(No Model.) 3 Sheets—Sheet 1.

C. HOFFMANN.

ELECTRIC ARC LAMP.

No. 518,719. Patented Apr. 24, 1894.

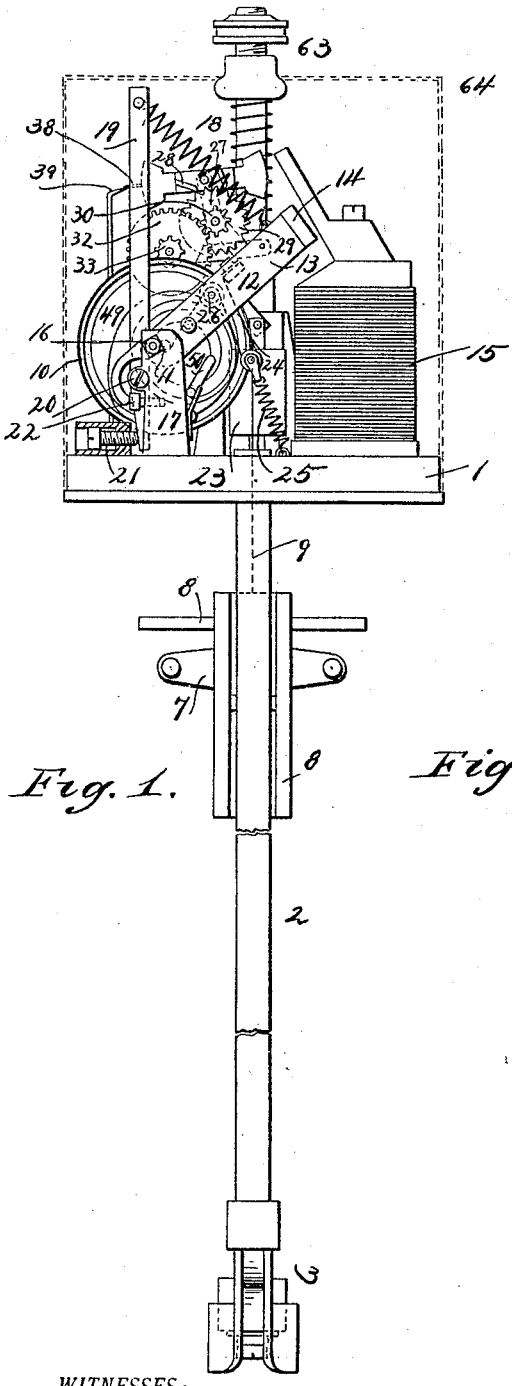

Fig. 1.

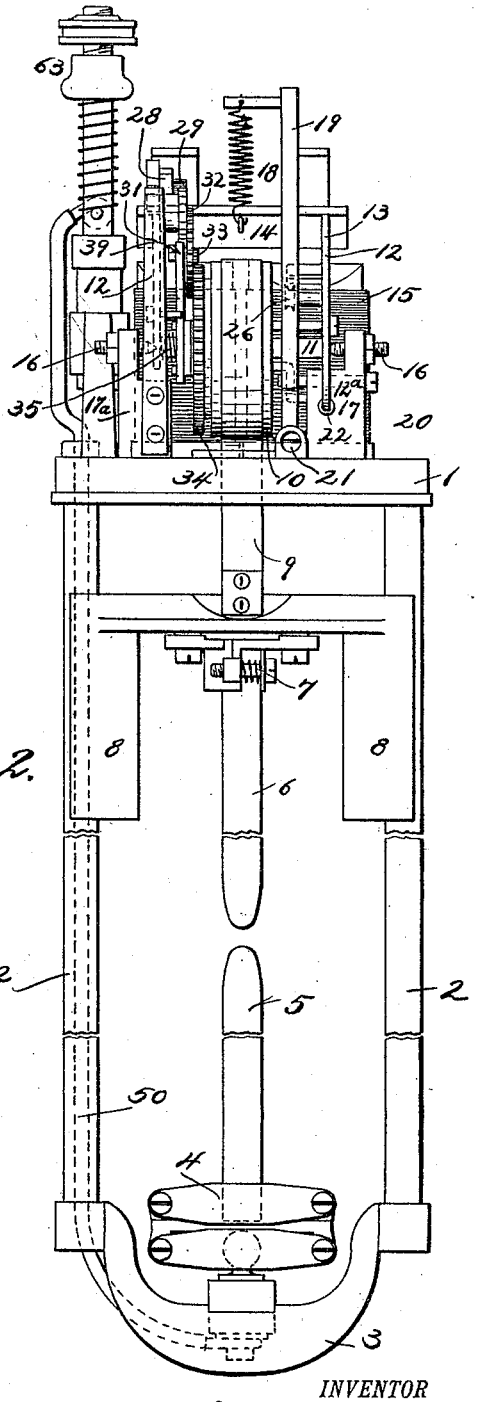

Fig. 2.

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Fig. 3.

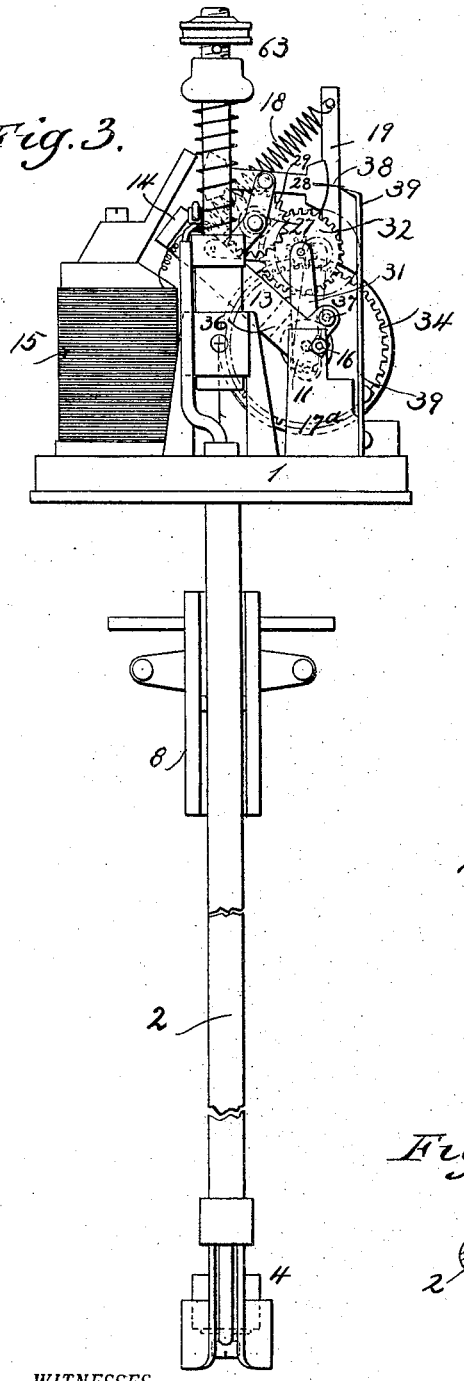

Fig. 4.

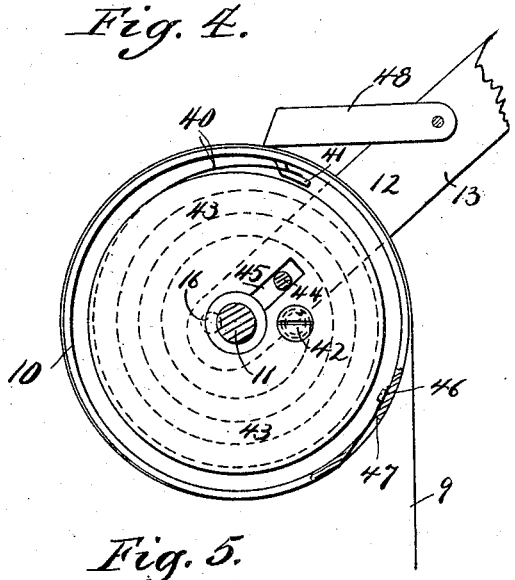

Fig. 5.

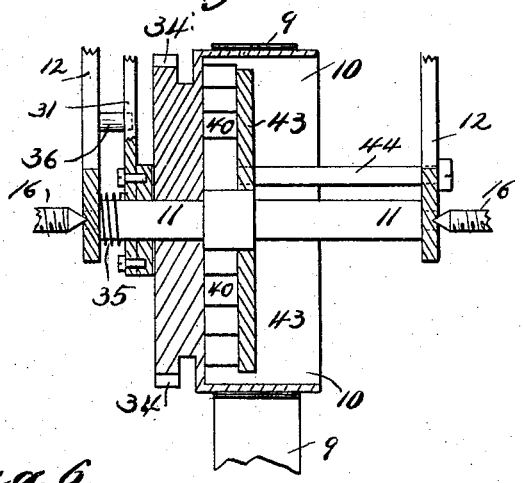

Fig. 6.

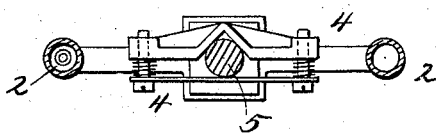

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Fig. 7.

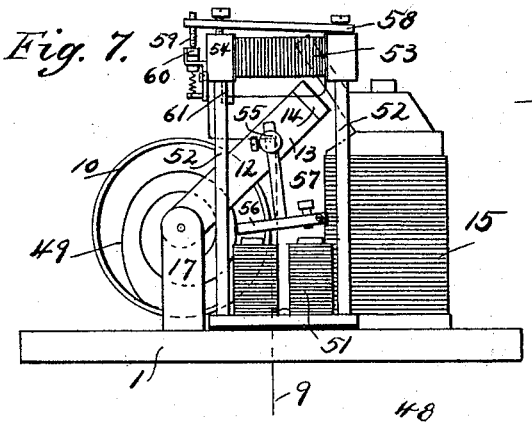


Fig. 8.

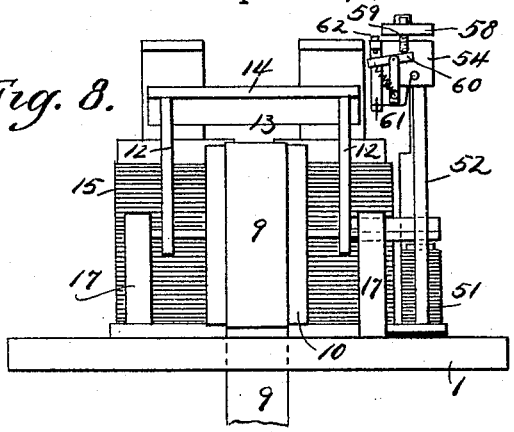
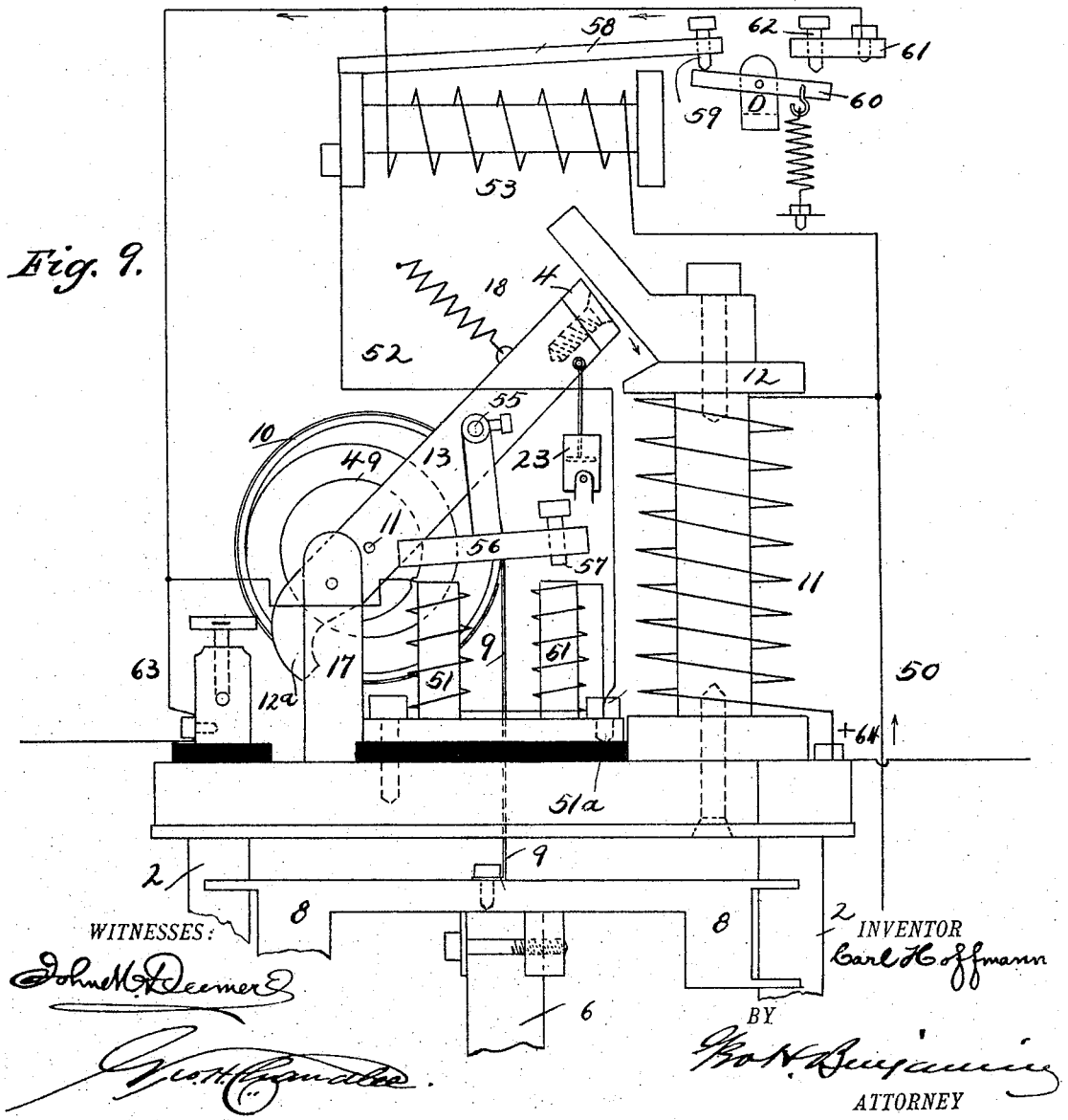


Fig. 9.



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UNITED STATES PATENT OFFICE.

CARL HOFFMANN, OF BERLIN, GERMANY, ASSIGNOR TO SIEMENS & HALSKE, OF SAME PLACE.

ELECTRIC-ARC LAMP.

SPECIFICATION forming part of Letters Patent No. 518,719, dated April 24, 1894.

Application filed September 28, 1893. Serial No. 486,665. (No model.)

To all whom it may concern:

Be it known that I, CARL HOFFMANN, a subject of the Emperor of Germany, residing at the city of Berlin, in the Empire of Germany, have invented new and useful Improvements in Electric-Arc Lamps, of which the following is a specification.

The present invention relates to electric arc lamps of that class or type shown in United States Patent No. 412,141, granted to F. von Hefner-Alteneck and myself October 1, 1889, and has for its object to improve the construction and operation of the lamp shown in said patent.

The invention also has for its object to provide an improved cut out mechanism for arc lamps arranged in parallel, and whereby when one or more of said lamps become inefficient or inoperative, they may be cut out without materially affecting the remaining lamps in the circuit.

The invention will first be described and then will be defined in claims hereinafter set forth.

Reference is to be had to the accompanying drawings, forming a part of this specification, and in which similar reference-numerals indicate like parts in the several views.

Figure 1, is a side view of my improved arc lamp, with the cover or casing of the regulating mechanism indicated by dotted lines. Fig. 2, is a front view thereof, without the casing. Fig. 3, is a view of the lamp, taken from the reverse side to that shown in Fig. 1. Fig. 4, is a detail sectional view of the upper carbon supporting drum and adjacent parts. Fig. 5, is a detail transverse vertical sectional view of the drum and adjacent parts. Fig. 6, is a horizontal detail sectional view of the lower carbon and its holder. Fig. 7, is an elevation of the regulating magnets and the magnetic cut out and the drum and adjacent parts. Fig. 8, is an elevation of like parts taken at right angles to Fig. 7, and Fig. 9, is a diagrammatic illustration of the electric circuits and connections of the lamp.

The numeral 1, indicates the bed-plate made of conducting material and which sustains the lamp mechanism and from which hang two tubular rods 2, 2, connected at their lower ends by a cross-bar 3, which supports a clamping device 4, holding the lower carbon 5, said clamp having adjustment on a ball joint of the crossbar to properly adjust the lower carbon relatively to the upper carbon 6, which is held to a spring clamping device 7, sustained by a weighted carrier 8, which is fitted to slide on the rods 2, 2, of the lamp frame. The carbon carrier 8, is held to the lower end of a metallic band or ribbon 9, which at its other end is fastened to a drum 10, onto which the ribbon is adapted to wind. The drum 10, is journaled by its shaft 11, in and near the lower ends of side arms 12, 12, of a yoke or U-shaped frame 13, the outer crossbar 14, of which constitutes an armature which at times is attracted by the poles of an electric magnet 15, sustained on the bed-plate 1, and as hereinafter more fully explained, preferably by conical screw bearings 16, 16, to the upper ends of two standards 17, 17ª, which rise from the bed-plate 1.

Figs. 1, 3, and 9, of the drawings, show that the bearings of the shaft 11, of drum 10, in the yoke 13, are eccentric to the journal bearings 16, of the yoke 13, in the standards 17, 17ª. To the outer upper part of the yoke 13, is connected one end of a spiral spring 18, the other end of which is fixed to a post 19, which is held to the standard 17, by a screw or fulcrum pin 20 and projects below said pin sufficiently to be acted upon by a screw 21, fitted in a projection of the bed-plate 1, and whereby the post may be adjusted at the top to nicely regulate the action of the spring 18, in drawing the yoke 13, upward, while the upward movement of the yoke is limited by contact of a prolongation or hooks 12ª on one of its side parts 12, with an adjustable screw stop 22, fitted in the standard 17, near the fulcrum pin 20.

A dash pot device 23, comprising an inverted cup linked to the yoke 13, and working over or with a piston held to the bed-plate 1, steadies the movements of the armature carrying yoke and prevents oversensitiveness of it to sudden fluctuations of current. A cord 24, which is fixed at one end to the yoke 13, is looped downward and at its bight passes over a guide or antifriction roller which is held to the upper end of a normally contracting spiral spring 25, which

at its lower end is fixed to the bed-plate 1. This cord 24, after passing under the spring roller or pulley passes upward over another guide pulley 26, journaled on the yoke 13, and thence to the shaft 11, of the upper carbon operating drum 10, whereby the cord will be wound upon and unwound from the drum shaft as the drum turns in one direction or the other. The object of the cord and spring 24, 25, is to compensate, by the increased tension of the spring, as the cord is wound upon the drum shaft, for the decreasing weight of the upper positive carbon as it is consumed.

To one side of the yoke 13, is fixed an arm 27, which at its outer end carries a rocking escapement 28, the detents of which engage a ratchet wheel 29, which is journaled on the arm and carries a pinion 30. On the drum shaft 11, is loosely fitted one end of a lever 31, which at its outer end carries a gear wheel 32, which is adapted to engage the pinion 30, on the escapement ratchet wheel. A pinion 33, fixed to the gear wheel 32, or to the shaft constantly engages a peripheral gear 34, formed on or fixed to the drum 10, and a spring 35, coiled on the drum shaft and fixed at opposite ends to the yoke and lever 31, 31, normally swings the lever outward and disengages the gear wheel 32, from the escapement pinion 30, the instant a lifting force is exerted on the carbon carrier 8. Means are thus provided controlled by the upward movement of the carbon carrying mechanism for disengaging said mechanism from the device for controlling the downward movement of the upper carbon. With this construction the carbon carrier may be quickly raised at any time without influencing the feeding mechanism, and to permit putting a new positive carbon in the lamp when the old one is consumed, it being understood that as the carrier 8, is lifted, the lever 31, will instantly carry its gear wheel 32, away from the escapement pinion 30, and as the drum turns to wind the ribbon 9, onto it, the drum gear 34, will simply rotate the gearing 33, 32, and when the carrier 8, is released its weight will at once and by the pull of the ribbon 9, on the drum, re-engage the gearing 32, 30, in readiness for feeding of the new carbon as the carrier is allowed to fall by the electrically regulated feeding mechanism. Stops 36, 37, shown as a lug cast on the yoke 13, and a screw pin fitted therein, limit the range of oscillation of the lever 31, during replacement of the upper carbon as above described. This gearing and co-operating devices, together with the spring 18, or their equivalents, I term "permissive controlling means" which is controlled by the electro magnet 15.

The escapement 28, carries a thin knife-edged tail-piece or pawl 38, which engages the bent somewhat sharp upper end of a detent 39, to prevent operation of the carbon feeding mechanism when the yoke 13, is not attracted by the magnet 15, but when the yoke armature is attracted by the energized magnet the escapement which is carried by the yoke will be moved over to swing clear of the detent and allow feeding of the positive carbon. This electro magnet therefore constitutes a means which permits the permissive controlling means to act. The detent 39, is preferably a thin plate of elastic metal held to the bed-plate or to the standard 17^a, thereon.

Within the drum 10, is fitted a coiled spring 40, one end of which is held to a hook 41, pressed inward from the drum periphery while its other end is held fast by a screw 42, which is passed inward transversely through a metal plate 43, which is fitted loosely around or upon the drum shaft 11, or an enlargement thereof. This plate 43, is prevented from turning with the drum by means of a screw stud or pin 44, which is fixed to and projects laterally from the adjacent side or arm 12 of the yoke 13, into a slot 45, of the plate. A number of these slots may be provided to accommodate adjustment of the tension of the spring 40, whose function is to turn the drum in a direction to wind the ribbon 9, upon it as the upper carbon carrier 8, is lifted prior to renewing the positive carbon in the manner above described.

The extremity of the carbon carrier sustaining ribbon 9, is preferably passed inward through a slot in the periphery of the drum 10, and is fastened by screws 46, from the inside, and the end wall of the slot forms a shoulder 47, against which a gravitating pawl 48, pivoted to the yoke 13, will engage to limit the descent of the carbon carrier. Normally the pawl 48, rides freely upon the ribbon 9, as the drum rotates in either direction. The drum 10, also accommodates within it a metallic elastic coil or band 49, arranged outside the plate 43, one end of said coil being fastened to the periphery of the drum while its other end is held to a metallic rod or wire 50, which is suitably bent or shaped to avoid contact with the oscillating yoke 13, and is fastened to the standard 17, through which and the rod 50, coiled band 49, drum 10, and ribbon 9, an electric circuit may be maintained to the upper positive carbon 6, irrespective of the rotative position or adjustment of the drum, as said coil 49, winds and unwinds as the drum turns in opposite directions.

On the bed-plate 1, but insulated therefrom, is supported an electro magnet 51, and insulated posts 52, 52, sustaining above 51 another electro magnet 53, one pole piece 54 of which is electrically connected to the insulated base of the other magnet 51. In one side or arm 12 of the yoke 13 is fixed a split conducting clamping pin 55 in which is held adjustably the stem of the armature 56 of magnet 51, and said armature carries a vertically adjustable contact 57 adapted for attraction by the electro magnet 51, through the medium of the armature 56, and to make contact with a conductor located within the magnet core

adjacent thereto, whereby a shunt circuit may be established through the upper positive carbon, the drum, the yoke and the magnet 51, as hereinafter more fully explained.

The magnet 53 has an armature 58 which carries an adjustable contact screw 59 to which a contact lever 60 is normally held by a spring. The lever 60 is conductively held by screws to the pole piece 54 of the magnet. A conductive metal bracket 61 held with interposed insulation to the magnet pole piece 54, carries at one end a contact screw 62 to which the lever 60 is brought in contact by pressure of the screw 59, when the magnet 53 attracts its armature 58. The wire coil of the magnet 53 has but few turns which prevents attraction of its armature by normal currents. One end of this wire coil is connected to the insulated bracket 61, and the other end of the coil is in circuit with the wire connecting the lower negative carbon of the lamp. The bracket 61 also is wired to the negative terminal or binding post 63 of the lamp, the positive terminal of which is marked 64.

Electric circuits and connections shown in Fig. 9 are as follows: When the carbons are not in apposition, entire current flows from the positive terminal 64 through the magnet 11 to the point 46, thence through the coil of magnet 53, which has but a few turns of wire and does not respond to normal currents, to the point 48 and out at the negative terminal 63. The pull of the shunt magnet 11 draws down the armature carrying yoke 13 against the lifting tendency of spring 18, thereby releasing the dog 38 from the spring pole 39. This releases the escapement 28 and 29 and permits downward feeding of the upper carbon through the train of gears by the action of the weight of the carbon carrier and the carbon, until the carbons are brought into apposition. At this moment the greater part of the current flows from the positive terminal 64 along the conducting base 1 to the standard 17, thence to the spring 49 to the drum 10, down the ribbon 9 to the upper carbon 6, lower carbon 5, lower carbon clamp 4, and up the wire 50 to the point 46. Thence to magnet 53, point 48, and negative terminal 63. The smaller part of the current still continues to flow through the magnet 11 from the positive terminal 64 to the point 46, where it joins the current on conductor 50 and flows to negative terminal 53 of the lamp. When the carrier 13, through the medium of the armature 4, has brought the pivoted armature 56 of the magnet 51 into contact with the right hand pole of said magnet by means of the contact screw at one end, a part of the current is caused to flow from the standard 17 along the carrier 13 through the pivoted armature 56, and its contact screw to the right hand pole of the magnet 51, to the binding screw 51^a; thence through the coils 63 of the magnet 51 to the negative terminal. The attraction of the magnet 51 for its armature 56 acts to hold down the armature whereby an auxiliary force is applied to bring the carbons into apposition and a path for a portion of the current is provided around the regulating mechanism. When the current becomes abnormal, the magnet 53, which does not usually act, attracts the armature 58, thus providing a second path from screw 51^a around the mechanism, that is, through the wire 52 to the armature 58, thence through contact screw 59 and lever 60 to 61, thence to the point 48 and negative terminal 63. This permits the armature carrier 13 to be released from the influence of the magnet 51, and it then rises and re-engages the dog 38 with the pole 39.

Having thus described my invention, I claim—

1. In an electric arc lamp, the combination of a gravity feeding carbon carrier, a permissive controlling means tending to raise said carbon carrier but which allows it to feed downward uniformly and gradually, means which permit the controlling means to act and means controlled by the upward movement of the carbon carrying mechanism for disengaging the carbon carrying mechanism from the permissive controlling means so as to enable the carbons to be rapidly separated and raised.

2. In an electric arc lamp, the combination of a gravity feeding carbon carrier, a permissive controlling means tending to raise said carbon carrier but which allows it to feed downward uniformly and gradually, electromagnetic means allowing the first means to act, and means controlled by the upward movement of the carbon carrying mechanism for disengaging the carbon carrying mechanism from the permissive controlling means so as to enable the carbons to be rapidly separated and raised.

3. In an electric arc lamp, the combination of weighted carbon carrying mechanism, escapement mechanism for permitting the feeding of the upper carbon uniformly, electromagnetic means for controlling the escapement mechanism, a spring actuated means for lifting the upper carbon, and means which permit the upward movement of the carbon independent of the escapement mechanism.

4. In an electric arc lamp, the combination of weighted supporting mechanism for the carbon, escapement mechanism, a drum carrying the supporting mechanism, said drum controlled by the escapement mechanism, electro-magnetic means for controlling the movement of the escapement mechanism, and means which is controlled by the reverse movement of the drum to separate the supporting mechanism from the escapement mechanism, thereby permitting the upper carbon to be quickly raised from the lower carbon to increase the distance between the carbons.

5. In an electric arc lamp, the combination

of gravity feeding carbon mechanism, escapement mechanism comprising a train of gears, a drum carrying the carbon feeding mechanism, a spring for rotating the drum in a direction to lift the carbon, and means controlled by the reverse movement of the drum to separate the feeding mechanism from the escapement mechanism, so as to permit the upper carbon to be quickly lifted and separated from the lower carbon.

6. In an electric arc lamp, the combination of a weighted carbon supporting and gravity feeding mechanism, means for controlling the supporting and feeding mechanism, means controlled by the upward movement of the carbon for disengaging the carbon supporting and feeding mechanism from the controlling mechanism so as to enable the carbons to be separated and the upper one to be raised quickly when the arc is to be lengthened, and a device for short-circuiting the lamp consisting of means which divert current from the means which control the feeding mechanism.

7. In an electric arc lamp, the combination of weighted carbon feeding and supporting mechanism, a high resistance magnet in shunt to the circuit through the carbons, and means controlled by the high resistance magnet for starting and stopping the carbon feeding and supporting mechanism, a low resistance magnet carrying the main current with the carbons, and means controlled by the said magnet to allow the carbon feeding mechanism to continue to act.

8. In an electric arc lamp, the combination of carbon supporting and feeding mechanism, consisting in part of a drum which carries the carbon supporting mechanism, a spring which tends to rotate the drum in a reverse direction, and a pivot stop or dog which prevents the drum from being rotated too far so as to prevent the upper carbon being fed too far down.

9. In an electric arc lamp, the combination of a weighted holder, escapement mechanism which controls the feeding of the upper carbon toward the lower carbon, said escapement mechanism consisting in a train of gears and a rotating drum driven by the weighted holder, an electro-magnet in shunt to the carbons for controlling the escapement mechanism, a spring which tends to rotate the drum in a reverse direction, and means controlled by the reverse movements of the drum to separate the parts of the train of gears, so as to permit a rapid upward movement of the carbon to take place.

10. In an electric arc lamp, the combination with carbon feeding mechanism, escapement mechanism which permits the gradual and uniform relative adjustment of the carbons, electro-magnetic means for releasing the escapement to allow the carbons to feed, and adjustable electro-magnetic auxiliary means for retaining the escapement mechanism under the influence of its controlling electro-magnet, and augmenting the controlling influence of said electro magnet.

11. In an electric arc lamp the combination of a weighted carbon carrier, a flexible support therefor, means for producing a gradual downward movement of the carbon carrier, an electro-magnet for bringing the carbons into apposition, and auxiliary means in shunt with said magnet for maintaining their juxtapositions.

12. In an electric arc lamp the combination of a weighted carbon carrier, a flexible support therefor, a spring actuated drum over which said flexible support is wound, mechanism for regulating the feeding action for said drum, and a shunt magnet acting to bring said feeding mechanism into and out of action, and an auxiliary means for augmenting the attractive influence of said shunt magnet.

13. In an electric arc lamp the combination of a pivoted frame, a carbon feeding and supporting mechanism carried thereby, an electro-magnet operating to lower said frame and to release the feeding mechanism and bring the carbons into apposition, and an auxiliary electro-mechanically operated device energized by an intense current for maintaining the carbons in juxtaposition and to shunt the current round the said electro-magnet.

14. In an electric arc lamp, the combination with the herein described mechanism; of electro-mechanical means for diverting the main current of the lamp through a plurality of paths; and a make-and-break for bringing into circuit the said electro-mechanical means, said make-and-break having its actuating electro-magnet in shunt with the main circuit of the lamp.

In testimony whereof I affix my signature in the presence of two witnesses.

CARL HOFFMANN.

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GEO. H. BENJAMIN.