(No Model.) 3 Sheets—Sheet 1.

J. A. MOSHER.

ELECTRIC ARC LAMP.

No. 539,877. Patented May 28, 1895.

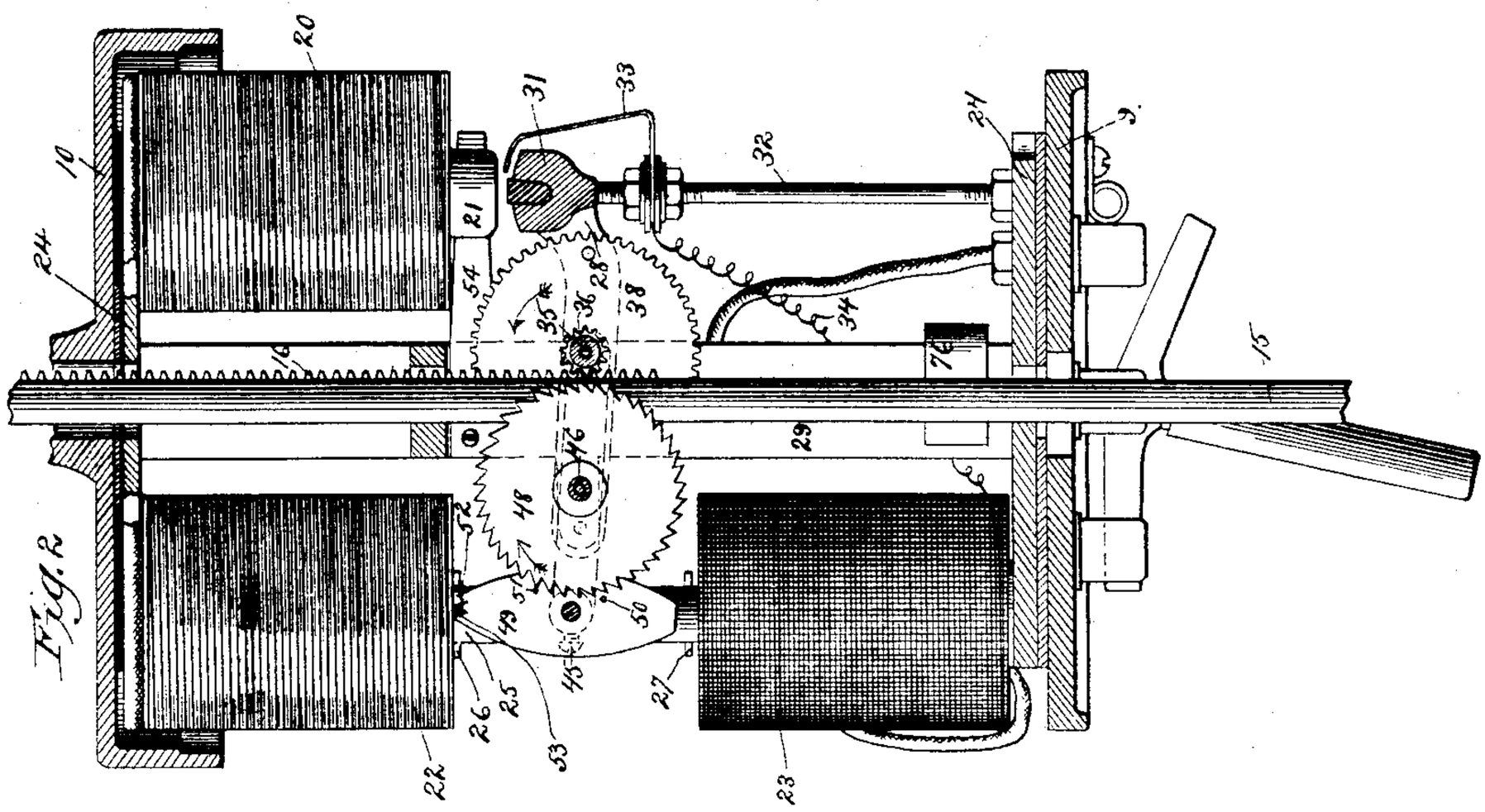

Fig. 2

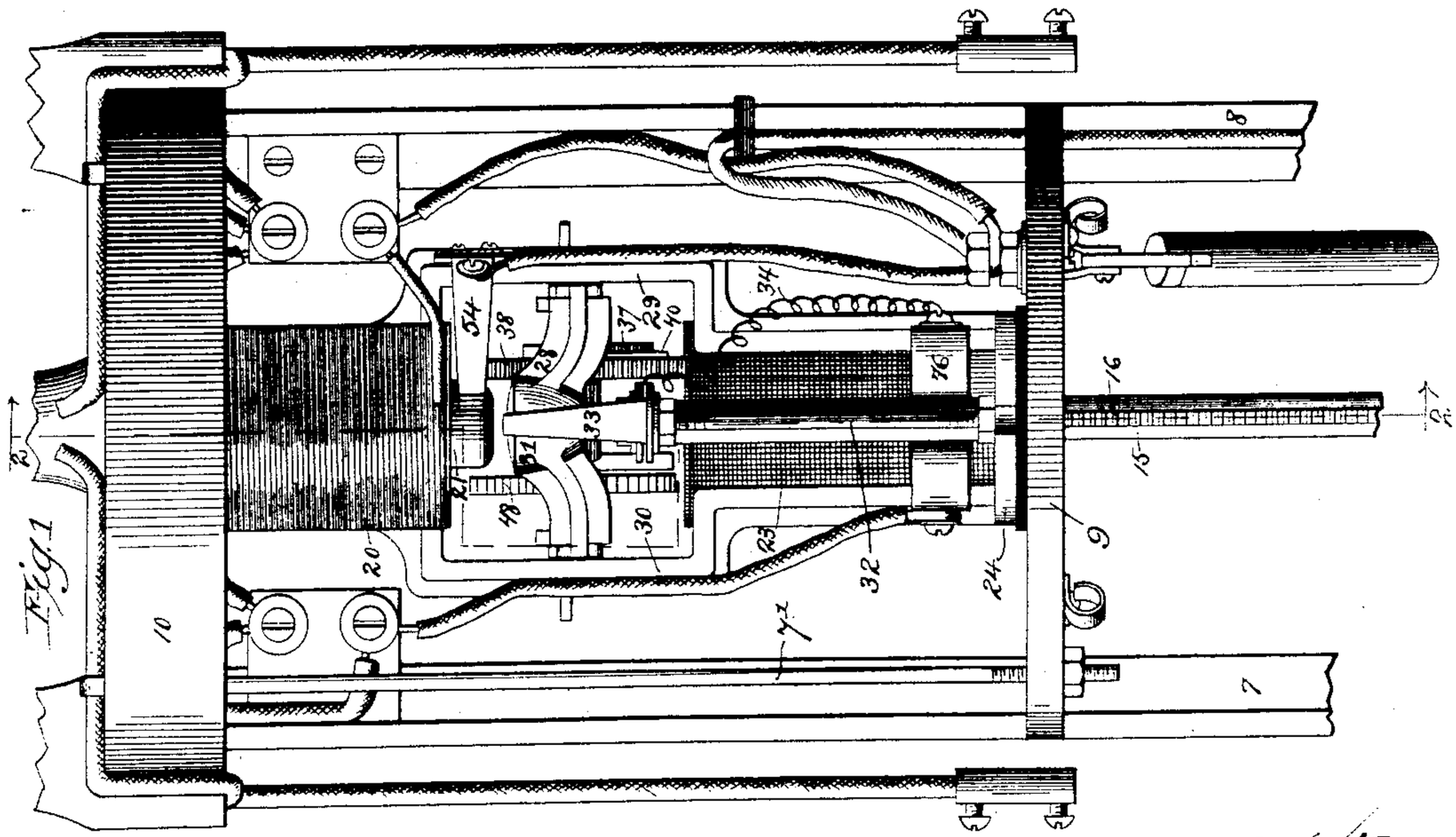

Fig. 1

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(No Model.) 3 Sheets—Sheet 2.

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Fig. 3

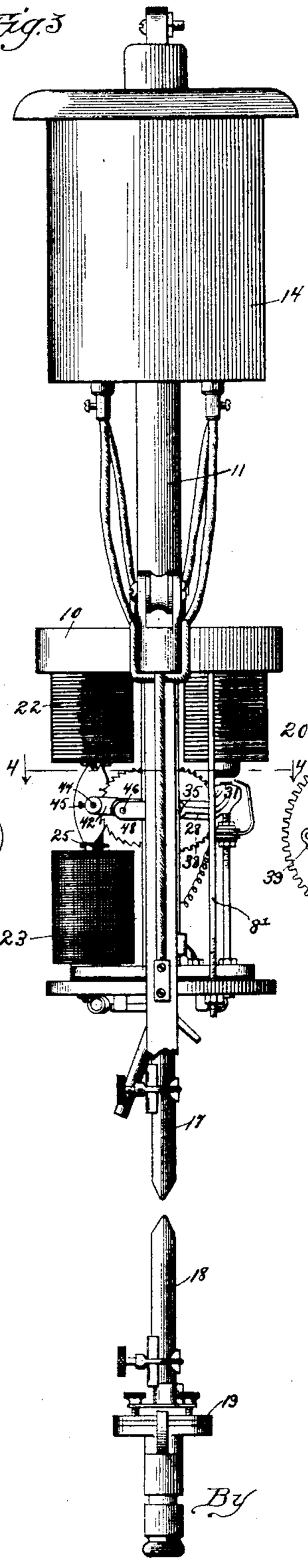

Fig. 4.

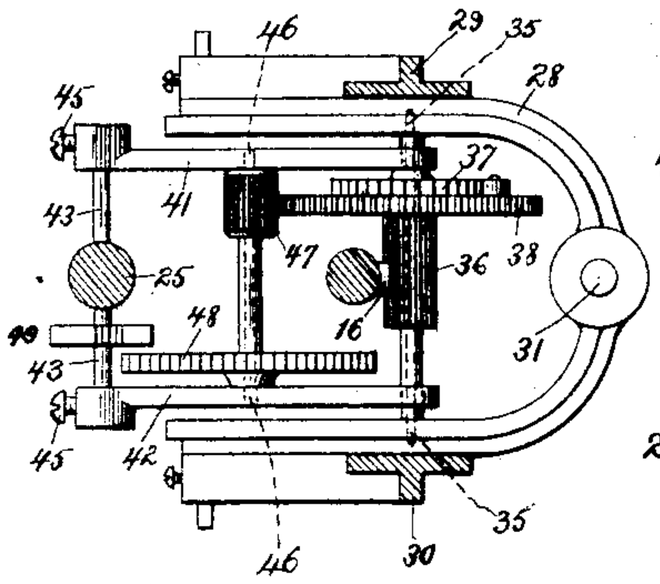

Fig. 5

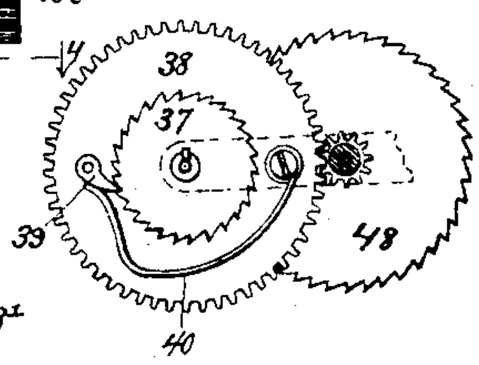

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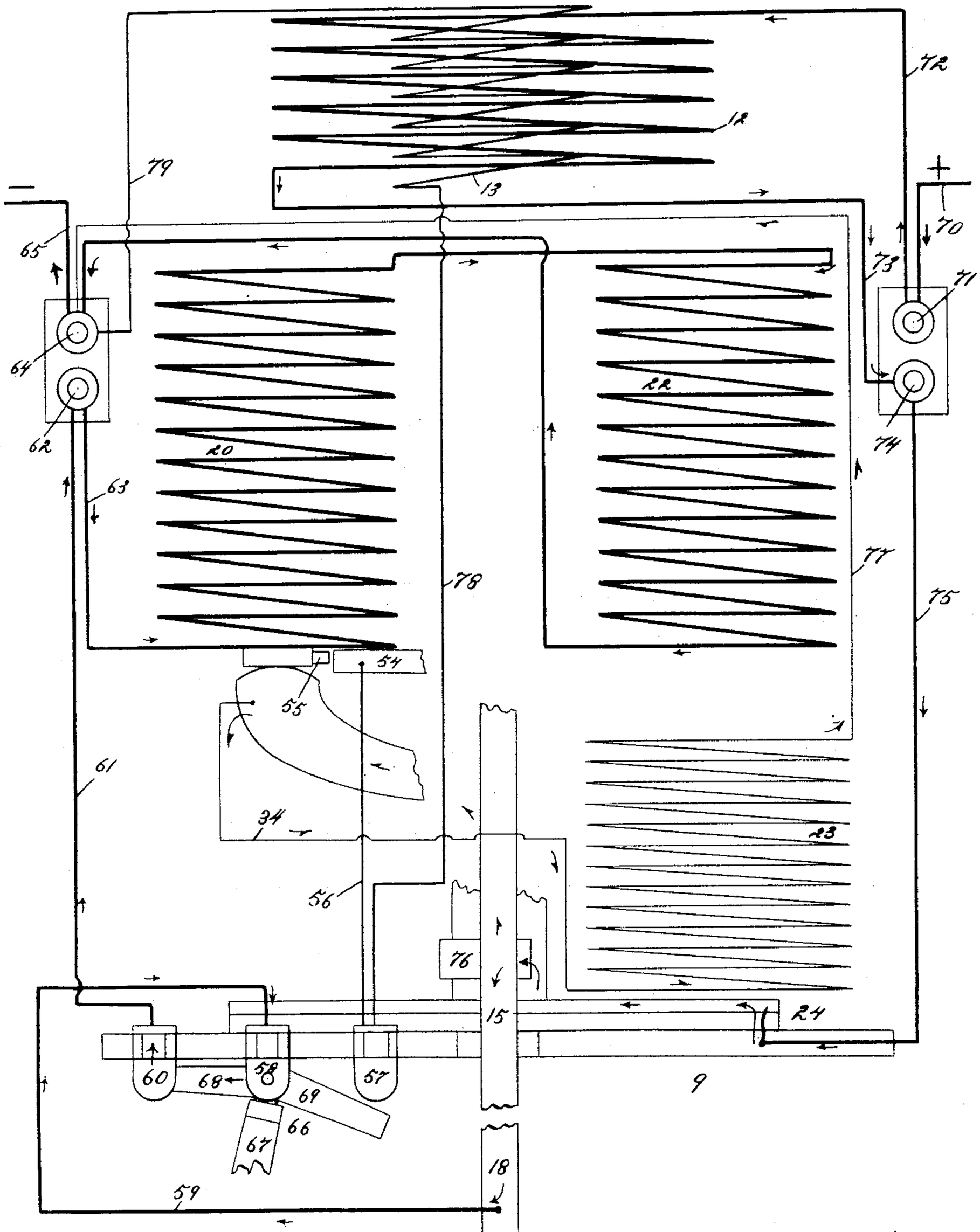
Fig. 6



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UNITED STATES PATENT OFFICE.

JOHN A. MOSHER, OF CHICAGO, ILLINOIS.

ELECTRIC-ARC LAMP.

SPECIFICATION forming part of Letters Patent No. 539,877, dated May 28, 1895.

Application filed May 1, 1893. Serial No. 472,509. (No model.)

To all whom it may concern:

Be it known that I, JOHN A. MOSHER, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Electric-Arc Lamps, of which the following is a specification, reference being had to the accompanying drawings, in which—

Figure 1 is a side elevation of the operating mechanism, the case being removed. Fig. 2 is a vertical section on line 2 2 of Fig. 1. Fig. 3 is a side elevation of a lamp. Fig. 4 is a cross-section on line 4 4 of Fig. 3. Fig. 5 is a detail showing the arrangement of the driving-wheels, and Fig. 6 is a diagram showing the connections.

My invention relates to electric lamps and particularly to that class commonly known as arc lamps.

The objects of my invention are to provide new and improved mechanism for operating the upper carbon-rod for the purpose of maintaining a constant arc, and to provide improved means for maintaining a constant resistance throughout the entire circuit. I accomplish these objects as illustrated in the drawings and as hereinafter specified.

That which I regard as new will be set forth in the claims.

In the drawings, 7 and 8 indicate side pieces or guides of a lamp frame which support the different parts of the lamp.

9 indicates a circular plate supported by the rods 7′ and 8′, which plate is adapted to support the feed mechanism.

10 indicates a second plate attached to the side pieces 7 and 8 above the plate 9 and form a cover for the feed mechanism and to it are attached the rods 7′ and 8′.

11 indicates a tube which rises from the plate 10, and supports the resistance coils 12 and 13, substantially as described in my former application, Serial No. 455,473, dated December 17, 1892.

14 indicates a cover for the resistance coils 12 and 13.

15 indicates the upper carbon-rod which passes centrally through the plates 9 and 10 and into tube 11. The carbon-rod 15 is provided with a rack 16, the object of which will be hereinafter set forth.

17 indicates the upper carbon which is secured to the lower end of the rod 15.

18 indicates the lower carbon, which is supported by a cross-piece 19, which connects the lower ends of the side pieces 7 and 8 in the usual manner.

20 indicates an electro magnet having a core 21, which magnet is secured to and depends from the frame 24, as best shown in Figs. 1 and 2.

22 indicates a low resistance solenoid, which is secured to and depends from the frame 24 at the opposite side of the lamp from that at which the magnet 20 is placed, as shown in Figs. 2 and 3.

The magnet 20 and solenoid 22 are both in the main circuit of the lamp, as best shown in Fig. 6.

23 indicates a second solenoid, which is supported by the frame 24 which is carried by the plate 9 and insulated therefrom, which solenoid is located under and in line with the solenoid 22, as best shown in Fig. 2.

The solenoid 23 is of high resistance and is on a shunt wire, as will be hereinafter more fully described.

25 indicates a rod which serves as a core for the solenoids 22 and 23, the ends of the rod 25 extending into said solenoids, as shown in Fig. 2.

26 and 27 indicate pins which limit the distance to which the core 25 may be moved into either of the solenoids.

The pins 26 and 27 are placed somewhat nearer together than the solenoids 22 and 23, whereby a slight vertical motion of the core will be permitted.

28 indicates a U-shaped frame which is pivotally mounted between standards 29 and 30 of the frame 24, as best shown in Figs. 1 and 4.

The U-shaped frame 28 is provided with a boss 31 arranged opposite and close to the core 21 of the magnet 20, as shown in Fig. 2, whereby said boss will be readily attracted by said core when the magnet 20 is active.

32 indicates a post which rises from the frame 24 immediately under the boss 31, which post serves to support the U-shaped frame 28 in a slightly inclined position, as shown in Fig. 2.

The arrangement of the U-shaped frame 28 is such that when the boss 31 is attracted

by the magnet 20, it will be raised to a substantially horizontal position. As best shown in Fig. 2, the central portion of the boss 31, which said central portion is of brass, projects slightly above the remaining portion. By this arrangement when the current is broken and the solenoid 20 thereby demagnetized, the boss 31 will immediately fall to its normal position.

32 indicates a spring which is supported by the post 32, and projects upward slightly above the boss 31 over which it projects a short distance. The arrangement is such that when the boss 31 is brought into contact with the core 21, it will be moved into contact with the spring 33. The spring 33 is insulated from the post 32, and is connected by a wire 34 to the coil of the solenoid 23. The other end of the solenoid is connected to the negative pole of the lamp. By this means, when the boss 31 is out of contact with the core 21, the solenoid 23 will be cut out.

35 indicates a shaft pivoted in the frame 28, as best shown in Fig. 4, at some suitable point between the pivot of the frame and the boss 31.

36 indicates a pinion mounted so as to rotate upon the shaft 35, both ends of said pinion being reduced to an extent equal to the depth of the cogs on said pinion.

37 indicates a ratchet-wheel which is mounted upon one of the reduced ends of the pinion 36, and is keyed thereto a sufficient distance from the shoulder of said pinion to allow to rotate the wheel 38.

38 indicates a gear-wheel which is loosely mounted upon the pinion 36 between the ratchet-wheel 37 and the shoulder of the pinion 36.

The gear wheel 38 carries a pawl 39, which is held in engagement with the teeth of the ratchet-wheel 37 by a spring 40. The pinion 36 intermeshes with the teeth of the rack 16, whereby the pinion 36 and ratchet-wheel 37 will be rotated by vertically moving the carbon-rod 15. The arrangement of the ratchet-wheel 37 and gear wheel 38 is such that when the carbon-rod 15 is moved downward, the pawl 39 will engage the teeth of the ratchet-wheel 37 and cause the rotation of the gear-wheel 38.

41 and 42 indicate bars pivotally mounted upon the shaft 35 at its opposite ends, as best shown in Fig. 4.

The bars 41 and 42 are connected to the opposite sides of the core 25 by the rod 43 which passes through said core. These rods are secured to the bars 41 and 42 by set-screws 45.

46 indicates a shaft mounted between the bars 41 and 42, which shaft carries a pinion 47 which intermeshes with the gear 38 and a scape-wheel 48.

49 indicates a plate mounted upon the rod 43 adjacent to the scape-wheel 48, as best shown in Figs. 2 and 4.

The plate 49 is provided with pins 50 and 51, which are adapted to engage the teeth of the scape-wheel 48, serving as pallets. By oscillating the plate 49 the pins 50 and 51 will alternately engage the teeth of the scape-wheel, thereby permitting it to rotate in the direction indicated by the arrow in Fig. 2, moving the space of only one tooth at each oscillation of the plate 49. The upper portion of the plate 49 terminates near the solenoid 22, and is provided with notches 52, as best shown in Fig. 2.

53 indicates a dog which depends from the solenoid 22, and is adapted to enter the notches 52 as the plate 49 is moved upward, and to be withdrawn from said notches when the said plate is moved downward. As the rod 43 which supports the plate 49 is connected to the core 25, the vertical movement of the plate 49 will be determined by that of the core 25.

54 indicates a fixed bar of some suitable conducting material which is supported by the standard 29, and is insulated therefrom, and extends to a point near the core 21, as best shown in Figs. 1 and 6.

55 indicates a spring bar, which is also supported by the standard 29, and extends between the core 21 and the bar 54.

The bar 55 is normally in contact with the bar 54, but when the core 21 is magnetized, it is attracted thereby and held in contact therewith.

The bar 54 is connected by a wire 56 with a contact-plate 57, as best shown in Fig. 6.

58 indicates a second contact-plate connected by a wire 59 to the lower carbon 18.

60 indicates a third contact-plate, which is connected by a wire 61 to the binding-post 62.

63 indicates a wire by which one end of the coil of the solenoid 20 is connected to the binding-post 62. The other end of the coil of the solenoid 20 is connected to the coil of the solenoid 22, the other end of the coil of the solenoid 22 being connected to a binding-post 64.

65 indicates the out-going line wire, which is also connected to the binding-post 64.

The contact-plates 57, 58 and 60 are in line with each other, as best shown in Figs. 1, 2 and 6.

66 indicates a switch having a handle 67, which is pivoted to the binding-post 58.

The switch 66 is provided with arms 68 and 69 arranged at an angle to each other, as best shown in Fig. 6, the arm 68 being adapted to connect the plates 58 and 60, and the arm 69 being adapted to connect the contact-plates 57 and 58, the angle of the arms 68 and 69 being such that when the arm 68 is in contact with the plate 60, the arm 69 will be out of contact with the piate 57, and vice versa.

70 indicates the incoming line wire which is connected to the binding-post 71.

72 indicates a wire which connects the resistance coil 12 with the binding-post 71.

73 indicates a wire which connects the opposite end of the resistance coil 12 with the binding-post 74.

75 indicates a wire which connects the plate 24 with the binding-post 74.

76 indicates a copper spring which connects the standards 29 and 30, and bears against the carbon-rod 15, thereby closing the circuit between the frame 24 and the carbon-rod 15.

As has been stated, one end of the shunt solenoid 23 is connected by a wire 34 and spring 33 to the boss 31. The other end of the solenoid 23 is connected by a wire 77 to the binding-post 64.

78 indicates a wire connecting the contact-plate 57 to the resistance coil 13.

79 indicates a wire connecting the resistance coil 13 to the binding-post 64. The resistance of the coil 13 is equal to that of the arc of the lamp, and its object is to provide for maintaining a constant resistance in the main circuit, whether the arc is established in the lamp or not, the resistance coil being automatically cut in by the spring bar 55 coming in contact with the bar 54 when the lamp goes out, as described in my former application above referred to.

The operation of my improved lamp is as follows: The switch 67 being in the position shown in Fig. 6, the current passes in on the wire 70, thence through the resistance coil 12 and the frame 24 to the carbon-rod 15; thence through the carbons and wire 59 to the contact-plate 58, through the arm 68 of the switch 66 to the contact-plate 60; thence through the magnet 20 and solenoid 22 to the wire line 65. As the current passes through the magnet 20, the core 21 will be magnetized and will attract the boss 31, which will move upward into contact with the core 21, and will also come into contact with the spring 33, closing the circuit through the shunt solenoid 23. The boss 31 will remain in contact with the core 21 and spring 33 as long as the current is unbroken, however much it may vary in intensity. As the boss 31 moves upward, the pinion 36 being in mesh with the teeth of the rack 16, the carbon-rod 15 will be slightly raised, separating the carbons and establishing the arc. By this time the core 25 will be at its highest position, owing to the attraction of the solenoid 22, and the plate 49 will be held in its uppermost position. The dog 53 will be held in one of the notches 52, thereby preventing the oscillation of the plate 49, and, consequently, preventing the rotation of the scape-wheel 48 and independent vertical movement of the carbon-rod 15. As the carbons are consumed and the resistance is thereby increased, a greater proportion of the current will pass through the shunt solenoid 23, increasing its magnetism to such an extent that it will move the core 25 downward, throwing the dog 53 out of its notch 52, and permitting the oscillation of the plate 49. The weight of the carbon and carbon-rod will then cause them to drop. This will cause a rotation of the gear-wheel 38 in the direction indicated by the arrow in Fig. 2, and a rotation of the scape-wheel 48 in an opposite direction. The rotation of the scape-wheel 48 will be controlled by the pins 50 and 51. As soon as the resistance is diminished by the downward movement of the carbon-rod, the greater portion of the current will pass through the upper solenoid 22, increasing its power and causing the core 25 to move upward sufficiently to permit the dog 53 to enter one of the notches 52, and thereby prevent further oscillation of the plate 49, and consequently preventing further rotation of the scape-wheel 48. The downward movement of carbon-rod 15 will thereby be arrested. As soon as the current passes through the magnet 20, the bar 55 will be attracted by the core 21, and the resistance coil 13 will be cut out as above described. If the voltage varies or the current is not constant and the carbons are allowed to come together by reason of low voltage or insufficient current, and then the voltage or current should be suddenly increased, the notches 52 in the plate 49 will allow of sufficient play in the plate 49, after its oscillation has been arrested by contact with the dog 53, to raise the carbon-rod 15 a sufficient distance to form an arc, but not enough to cause "pumping" as known in the art. By this arrangement the feed of the lamp is made very sensitive, pumping being impossible and thus dispensing with the usual dashpot or other retarding mechanism. Should the circuit through the lamp be broken, the magnet 20 will be demagnetized and the bar 55 will spring into contact with the bar 54, thereby closing the circuit through the resistance coil 13. A constant resistance will thus be maintained. If it is desired to cut out the magnet 20 and solenoid 22, it may be accomplished by turning the switch 66 to throw the arm 69 into contact with the contact-plate 57, whereby the current will be caused to pass through the resistance coil 13.

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

1. In an electric lamp, the combination with an upper carbon-rod, an outer pivoted frame, an inner pivoted frame, and a feeding train carried thereby, of a shunt solenoid, a core therefor, said core being connected to said inner frame, devices operated by the vertical movement of said core to effect the feeding of the carbon, an electro magnet in the main circuit adapted to attract and tilt said outer frame for the purpose of establishing the arc, and a cut-out for said shunt solenoid, said cut-out being adapted to be engaged by said outer frame when it is tilted by the magnet in the main circuit, so that said shunt solenoid will be cut into circuit upon the establishment of the arc, substantially as described.

2. In an electric lamp, the combination with an upper carbon rod, an outer pivoted frame, an inner pivoted frame, and a feeding train carried thereby, of upper and lower main and shunt solenoids, a core therefor, said core be-

ing connected to said inner frame, devices operated by the vertical movement of said core to effect the feeding of the carbon, an electro-magnet in the main circuit adapted to attract and tilt said outer frame for the purpose of establishing the arc, and a cut out for said shunt solenoid, said cut out being adapted to be engaged by said outer frame when it is tilted by said magnet in the main circuit so that said shunt solenoid will be cut into circuit upon the establishment of the arc, substantially as described.

3. In an electric lamp, the combination with supporting devices and a pinion carried thereby, of a carbon-rod having a rack intermeshing with said pinion, main and shunt circuit solenoids located one above the other, a core for said solenoids, said core being vertically movable under the action of said solenoids, bars 41 and 42, a rod 43 connecting said bars with said core, a rocking-plate 49 mounted upon said rod, notches in one end of said rocking-plate, a scape-wheel pivotally mounted between said bars, pallets 50 and 51 carried by said plate 49, said scape-wheel being geared to said pinion, whereby the rotation of said scape-wheel will permit the rotation of said pinion to permit the carbon-rod to descend, a dog 53 adapted to enter the notches 52 to prevent the rocking of said plate 49, substantially as described.

4. In an electric lamp, the combination with supporting devices of a frame 28 pivotally mounted thereon, said frame having a boss 31 and a pinion 36 mounted in said frame, a carbon-rod having a rack intermeshing with said pinion, an electro magnet located over said boss 31 and adapted to attract the same when said magnet is active and to move said frame into a horizontal position, an upper main circuit solenoid, a shunt circuit solenoid located under said main circuit solenoid, a core 25 for said solenoids, bars 41 and 42, a rod 43 connecting the outer ends of said bars, said rod 43 passing through the core 25, a plate 49 mounted upon said rod, said plate having notches in its upper end, a dog adapted to engage said notches when the core is in its uppermost position, a scape-wheel geared to said pinion and pallets carried by said plate 49 and adapted to engage the teeth of the said scape-wheel successively when the plate 49 is rocked, substantially as described.

5. In an electric lamp, the combination with a resistance coil, the resistance of which is equal to that of the lamp when burning, of an electro magnet in the main circuit, a bar 54 connected to the frame of the lamp and extending to a point near the core of the said magnet and insulated from said frame, a spring plate supported by the frame of the lamp and projecting between said fixed plate and the core of the said magnet and being normally in contact with said fixed plate, said spring plate being adapted to be attracted by and to move into contact with the core of said magnet when the current passes through said magnet, a wire connecting said fixed plate with said resistance coil, a wire adapted to conduct the current to the frame of the lamp, upper and lower carbons, supporting devices, a wire adapted to conduct the current from the lower carbon supporting device to said magnet, substantially as described.

6. In an electric lamp, the combination with an upper carbon rod, a pivoted frame, and a feeding train carried thereby, of upper and lower, main and shunt, solenoids, a core therefor, said core being connected to said frame, a rocking plate 49, said plate having notches at its upper end, a dog 53 adapted to enter said notches, and pallets 50—51 carried by said rocking plate, substantially as described.

7. In an electric lamp, the combination with an upper carbon rod, a pivoted frame, and a feeding train carried thereby, of a shunt solenoid, a core therefor, said core being connected to said frame, a rocking plate 49, said plate having notches at its upper end, a dog 53 adapted to enter said notches, pallets 50—51 carried by said rocking plate, and means for raising said core, substantially as described.

8. In an electric lamp, the combination with a resistance coil the resistance of which is equal to that of the lamp when burning, of an electro-magnet in the main circuit, a bar 54 connected to the frame of the lamp and extending to a point near the core of the said magnet and insulated from said frame, a spring plate supported by the frame of the lamp and projecting between said fixed plate and the core of the said magnet and being normally in contact with said fixed plate, said spring plate being adapted to be attracted by and to move into contact with the core of said magnet when the current passes through said magnet, a wire connecting said fixed plate with said resistance coil, a wire adapted to conduct the current to the frame of the lamp, upper and lower carbons, supporting devices, a wire adapted to conduct the current from the lower carbon supporting device to said magnet and a hand operated switch for cutting out said magnet and throwing in said resistance and vice versa, substantially as described.

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