(No Model.) 2 Sheets—Sheet 1.

# E. C. RUSSELL.

## ELECTRIC ARC LAMP.

No. 462,673. Patented Nov. 3, 1891.

Fig. 1.

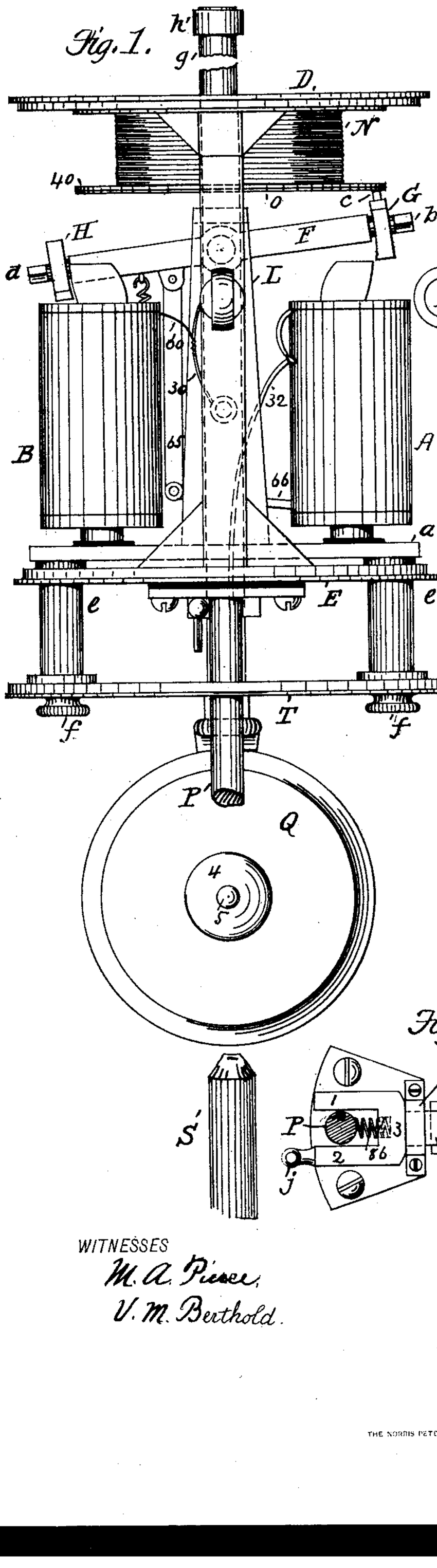


Fig. 2.

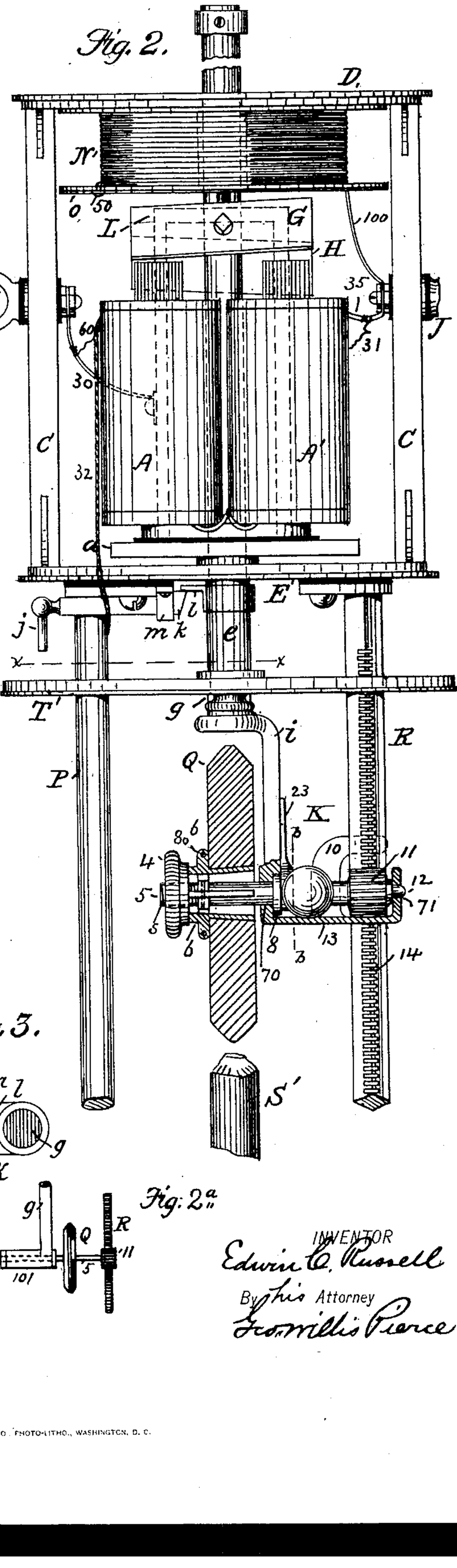


Fig. 3.




Fig. 2a.







WITNESSES

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INVENTOR

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By his Attorney

Fred. Gerrish Pierce

(No Model.) 2 Sheets—Sheet 2.

# E. C. RUSSELL.

## ELECTRIC ARC LAMP.

No. 462,673. Patented Nov. 3, 1891.

Fig. 7.

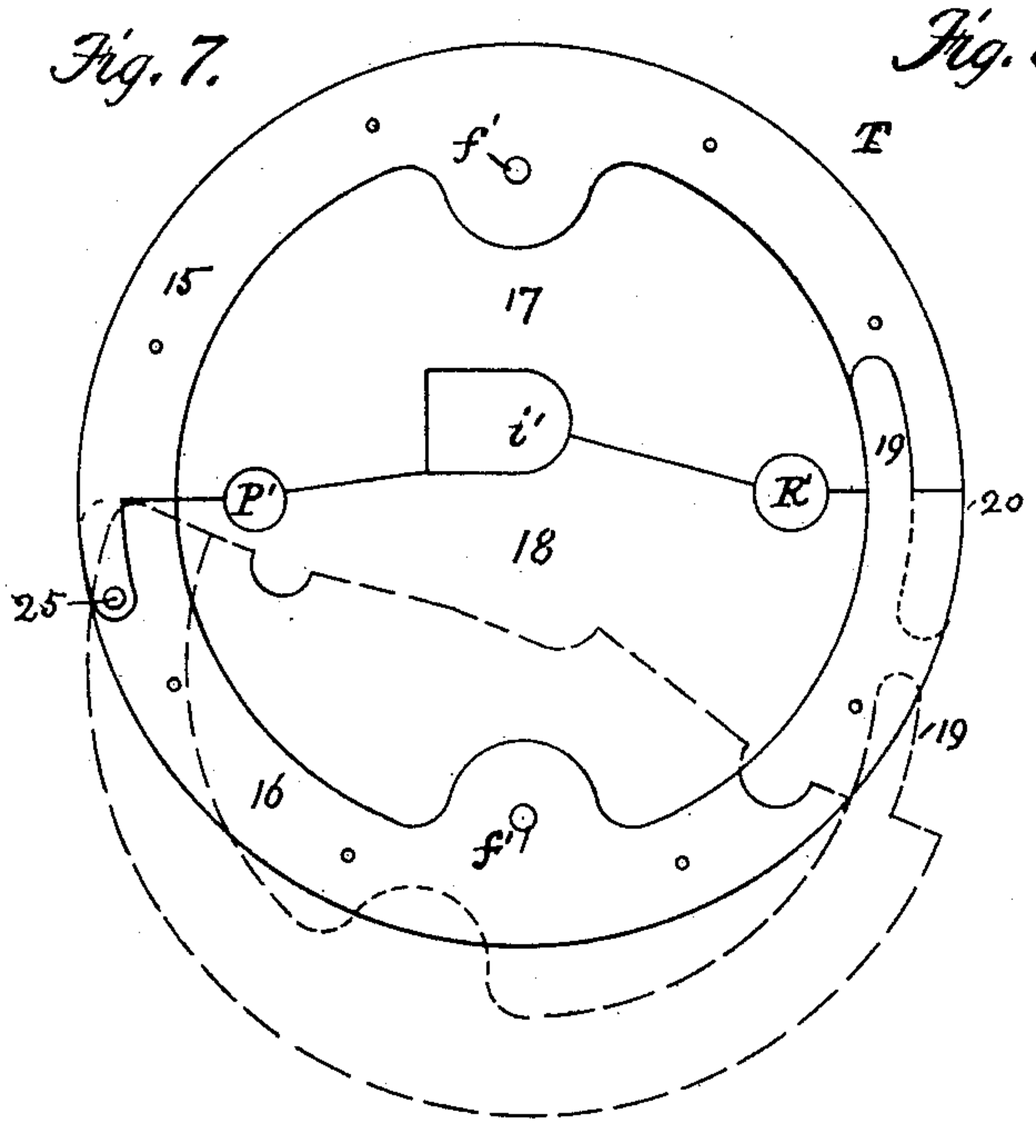



Fig. 8.

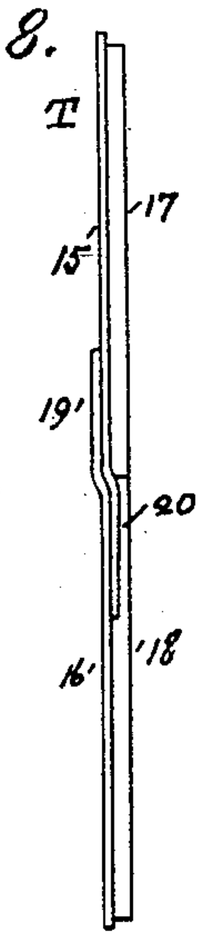



Fig. 4.

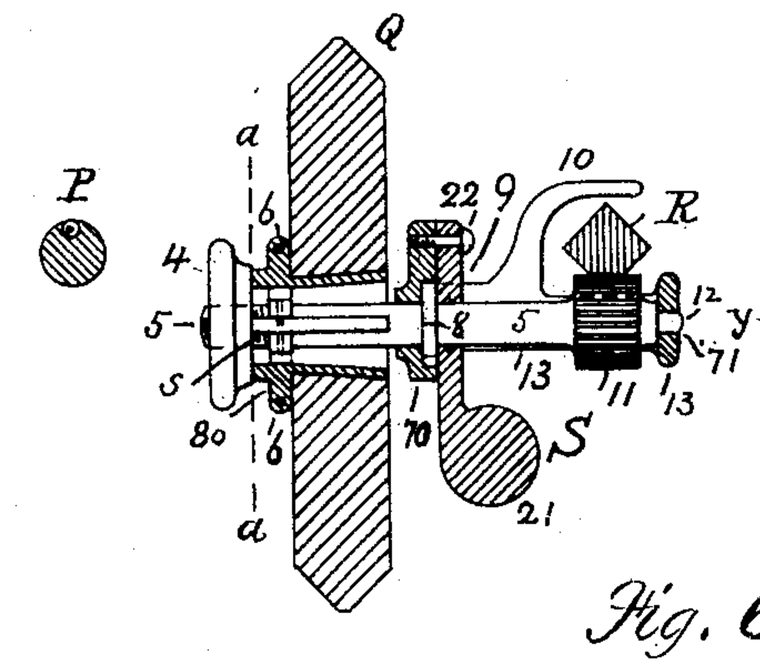



Fig. 5.

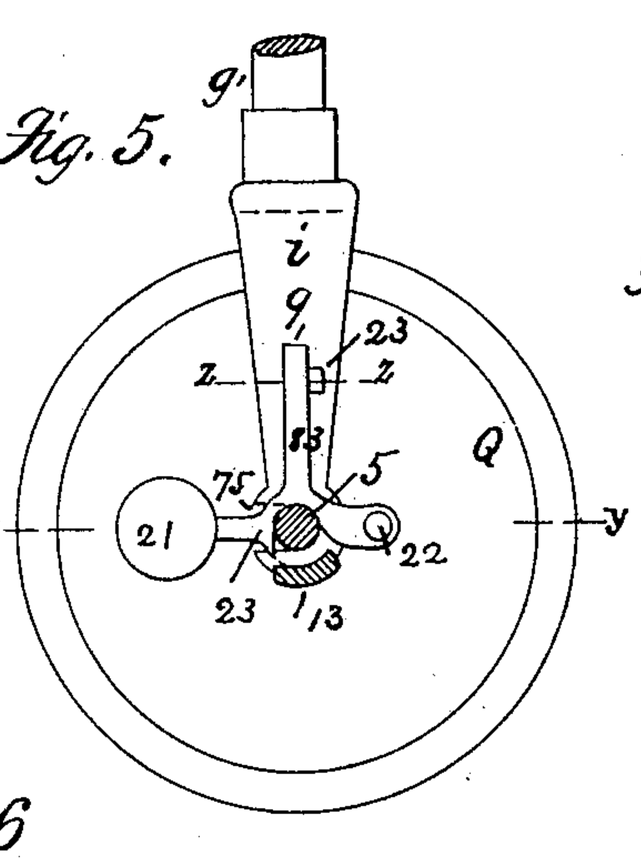
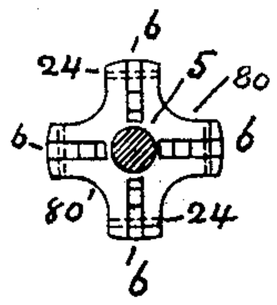



Fig. 9.


Fig. 6

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# UNITED STATES PATENT OFFICE.

EDWIN C. RUSSELL, OF BOSTON, MASSACHUSETTS, ASSIGNOR TO THE RUSSELL ELECTRIC COMPANY, OF SAME PLACE.

## ELECTRIC-ARC LAMP.

SPECIFICATION forming part of Letters Patent No. 462,673, dated November 3, 1891.

Application filed May 21, 1891. Serial No. 393,557. (No model.)

*To all whom it may concern:*

Be it known that I, EDWIN C. RUSSELL, residing at Boston, in the county of Suffolk and State of Massachusetts, have invented certain Improvements in Electric-Arc Lamps, of which the following is a specification.

This invention relates to electric-arc lamps, and especially to that class of lamps described in Patent No. 432,284, issued to me July 15, 1890, in which the upper or positive carbon is a rotative disk, although some of the features of this application are applicable to electric-arc lamps employing two pencil carbons.

My improvements mainly have reference to a lamp in which the regulation of the positive carbon is accomplished by means of main and secondary or shunt magnets and a lever of the first order, with an armature on each end pivoted between the said magnets to operate the clutch and cut-out mechanism.

My invention relates, first, to so constructing the said armatures that when one of them is away from the poles of its electro-magnet one end or a portion thereof is nearer to its pole than is the other or opposite end to its pole, by which means the said armature is brought more quickly into action or "catches" quicker then when the armature is at the same distance from each pole.

Second. The said armatures are located outside of their poles in order that I may make the lamp as a whole more compact, as by this method I am enabled to obtain a longer lever and secure more leverage upon the clutch mechanism, and at the same time I am enabled to bring the main and secondary magnets closer to each other.

Third. I provide a novel automatic cut-out operating by the armature of the main magnet whereby the current is directed through a resistance-coil to the outgoing hanger-hook.

Fourth. I provide novel means for connecting the rotative-disk-carbon support and the disk carbon with the carbon-rod and for holding the same in position relative to the negative or pencil carbon, the said means consisting of an extension of the carbon-rod having upon its lower end bearings for the detachable carbon-holder, and a catch for securing the said carbon-holder in place. The carbon-holder itself is of new and novel construction, means being provided for quickly securing and removing the disk carbon to and from the holder, the carbon having a tapering central orifice.

Fifth. My invention relates to a spring-catch located under the floor of the lamp, combined with a lip on the carbon-rod whereby the latter and its connected disk carbon is held to the upper part of the lamp and by means of which it is lowered into operative position.

Sixth. I provide a detachable heat shield or protector for the electro-magnets located between them and the upper carbon, by means of which the heat rays from the burning carbons are prevented from reaching the said magnets and thereby affecting them.

Certain other features which I believe to be new will be described and claimed.

In the drawings, Figures 1 and 2 represent side and end elevations, respectively, of the upper part of an electric lamp, in which my improvements are shown, parts being drawn in section to illustrate the same more fully. Fig. 2 is a modification. Fig. 3 is a view on line *x x* of Fig. 2, looking upward. Fig. 4 is a section on line *y y* of Fig. 5, the latter being a section on line *b b* of Fig. 2. Fig. 6 is a section on line *a a* of Fig. 4. Figs. 7 and 8 are side and edge views, respectively, of the shield or heat-protector, and Fig 9 is a section on *z z* of Fig. 5.

A A′ are the main magnets, and B B′ are the secondary or shunt magnets, mounted upon the floor *a*.

L is a standard secured to the floor *a*, pivoted to which at its upper end is the lever F, having on each end armatures, as H and G, arranged to operate very much in the same manner as the magnets shown in Patent No. 351,601, granted to W. S. Hill. The armatures H and G are arranged to be operated outside of the poles of their respective magnets and to be adjusted thereto by the screws *d* and *b*.

Referring to Fig. 2, the armature G is shown as being inclined, the lower edge of the left end being nearer to the pole on the spool A than is that of the right end to its pole on the spool A′, the armature G being shown as away from the pole of the magnets A A′ and the lamp cut out. I find by means of this in-

clined armature, in which one end is nearer to the electro magnet than it otherwise would be, that it operates very much more sensitively and catches quicker than when its lower edge is straight. The opposite armature H is inclined in the same way, but preferably in a reverse direction. By means of the screws *d* and *b* the armatures can be adjusted, relatively, to their magnet cores.

The armature G is provided with a pin *c* to make contact with a plate *o* on the under side of the insulating-bobbin 40, which bobbin has wound upon it a resistance-coil N, of German silver, one end of which is connected to the plate *o* at 50, the other end being attached to the hanger-hook J by wire 100. The carbon-rod *g* has upon its end a collar *h*, the carbon-rod passes through an opening in the center of the bobbin 40 and of its plate *o*, and the collar *h* is so adjusted that when the pencil carbon is quite burned off the carbon-rod will have dropped down so that the under edge of its collar will rest upon the upper side of the plate *o*, the hole in the bobbin admitting the passage of the rod and collar; but the hole in the plate *o* is smaller, not allowing the collar to pass through. The current comes in at hanger-hook I and passes by wire 30 to the standard L and to the carbon-rod *g* through the carbons, returning by the frame-rod P, wire 32 through the main magnets A A′ to the hanger-hook J, the shunt-magnets B B′ being connected to the wire 30 by wire 60 on the incoming side, and to wire 35 by wire 31 on the outgoing side. When the current ceases to traverse the main circuit through the magnets A A′ by reason of a wide separation of the carbons from any cause, the shunt-magnets B B′ attract the armature H and the pin *c* on the armature G makes contact with the plate *o*, shunting the current through the resistance-coil N to the hanger-hook J and substituting for the lamp-resistance the resistance of the coil N and maintaining the equilibrium of the circuit in which the lamps are connected. Should the separation of the carbons be temporary, the current is established again through coil A A′ and the lamp lighted; but should either carbon be destroyed or burnt entirely out the armature H continues attracted and the contact of the pin *c* with the plate *o* is maintained, thus keeping the clutch 66 depressed by means of the rod 65. This permits the carbon-rod *g* to fall, which it continues to do until it is stopped by the collar *h* striking upon the upper face of the plate *o*, thus short-circuiting the lamp.

The disk-carbon holder K consists of the arm *i*, connected to the carbon-rod *g* by its upper end, the lower end 13 is extended at a right angle to the arm *i* and has bearings 70 and 71, in which is journaled the carbon-holder spindle, the bearing 70 has a slot 75 cut outward on its side, the bearing 71 is bored through the end of the frame 13. The frame 13 extends straight outward from the arm *i*, as shown in Fig. 2, and has a hook 10, which embraces the frame-rod R, which has teeth cut on one angle thereof. I have shown this frame-rod square in cross-section and with teeth cut on one angle. This section is not material, as it can be round in section as is the other rod P. These frame-rods are secured to the upper part of the lamp and at the lower part thereof have a cross-connection and pencil-carbon holder in the usual way.

The carbon-holder S consists of a spindle having a journal 12 on one end, which rests in the bearing 71 of the frame 13; a pinion 11, which meshes with the teeth of the rack-teeth 14 on the rod R; a collar 8, which rests in bearings 70; a collar 80, in which are pivoted four levers 6 in slots cut therein by the pins 24. The levers are of the first order, their arms being of unequal length. Upon the end of the spindle is cut a screw-thread *s*, upon which is a nut 4.

Q is the disk carbon with a central beveled hole. The pivots of the levers 6 are at one side of their axis, so that when one end is pushed the other end swings outward. To secure the disk carbon Q to the holder, it is passed over the pinion 11. The long ends of the levers 6, being brought together, are inserted into the hole of the carbon, the latter being held against the face of the collar 80. The nut 4 is screwed against the short ends of the levers 6, causing their opposite ends to open and press against the face of the orifice in the carbon, holding it securely against the collar. The arm *i* is an extension of the carbon-rod, and is offset therefrom simply for convenience. It is obvious that it could be extended straight down to the frame 13.

Fig. 2ª shows a modification, in which the carbon-rod *g* is on one side of the disk carbon and its holder, a long bearing 101 holding the carbon-holder.

9 is a catch for securing the carbon-holder S into the support K, and consists of a lever pivoted by screw 22 to the lower end of the arm *i*. It has a hook 23, which embraces the spindle of the carbon-holder, provided with a weighted arm 21 to assist in keeping it in place. A spring-arm 83 extends upward, bearing against the face of the arm *i*.

23 is a locking-stud on the arm *i*.

To insert the carbon-holder S into its support K, the journal 12 is placed in its bearing 71, the collar 8 is swung into the bearing 70, the catch 9 is pressed down, so that its hook 23 embraces the spindle 5, the spring-arm 83 jumps over the stud 23 and is held in place thereby, the weight 21 also assisting to the same end. The method of removing the carbon-holder is obvious. The weight 21 serves also to effect an electric contact between the arm *i* and the spindle 5 and prevents sparking between them.

In my patent hereinbefore referred to I employ two frame-rods and a separate rod for the rack-rod. I find that one rod answers the double purpose.

To secure the carbon-rod and its attached

carbon to the top of the lamp for any purpose, I provide on the said rod a lip *l* and upon the under side of the floor of the lamp a spring catch-lever. I have shown the latter as embracing the frame-rod P, with its extensions 1 and 2, the latter being provided with a handle *j*. The lever works in a straddling-piece *m*, which secures it to the said floor. The spring 86 keeps the lever pressed against the piece *m*. By pushing the carbon-rod upward the lip strikes the catch-lever, forcing it back until the lip passes it, when it returns, and the lip rests upon it. To release the carbon-rod, the handle *j*, with the catch, is pulled away from the lip.

T is a heat-shield between the carbons and the magnets. It is made in halves 17 and 18. The outer rims 15 and 16 are of metal pivoted to each other at 25, so that the parts can be swung open and removed from the lamp. The central portions 17 and 18 are made of asbestus or other heat-insulating substance.

Holes P′, *i*′, and R′ are for the admittance of the frame-rods P and R and for the carbon-rod *i*.

The shield is secured to the under side of the lamp-floor by the screws *f*, which pass through the holes *f*′ into the studs *e*. To place the shield in position, it is opened, as shown in dotted lines, passed over the rods and brought together, as shown in full lines, the springs 19 and 20 on the opposite ends of the rims pressing upon each other sufficiently to close the ends thereof, and the screws *f* hold it in place.

I have shown the heat-protector with a rim of metal. It is obvious that this is for durability only, as the two pieces of asbestus can be secured to each other in precisely the same way as described of the metal rim *s*.

I claim as my invention—

1. An electric-arc lamp in which the regulation of the positive carbon is accomplished by means of main and secondary or shunt magnets in pairs, and a lever of the first order, with an armature on each end pivoted between each of the said pairs of magnets, the lower edge of one or both of the said armatures being inclined relative to the respective magnet-cores, as set forth.

2. An electro-magnet and an armature therefor having a pivotal support at right angles to the line of the poles and also to the axes thereof, with its lower edge inclined relative to the respective cores of the said electro-magnet.

3. An electric-arc lamp in which the regulation of the positive carbon is accomplished by means of main and secondary or shunt magnets in pairs, and a lever of the first order with an armature on each end pivoted between each of the said pairs of magnets, the said armatures being arranged to operate outside of their respective magnet-cores, as set forth.

4. An electric-arc lamp in which the regulation of the positive carbon is accomplished by means of main and secondary or shunt magnets in pairs, and a lever of the first order with an armature on each end pivoted between each of the said pairs of magnets, the lower edge of one or both of the said armatures being inclined relative to the respective magnet-cores and provided with means of adjustment thereto, as set forth.

5. An electric-arc lamp in which the regulation of the positive carbon is accomplished by means of main and secondary or shunt magnets in pairs, and a lever of the first order with an armature on each end pivoted between each of the said pairs of magnets, the said armatures being arranged to operate outside of their respective magnet-cores and provided with means of adjustment thereto, as set forth.

6. An electro-magnet and an armature therefor having a pivotal support at right angles to the line of the poles and also to the axes thereof, with its lower edge inclined relative to the respective cores of the said electro-magnet and provided with means of adjustment thereto.

7. An electro-magnet and an armature therefor having a pivotal support at right angles to the line of the poles and also to the axes thereof, with its lower edge inclined relative to the respective cores of the said electro-magnet and arranged to operate outside thereof and provided with means of adjustment thereto.

8. An electric-arc lamp in which the regulation of the positive carbon is accomplished by means of main and secondary or shunt magnets in pairs, and a lever of the first order with an armature on each end pivoted between each of the said pairs of magnets, the lower edge of one or both of the said armatures being inclined relative to the said poles and arranged to operate outside thereof and provided with means of adjustment thereto, as set forth.

9. An electric-arc lamp in which the regulation of the positive carbon is accomplished by means of main and secondary or shunt magnets in pairs, and a lever of the first order with an armature on each end pivoted between each of the said pairs of magnets, provided with an automatic cut-out for the said magnets, consisting of a contact on the main magnet-armature arranged to come into contact with one end of a resistance-coil whose other end is in connection with the current-outgoing hanger-hook, as set forth.

10. In an electric-arc lamp in which the regulation of the positive or disk carbon is accomplished by means of main and secondary or shunt magnets, of a carbon-rod provided at its lower end with means for holding the disk-carbon holder, consisting of an extension of the said carbon-rod having a suitable support for the said carbon-holder at its extremity, whereby when the said holder is

in place the pinion thereof is upon one side of the said extension and the disk carbon upon the other side.

11. In an electric-arc lamp in which the regulation of the positive disk carbon is accomplished by means of main and secondary or shunt magnets, of a carbon-rod provided at its lower end with means for holding the disk-carbon holder centrally, consisting of an extension of the said carbon-rod having a suitable support for the said carbon-holder at its extremity, whereby when the said holder is in place the pinion thereof is upon one side of the said extension and the disk carbon upon the other side.

12. In an electric-arc lamp in which the regulation of the positive or disk carbon is accomplished by means of main and secondary or shunt magnets, of a carbon rod, a disk-carbon holder provided with a support for the disk carbon and means for rotating the same, the said carbon-holder being supported by a single extension from the said carbon-rod.

13. In an electric-arc lamp in which the regulation of the positive or disk carbon is accomplished by means of main and secondary or shunt magnets, of a carbon-rod, two frame-rods, one on each side of the said carbon-rod, one of the former having teeth cut upon it, a disk-carbon holder supported by the said carbon-rod, having a pinion to mesh into the teeth on the said rod and a disk-carbon support to hold the disk carbon.

14. In an electric-arc lamp in which the regulation of the positive or disk carbon is accomplished by means of main and secondary or shunt magnets, of a carbon-rod provided at its lower end with means for holding a disk-carbon holder, consisting of a frame extending laterally therefrom over the face of a frame-rod having teeth thereon provided with a hooked projection extending around the said frame-rod and with bearings for the disk-carbon holder, one of them being slotted outwardly, and a locking device pivoted to said frame having a hook to embrace the spindle of the disk-carbon holder, a weighted arm, and a spring-arm in connection with a stud on said carbon-rod.

15. A disk-carbon holder consisting of a spindle provided with a pinion, suitable journals, a disk-carbon support consisting of a slotted collar in which are pivoted levers of the first order, and a screw-thread upon said spindle, upon which a nut traverses, for the purposes set forth.

16. In an electric-arc lamp, the carbon-rod provided with a lip, in combination with a spring-catch provided with a releasing-handle located on the frame of the lamp, as set forth.

17. In an electric-arc lamp, the carbon-rod provided with a lip, in combination with a spring-catch located on the lamp-frame, the lever of which embraces one of the frame-rods and which is secured to the said lamp-frame by a straddling-piece, a spring being interposed between the said spring-catch and the frame-rod.

18. In an electric-arc lamp, a removable heat-protector interposed between the electro-magnets and the carbons of a circular form consisting of two pieces of asbestus or other heat-insulating substance (each of said pieces having metal rims provided with locking-springs) jointed together, as set forth.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, this 20th day of May, 1891.

EDWIN C. RUSSELL.

Witnesses:
GEO. WILLIS PIERCE,
S. B. TUTTLE.