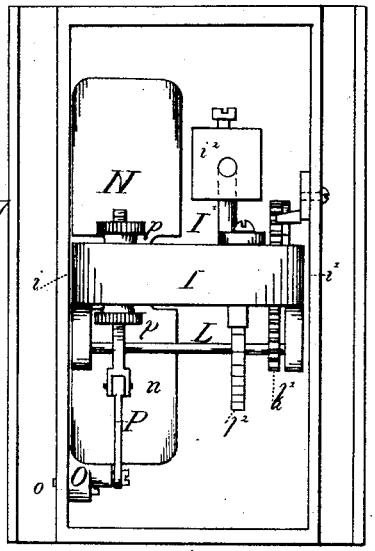

Fig 7

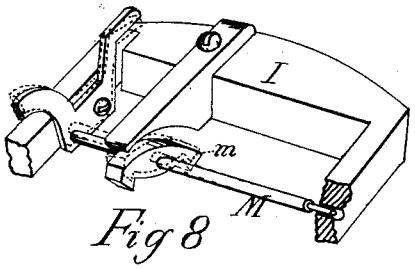

Fig 8

WITNESSES:
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Wm. H. Powell.

INVENTOR
Chas. E. Ball,
By Connolly Bros,
ATTORNEYS

UNITED STATES PATENT OFFICE.

CHARLES E. BALL, OF PHILADELPHIA, PENNSYLVANIA.

ELECTRIC-ARC LAMP.

SPECIFICATION forming part of Letters Patent No. 260,925, dated July 11, 1882.

Application filed May 3, 1882. (No model.)

To all whom it may concern:

Be it known that I, CHARLES E. BALL, a citizen of the United States, residing at Philadelphia, in the county of Philadelphia and State of Pennsylvania, have invented certain new and useful Improvements in Electric-Arc Lamps; and I do hereby declare the following to be a full, clear, and exact description of the invention, reference being had to the accompanying drawings, which form part of this specification, in which—

Figure 1 is a side elevation. Fig. 2 is a vertical section; Fig. 3, a top view; Fig. 4, a side elevation with a portion of the frame broken away to show the escapement. Fig. 5 is a detail plan view. Fig. 6 is a front elevation, and Figs. 7 and 8 are detail views of my improvement.

My invention has for its object to provide an electric lamp with means for feeding the carbon by a positive motion corresponding to or dependent upon the consumption of the carbons and not at a uniform time rate of speed.

A still further object of my invention is to provide means for moving the carbon-holder so as to avoid backlash or slip between teeth.

A still further object of my invention is to provide means whereby the carbon-holders of electric lamps may be weighted, so as to render the movement of a series of such holders uniform.

My improvements consist in the peculiar construction and combination of parts, having reference chiefly to the following points: first, to the combination, with the tilting feeding mechanism of an electric lamp, of an automatic stop of peculiar construction, whereby after the arc has been established the feed will be arrested until by the consumption of the carbons such arc fails or weakens, whereupon the stop is released and the feed renewed; second, to the construction of the stem of the carbon-holder with a worm or spiral thread, so as to insure constant engagement with an engaging pinion, and thus avoid backlash or the slip which occurs between the teeth of a rack such as is ordinarily employed; third, to the combination, with a hollow carbon-holder, of pellet-weights for adjusting a series of holders so as to cause them to descend with uniformity.

Referring to the accompanying drawings, A indicates the frame of an electric lamp; B, the negative or stationary carbon in a fixed holder, B′, and C the positive or movable carbon in a sliding holder, D. Said holder D consists of a hollow tube having bearings in the plates *a a′* of the frame A, and provided at its lower end with a clamp, *d*, in which the carbon C is fastened. The upper end of said holder fits and moves freely in a surrounding tube, E, whose lower end is firmly secured to the plate *a* of the frame A, its upper end having a nut, *e*, with eye *e′*, which affords a point of suspension for the lamp. The tube D is formed with an external worm or spiral thread, *d′*, and an internal floor or partition, d^2, designed to receive shot or small balls or pellets d^3 to weight the holder, such shot being introduced through the open upper end of the tube D.

F and F′ represent electro-magnets, the first named being wound with coarse wire located in the main circuit, the other being wound with fine wire, so as to have a high resistance, and being located in the shunt-circuit. The coils of the magnet F are partly exposed or naked, having a portion of their insulation removed, as shown at *f*, so as to permit contact with any one of such coils by a sliding head, G, having a set-screw, *g*, whereby it is held in any adjusted position on a rod, *g′*, which depends from the plate *a* of the frame A.

H represents a sliding core, common to both of the magnets F F′, (the latter being in alignment vertically,) and forming the armature therefor.

I represents a rectangular frame, fulcrumed at *i i* in brackets a^2 a^2, projecting from the side posts, a^3 a^3, of the main frame A. Said frame is pivotally connected at *h* with the armature H, so that as the latter is moved up or down said frame I is vibrated or tilted on its fulcra.

I′ represents a rod secured to the frame I at *i′*, and extending outward horizontally, or nearly so. It carries a sliding weight, i^2, whereby said frame may be counterbalanced more or less, according to the pull of the magnet F on armature H. The frame I affords bearings for a shaft, K, carrying a beveled pinion, *k*, which gears with the worm or spiral thread *d′* on the carbon-holder. Said shaft K also carries a

gear-wheel, k', which engages with a wheel, l, on another shaft, L, supported in said frame I and carrying an escapement-wheel, l^2.

M is another shaft in the frame I, carrying an escapement-pawl, m, and a two-bladed straight fan or lever, N.

O represents a lever or dog pivoted at o on one of the frame-posts a^3, and connected with the tilting frame I by a link, P, having adjusting-nuts $p\ p$ on its upper end. Said dog O has teeth $c'\ o'$ on its upper side, with which the lower blade, n, of the fan N engages, as hereinafter set forth. The circuit is as follows: entering at the binding-post 1 in the frame A, thence by a copper plate or brush, q, to the carbon-holder D, then down through the carbons B C and up the frame-rods $a^5\ a^5$, which are insulated by a gutta-percha plate, a^4, to a post, 2, thence to the main coil F, thence to the sliding block G on the rod g', and from the latter to the binding-post 3, which is insulated, as shown at a^6, from the frame-plate a, and onward to line. The shunt-circuit in which magnet F′ is located is from post 4, in circuit with plate a, to metallic head f', thence through coil of said magnet, thence by wire 5 to rod g', to binding-post 3.

The operation is as follows: The lamps which are intended to be arranged in a series in one circuit are first regulated so that their sliding carbon-holders will move at a uniform rate of speed, which is effected by introducing shot into such holders and timing the descent of the latter. The lamps being next placed in circuit with a dynamo-machine or other source of electric energy and the current turned on, the sliding heads G are moved up or down, as required, until the resistance of the coils F is graduated so that the frames I will each be lifted easily and with little or no shock or noise. The stop-motion is next adjusted by turning the screws $p\ p$, so as to regulate the distance between the edge of the fan-blade n and the bottom of the spaces between the teeth o, according to the length of arc which it is desired to obtain. The weights i^2 on the horizontal rods I′ are next moved in or out, (as may be required to counterbalance the frames I, according to the strength of the current or pull of the magnets F,) being moved outwardly to assist the magnet and inwardly for the opposite purpose. The current energizing the magnet F causes the latter to draw up the armature H, tilting the frame I, so as to elevate its inner end, and thereby lifting the carbon-holder D, so as to separate the carbon points and produce the arc. The tilting of the frame causes the dog O to be vibrated, bringing it into contact with the blade n of the fan or lever N, locking the shaft M, on which said fan is mounted, and preventing the gearing composed of escapement m, wheels $l^2\ k'$, and pinion k from running. This holds the movable carbon-holder stationary. As the carbons become consumed and the arc lengthens its resistance increases, until finally the current, or a portion of it, passes to the shunt-magnet F′, energizing the latter. Said magnet F′ now pulls down the armature H and tilts the frame I correspondingly, the dog O dropping, so as to release its hold on the fan. This allows the movable carbon-holder to descend, the pinion k rotating and communicating motion to the rest of the gearing in the frame I, the escapement devices preventing a too rapid movement. This goes on until the arc is re-established, if it has failed, by the current leaving the shunt-magnet F and confining itself to its normal circuit. If the arc was not lost, but merely elongated, so that its resistance was greater than that of the shunt-magnet F^2, the carbon descends merely enough to bring the points a proper distance apart, whereupon the frame is tilted and locked, as before. When the carbon-holder D is descending the engagement of the worm with the pinion k gives a rotary motion to the latter and a rocking motion to the shaft M, vibrating the fan N and preventing said carbon-holder from running down too fast. The descent of the carbon-holder D is due partly to its gravity and partly to the pull of the magnet F. The pinion k is clutched on the shaft K, so that when the holder D is descending the gearing in frame I will run, as described, but when said holder is ascending the pinion is loose on its shaft and the rest of the gearing does not run.

What I claim as my invention is—

1. The combination, with the carbon-holder D and tilting frame I, carrying a lever or fan, F, of the pivoted dog O, having an adjustable link-connection, P, substantially as shown and described.

2. The carbon-holder D, having a spiral thread or worm, d', in combination with pinion k, substantially as shown and described.

3. The hollow carbon-holder D, in combination with pellet regulating-weights d^3, substantially as described.

In testimony that I claim the foregoing I have hereunto set my hand this 28th day of April, 1882.

CHAS. E. BALL.

Witnesses:

C. S. BRADFORD, Jr.,

CHAS. F. VAN HORN.