(No Model.)

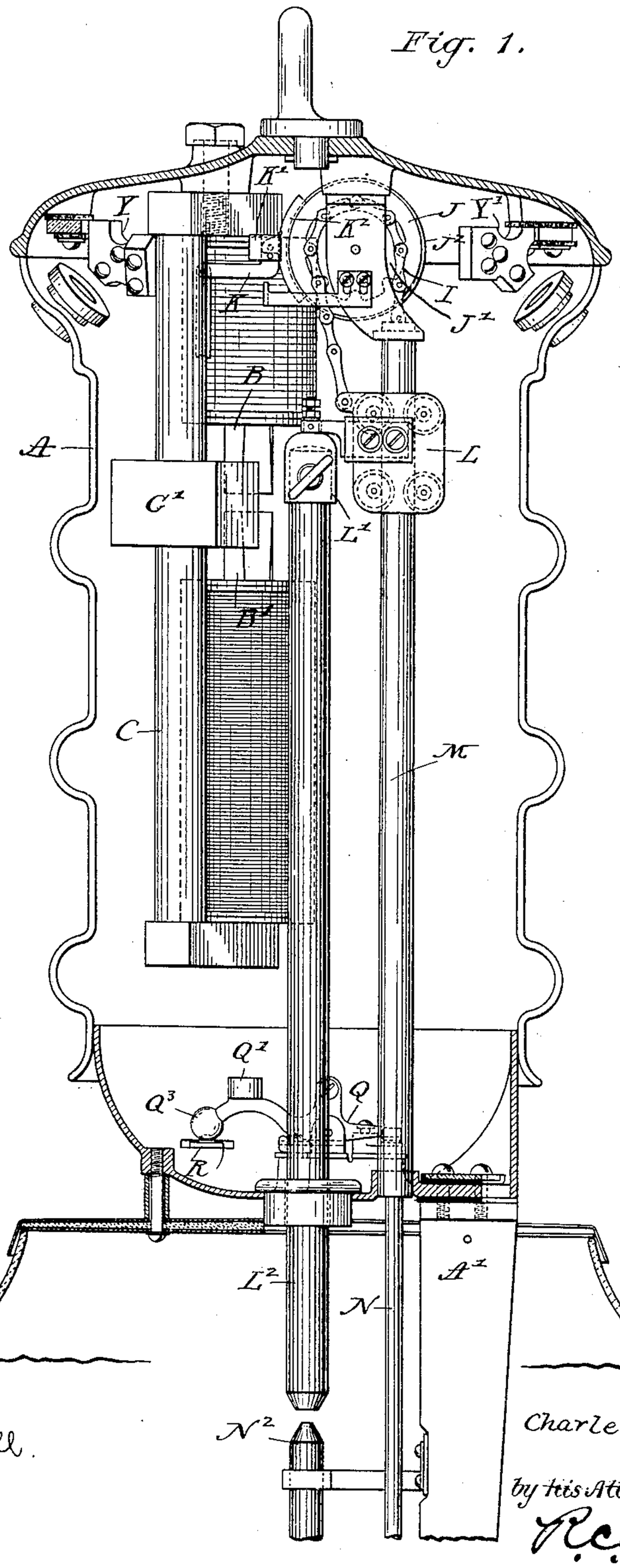
4 Sheets—Sheet 1.

C. N. BLACK.

ELECTRIC ARC LAMP.

No. 599,032. Patented Feb. 15, 1898.

Fig. 1.



Witnesses.
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Frank L. Ober

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by his Attorney.
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THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

(No Model.)

4 Sheets—Sheet 2.

C. N. BLACK.

ELECTRIC ARC LAMP.

No. 599,032. Patented Feb. 15, 1898.

Fig. 2.

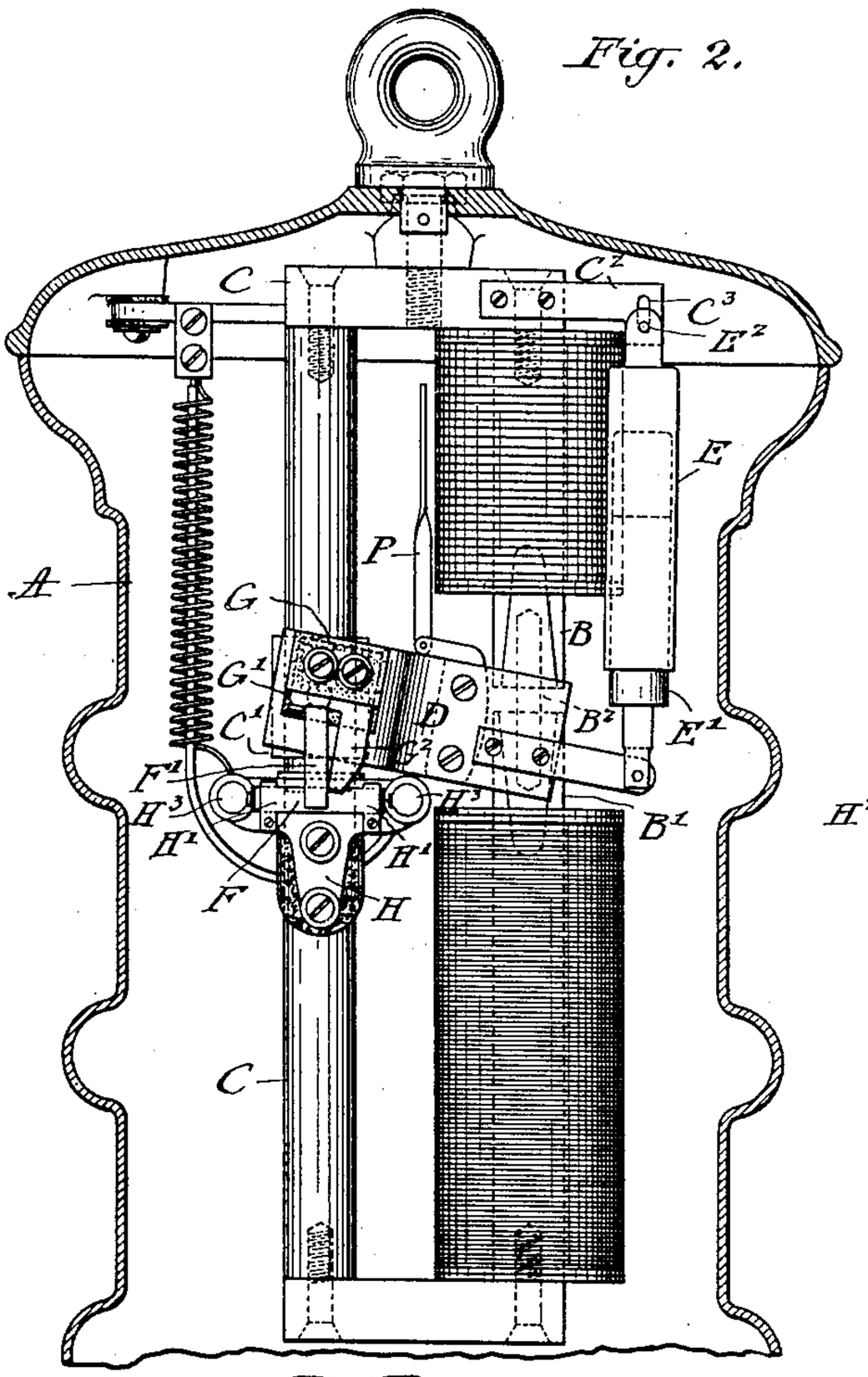


Fig. 3.

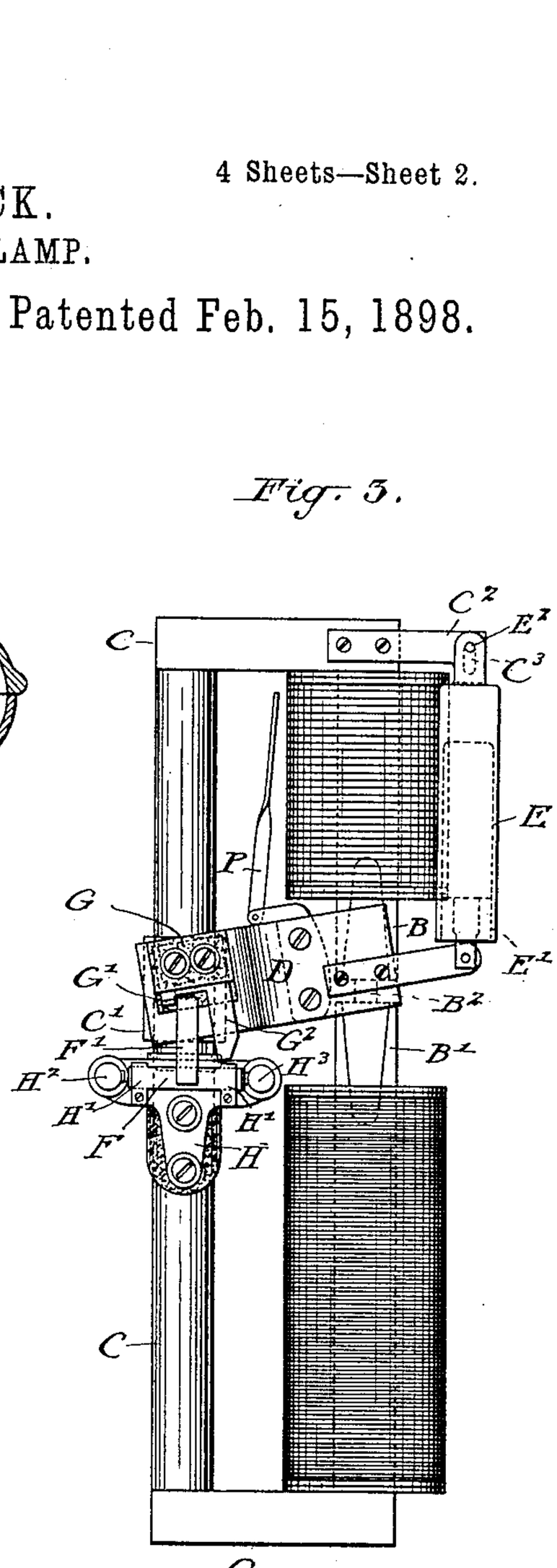


Fig. 4.

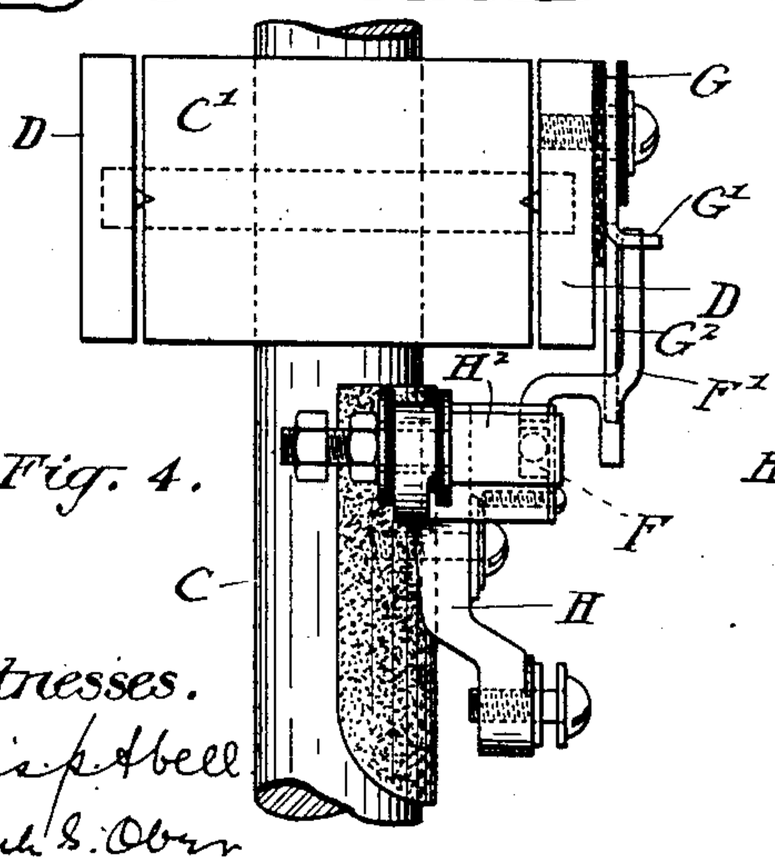
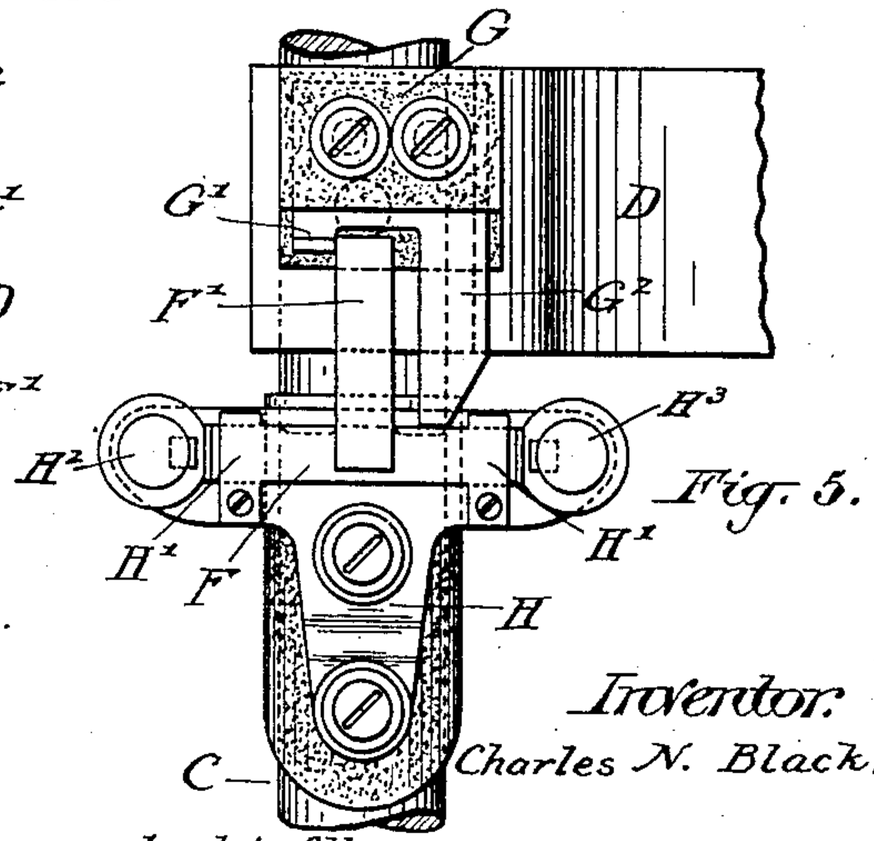


Fig. 5.



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(No Model.) 4 Sheets—Sheet 3.

C. N. BLACK.

ELECTRIC ARC LAMP.

No. 599,032. Patented Feb. 15, 1898.

Fig. 6.

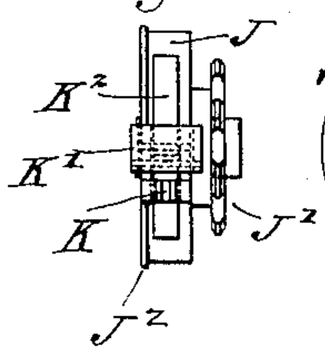


Fig. 7.

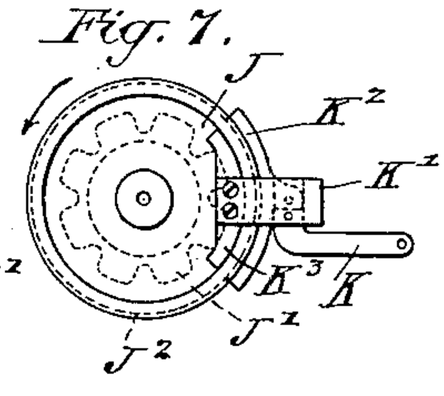


Fig. 8.

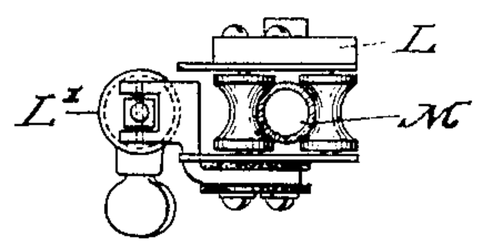


Fig. 9.

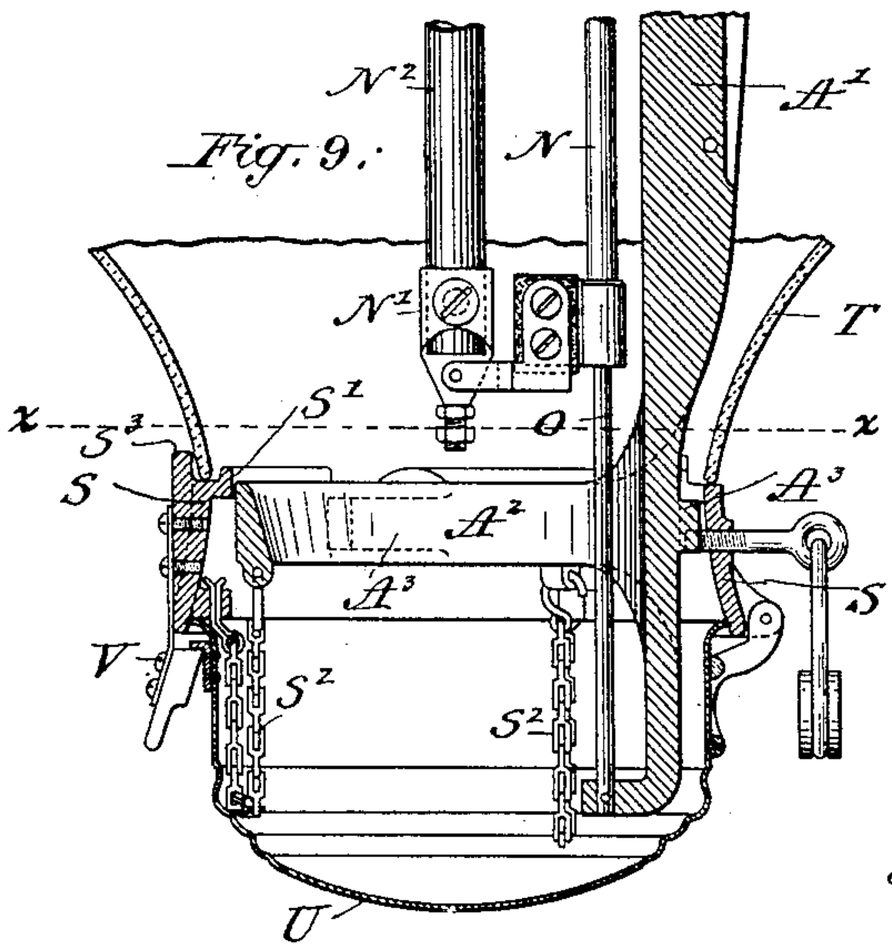


Fig. 10.

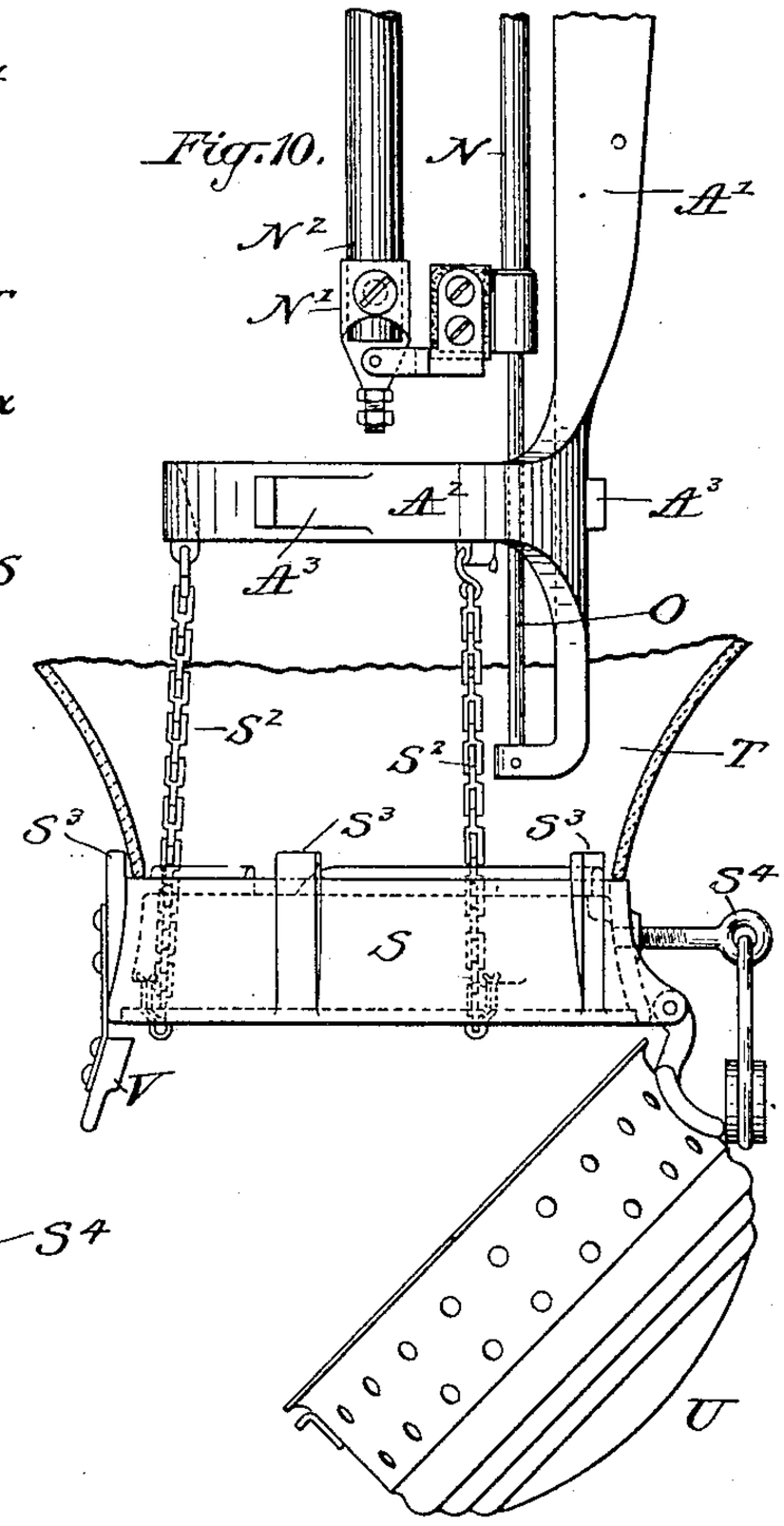
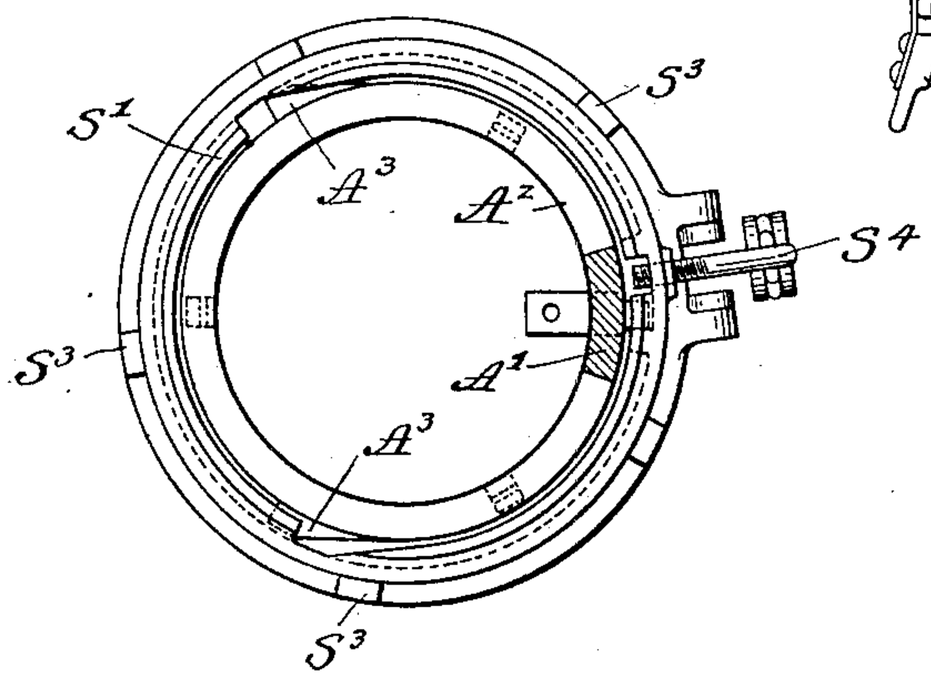


Fig. 11.



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(No Model.) 4 Sheets—Sheet 4.

C. N. BLACK.

ELECTRIC ARC LAMP.

No. 599,032. Patented Feb. 15, 1898.

Fig. 12.

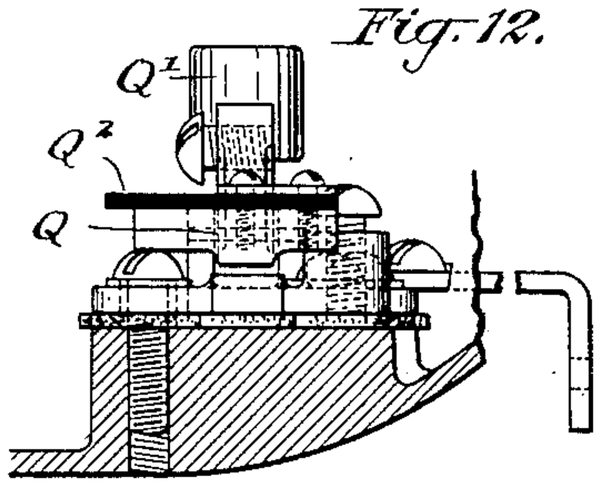


Fig. 13.

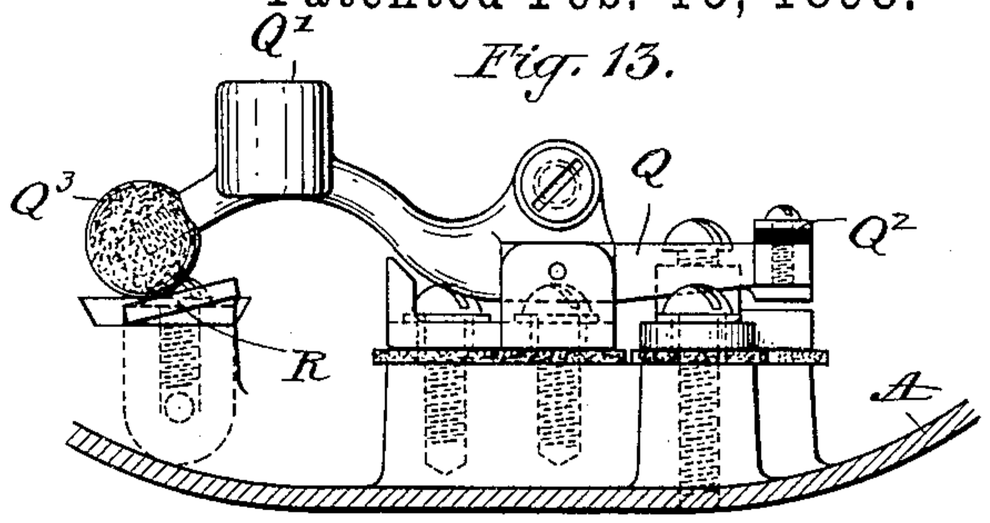
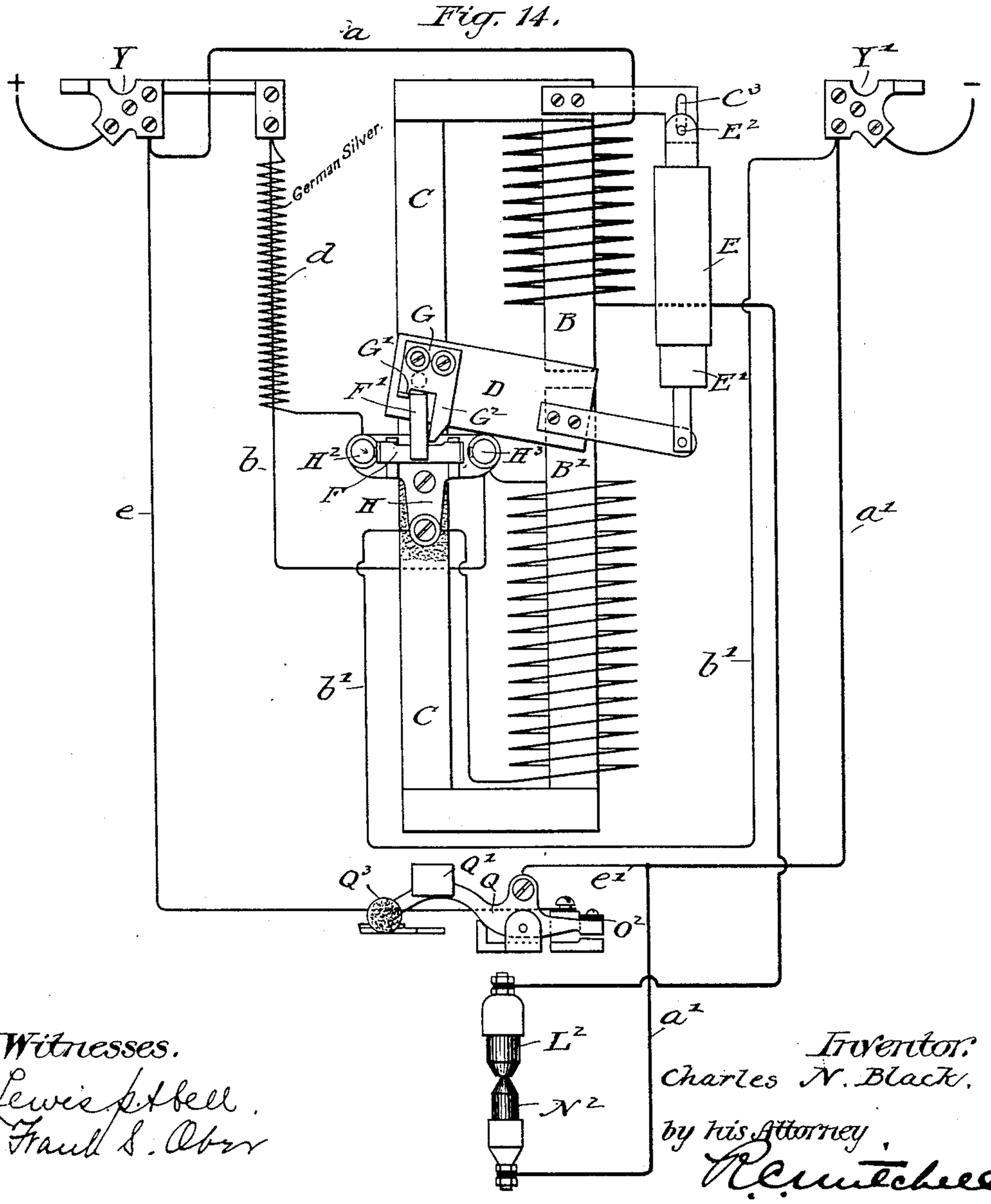


Fig. 14.



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UNITED STATES PATENT OFFICE.

CHARLES N. BLACK, OF NEW HAVEN, CONNECTICUT, ASSIGNOR TO THE WALKER COMPANY, OF CLEVELAND, OHIO.

ELECTRIC-ARC LAMP.

SPECIFICATION forming part of Letters Patent No. 599,032, dated February 15, 1898.

Application filed April 20, 1897. Serial No. 632,902. (No model.)

To all whom it may concern:

Be it known that I, CHARLES N. BLACK, residing at New Haven, in the county of New Haven and State of Connecticut, have invented certain new and useful Improvements in Electric Lamps, of which the following is a full, clear, and exact specification.

My invention relates particularly to improvements in that class of electric lamps known as "arc-lamps."

Among the main objects of my invention are the provisions of a simple and effective electromagnetic mechanism for establishing the arc and for regulating its length and maintaining it uniform in its length and brilliancy by automatically adjusting and feeding both the upper and lower carbons; further, to furnish the lamps with an improved clutch mechanism in connection with a sprocket-wheel engaging a chain attached to the carbon-holders; further, to provide an improved cut-out for short-circuiting the lamp in case the carbons stick or fail to feed or break, which also performs the additional function of reëstablishing the arc in case the clutch slips; further, to provide an additional means for automatically short-circuiting the lamp when the carbons are consumed; further, to provide a simple, inexpensive, and effective holding device for the globe whereby the same may be readily lowered for cleaning, and, further, to provide a simple, inexpensive, and effective guide for both the upper and lower carbon holders.

My invention is illustrated by the accompanying drawings, in which—

Figure 1 is a vertical sectional view of the casing of my lamp, revealing the internal construction with the exception of the armature and cut-out, the lower part of the lamp being broken away. Fig. 2 is a similar view taken in a different vertical plane, this view showing the armature, cut-out, and dash-pot. Fig. 3 is a view of the magnet, armature, and cut-out, the position of the armature being varied from that shown in Fig. 1. Figs. 4 and 5 are respectively relatively-enlarged end and front views of the cut-out, illustrating the position of the same when the current is flowing through the lamp, the parts being in the normal working position. Figs. 6 and 7 are respectively end and side elevations of the clutch mechanism by which the position of the carbons is controlled. Fig. 8 is a plan view of the carriage of the upper-carbon holder. Figs. 9 and 10 are side elevations, partly in sections, of the lower part of the lamp, illustrating the lower-carbon holder, globe-holder, and ash-pan, the said views illustrating different positions of the globe-holder and ash-pan. Fig. 11 is a horizontal section on substantially the plane of the line $x\,x$, Fig. 9. Figs. 12 and 13 are respectively end and side elevations of a supplemental cut-out. Fig. 14 is a diagrammatic view illustrating the circuits.

Similar letters refer to similar parts.

A is a casing, of any suitable form, inclosing the mechanism by which the position of the carbons is regulated and the arc automatically controlled. One side of the casing is by preference capable of being opened to afford access to the internal mechanism.

The electromagnet within the casing A is composed of two cores B and B′ in line with each other, the former being a series coil wound with coarse wire, the latter the shunt-coil wound with a finer wire. The cores B B′ are held by a suitable yoke-piece C, which engages the opposite ends of said cores, as shown. To insure alinement of the cores B B′, I provide, by preference, at their internal extremities a suitable connecting piece or plug B^2, of brass or some other suitable non-magnetic metal. The adjacent inner ends of the cores B B′ are by preference tapered, as shown, adjacent to the armature D, so as to produce a varying pull depending upon the current passing through the arc and the voltage around the arc. The armature D is preferably built up of two parts suitably fastened together and pivoted to the block C′ on the yoke-piece C.

By the construction herein described it will be seen that a magnetic circuit of very low reluctance is produced, and in consequence the magnet responds quickly and sensitively to all variation in the current or in the voltage around the arc.

A suitable projecting arm from the free end of the armature D is attached to a plunger E′, operating in a dash-pot E, the latter being

loosely attached to an overhanging shoulder or connecting-piece C^2 on the yoke C. One means for providing this loose attachment is shown in the drawings, in which a slot C^3 is formed in the connecting-piece C^2, while a pin E^2, carried by the dash-pot, moves freely in said slot.

The switch F of the main cut-out is mounted upon the yoke C, preferably below the block C'.

G is the switch-controller of the main cut-out, carried by, but insulated from, the armature D.

G' is a shoulder on the switch-controller, adapted to operate against one side of an upwardly-extended arm F' of the switch F and by which means the said switch is moved in one direction.

G^2 is a depending arm on the switch-controller G, adapted to operate against the opposite lower side of the arm F' and by which means the switch is moved in the opposite direction, the raising or lowering of the free end of the armature tilting the switch-controller and shifting the position of the switch F in the manner described. As the depending arm G^2 extends into a lower plane than the shoulder G', it shifts the position of the switch by a quicker movement than is effected by the movement of the shoulder G'. It should be noted that the space between the said shoulder and the said depending arm is greater than the width of the arm F', the purpose being to allow the armature to tilt in a downward direction to a substantial degree before shifting the position of the switch F. To tilt the armature into its extreme lower position causes the arm G^2 to contact with the switch and shift it quickly into the position shown in Fig. 14.

The switch F is adapted to freely slide in a suitable guide H' on the framework H, carried by, but insulated from, the yoke C.

H^2 H^3 are insulated studs carried by the framework H at the opposite ends of the switch F, so that when the switch is in its extreme left-hand position it contacts with the stud H^2 and when in the extreme right-hand position with the stud H^3.

The means by which the carbons are held in the desired position comprises a clutch-drum J, carried by a sprocket J', which in turn carries a chain K, one end of the chain being connected to the carriage L, which supports an insulated upper-carbon holder L'. This carriage L is preferably provided with antifriction-rolls, which move upon a stationary tubular guide M. The opposite end of the chain K is attached to a tubular carriage N, moving within the tube M and supporting toward its lower end an insulated carbon-holder N'.

O is a rod carried by a downwardly-projecting arm A' of the casing A. This rod O projects into and serves as a supplemental guide for the tubular carbon-carriage N. The weight of the upper carbon, its holder, and carriage is sufficient to counterbalance the weigth of the lower carbon, holder, and carriage, so that by the action of gravity the carbons L^2 N^2 are caused to approach each other. To separate said carbons sufficiently to form the arc, suitable clutch mechanism is employed in connection with the drum J of the sprocket J' to turn the latter in a direction opposite to that occasioned by the force of gravity. This clutch mechanism comprises a lever K, pivotally connected at a point intermediate of its length to a yoke-piece K', the inner extremity of said lever being pivotally connected to an outer shoe K^2, adapted to engage the outer surface of the drum J. The yoke-piece in turn carries at its inner end a shoe K^3, operating against the inner surface of said drum, the latter being provided with a flange J^2 to prevent the accidental detachment of the said shoes. Carried by the armature D is an upwardly-projecting connecting-rod P, pivoted at its upper end to the end of the lever K, so that as the armature is raised the lever J is correspondingly raised, bringing the brake-shoes K^2 K^3 into operative engagement with the clutch-drum J. By raising the armature to a sufficient height the drum and sprocket-wheel are rotated slightly in the direction of the arrow, Fig. 7, the said rotation being sufficient to separate the carbons and establish the arc. As the carbons are gradually consumed and the resistance through the arc correspondingly increased, an increased percentage of the current passes around the arc through the shunt-coil, increasing the pull of the lower magnet and causing the armature to descend, releasing the clutch mechanism sufficient to allow the sprocket to rotate in the reverse direction and reëstablish the uniform length of the arc, at which moment further approach of the carbons is checked by the action of the clutch mechanism, which is again actuated by the raising of the armature consequent upon the renewal of the normal flow of electricity through the shunt-coil.

Fig. 2 shows the position of the armature and main cut-out when no current is flowing through the lamp. Fig. 3 shows the position of the armature and cut-out when there is an abnormal flow of current through the series coil, and Fig. 5 shows substantially the position of the armature when the current is flowing through the lamp and it is working in its normal condition.

Q is a supplemental cut-out located in the path of movement of the carriage L and in the lower part of the casing A. When the carbons are consumed, the carriage L has descended to a point where it contacts with one end of the supplemental cut-out, tilting it and short-circuiting the lamp. This point of contact is insulated, as at Q^2. The opposite end of the cut-out Q is also provided with an insulated tip Q^3, and adjacent thereto is a counterweight Q', whereby the cut-out is tilted so as to be normally out of circuit. R is a

manually-controlled switch bearing against the insulated tip Q^3. This bearing-face is by preference beveled, so that by turning the said switch R the cut-out Q may be tilted, short-circuiting the lamp.

A^2 is a ring carried near the lower extremity of the arm A'. A^3 are lugs carried by said ring and adapted to coöperatively act with a globe-supporting ring S.

S' is an inwardly-directed flange on the ring S, the said flange having recesses to correspond and register with the lugs A^3.

S^2 are chains attached at their upper ends to the stationary ring A^2 and at their lower ends to the ring S. Suitable flanges S^3 are provided around the upper edge of the ring S to hold the globe T. Thus by raising the ring S until the lugs A^3 have passed through the recesses in the flange S by turning the said ring the flange S is projected over the said lugs A^3, securely holding the ring S and globe in the elevated position shown in Fig. 9.

S^4 is a screw the inner end of which when screwed home against the fixed ring A^2 locks the globe-holder in said elevated position. By loosening the screw S^4 and reversing the movement of said ring S the globe may be lowered to the length of the chains S^2.

U is an ash-pan hinged at one side to the ring S and detachably held at its opposite side by means of the spring-latch V.

Referring now to the diagrammatic view of the circuits, Y Y' are the terminals to which the line-wire is connected, being respectively the points where the current enters and leaves the lamp.

Circuit 1 extends from the terminal Y through wire *a* to and around the series coil to the upper carbon L^2, through the lower carbon N^2 and wire *a'*, to the terminal Y'.

Circuit 2 extends from the terminal Y through wire *b* to the insulated post H^3, thence around the shunt-magnet to the frame H, and thence through the wire *b'* to the terminal Y'.

Circuit 3 extends from the terminal Y through wire *d* to the stud H^2, said wire *d* being formed of German silver or any high-resistance metal. This circuit is normally open; but when closed by the switch F the current flows from this point H^2 to the negative terminal Y' through the framework H and the wire *b'*.

Circuit 4 extends from the positive terminal Y through wire *e* to the supplemental cut-out Q, which is normally open, but which when closed, by reason of the carbons being consumed or the switch R being thrown, completes said circuit 4 through the wires *e'* and *a'* to the terminal Y', short-circuiting the lamp.

In operation when the armature is in its lowest position, Fig. 14, the resistance-wire *d* forms a shunt to the series coil and the carbons and when the current enters the lamp forces a percentage of this current around the series coil sufficient to raise the armature slightly and open the contact between the post H^2 and the switch F, after which all of the current passes around the series coil, thus raising the armature to the position indicated in Fig. 5 and establishing the arc through which the current flows to the terminal Y'. When the armature is in the position shown in Fig. 3 by reason of the clutch slipping the principal part of the current flows through circuit 2 to stud H^3 and thence through the switch F, (which is then at its extreme right-hand position,) frame H, and wire *b'* to the negative terminal Y', thus short-circuiting the series coil and the carbons and allowing the armature to drop and the clutch to take a new hold.

In the operation of the lamp the loose connection of the dash-pot to the arm C^2 serves the following important function: When the armature has raised the plunger to its limit of upward movement in the dash-pot, unless the shunt-circuit is open or the clutch has failed in its function of separating the carbons the armature continues to rise, lifting the dash-pot itself, the weight of the dash-pot being then transferred from the arm C^2 to the end of the armature. When the armature has raised the dash-pot to its upper limit, the switch F makes contact with the stud H^3, short-circuiting the series coil of the lamp and the carbons and causing the armature to drop until it throws the switch F and breaks connection with the stud H^3, permitting the current to follow the normal path through the series coil and carbons, thereby raising the armature, causing the clutch to take a new hold. By this means the dash-pot serves the function of a weight to check the movement of the armature and to prevent the lamp from "pumping." This check upon the armature gives sufficient time for the shunt-magnet to reach its full strength, so as to effect its normal pull on the armature, an appreciable amount of time being required for the current to be established in the shunt-coil.

I would not have any of the foregoing language construed as requiring given specific mechanism; but although no modifications are described I desire to have its understood that it is my intention that this application includes all such modifications as come fairly within the spirit and scope of my invention.

What I claim is—

1. In an arc-lamp, a pivotally-supported armature carrying a plunger, a dash-pot loosely supported from above in which said plunger works.

2. In an arc-lamp, an electromagnetic mechanism and carbon, an armature actuated by said electromagnetic mechanism and pivoted to one side thereof, the free end of said armature carrying a plunger of a dash-pot, and a dash-pot loosely supported in the line of movement of said plunger.

3. In an arc-lamp, an electromagnetic mechanism and carbons, an armature actuated by said electromagnetic mechanism and pivoted

to one side thereof, the free end of said armature carrying the plunger of a dash-pot, and a dash-pot loosely supported from above in the line of movement of said plunger.

4. In an arc-lamp, an electromagnetic mechanism, an armature pivotally connected to one side of said mechanism, the free end of said armature carrying a plunger, a dash-pot in which said plunger reciprocates, the upper end of said dash-pot being supported by a pin moving freely in a slot in the supporting member in the line of movement of said plunger.

5. In an arc-lamp, a cut-out comprising a switch mounted in guides in a suitably-insulated frame, an arm carried thereby, a switch-controller having a shoulder on one side of the arm of said switch and an arm on the opposite side of the arm of said switch, the space between the adjacent sides of the shoulder and arm of the switch-controller being greater than the width of the arm of said switch.

6. In an arc-lamp, a cut-out comprising a switch mounted in guides in a suitably-insulated frame, an arm carried thereby, a switch-controller having a shoulder on one side of the arm of said switch and an arm on the opposite side of the arm of said switch, the space between the adjacent sides of the shoulder and arm of the switch-controller being greater than the width of the arm of said switch, the point of operative contact of the controller-arm against the switch-arm being a greater arc than the point of contact of said shoulder against the switch-arms.

7. In an arc-lamp, a cut-out comprising a switch mounted in a suitably-insulated frame, insulated studs carried by said frame and in line with said switch, said switch being adapted to slide longitudinally to contact with either one of said studs, and a switch-controller carried by a pivotally-supported, electrically-controlled armature, said controller being mounted perpendicular to the axis of movement of said armature.

8. In an arc-lamp, a cut-out comprising an insulated frame supporting in suitable guides a laterally-moving switch, insulated studs supported in said frame at opposite ends of said switch and in the line of movement thereof, an upwardly-extending arm carried by said switch, a switch-controller carried by an electromagnetically-controlled armature, said controller being insulated and having a shoulder and an arm, each for operatively engaging the arm of the switch.

9. In an arc-lamp, a clutch mechanism, comprising a flanged clutch-drum, free to revolve in either direction, a clutch comprising an inner shoe, a yoke-piece connected thereto, a lever pivotally carried at the opposite end of said yoke-piece, and an outer shoe carried by the inner end of the said lever, the inner end of said clutch mechanism being supported by said drum, and a connection between the armature and the free end of said lever.

10. In an arc-lamp, a clutch mechanism, comprising a rotatable clutch-drum, a brake therefor comprising an inner shoe, a yoke-piece carrying said inner shoe, a substantially rectangular lever pivotally carried at the outer end of said yoke-piece, an outer shoe carried at the inner end of said lever and a connecting-rod between an electromagnetically-controlled armature and the free end of said lever.

11. In an arc-lamp, an upper-carbon holder carried on one side of a movable support or carriage freely sliding on a single stationary tubular guide, a tubular lower-carbon carriage sliding freely within the first-named stationary tubular guide, a chain connecting both of said carriages and passing over a suitable wheel carried by a rotatable flanged clutch-drum, a brake for said drum, said brake being controlled by an electrically-controlled armature.

12. In an arc-lamp, a clutch mechanism comprising a rotatable clutch-drum carrying a sprocket-wheel, a flange at the free edge of said drum, a brake for said drum comprising an inner shoe, a yoke-piece carrying said inner shoe, a substantially rectangular lever pivotally carried at the outer end of said yoke-piece, an outer shoe carried at the inner end of said lever and a connecting-rod between an electromagnetically-controlled armature and the free end of said lever.

13. In an electric-arc lamp, a globe-holder comprising a stationary ring carried by an arm projecting downwardly from the casing of the lamp, a loose ring and suitable means thereon for supporting a globe, a recessed flange on one of said rings and lugs on the other ring registering with said recesses.

14. In an electric lamp, a globe-holder comprising a stationary ring carried by an arm projecting downwardly from the casing of the lamp, a loose ring and suitable means thereon for supporting a globe, a recessed flange on one of said rings and lugs on the other ring registering with said recesses, and chains as described loosely connecting the said rings.

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