(No Model.) 3 Sheets—Sheet 1.

J. F. KESTER.

ELECTRIC ARC LAMP.

No. 482,253. Patented Sept. 6, 1892.

FIG. 1.

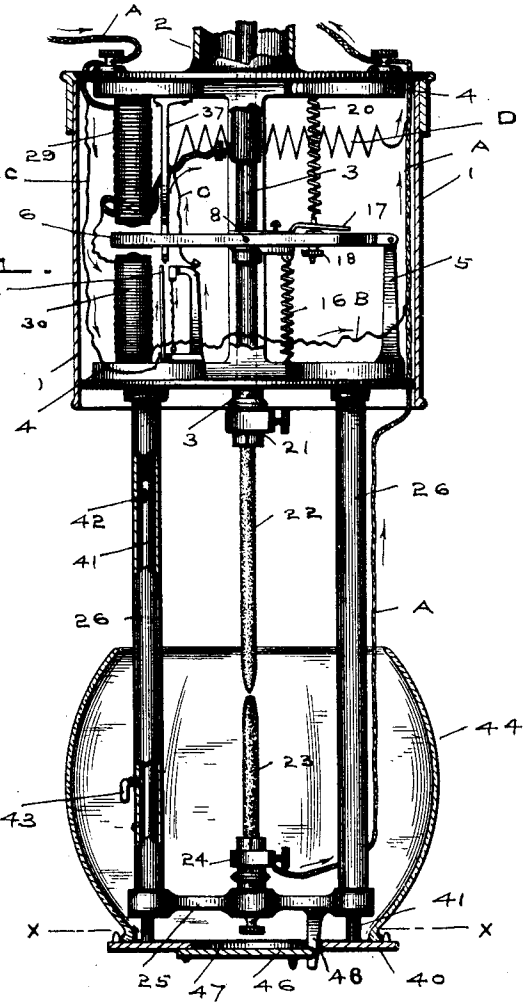
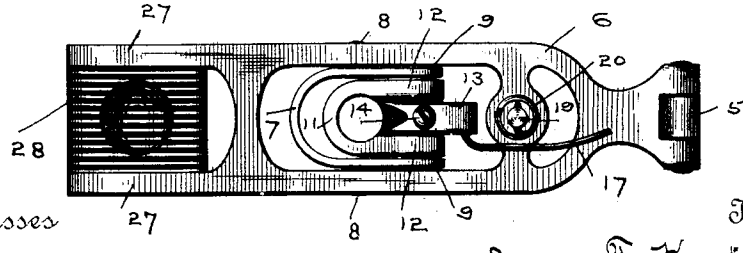


FIG. 2.



Witnesses

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Inventor

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

(No Model.) 3 Sheets—Sheet 2.

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FIG. 3.

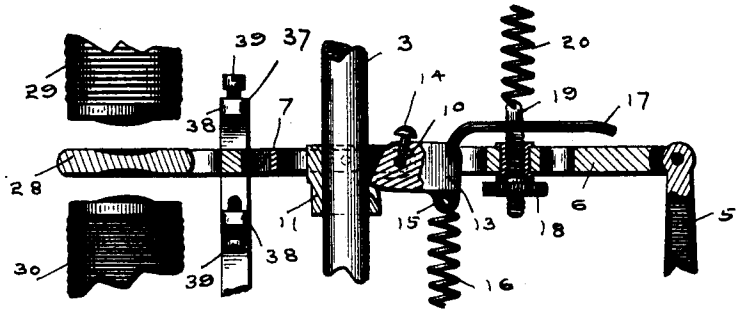

FIG. 4.

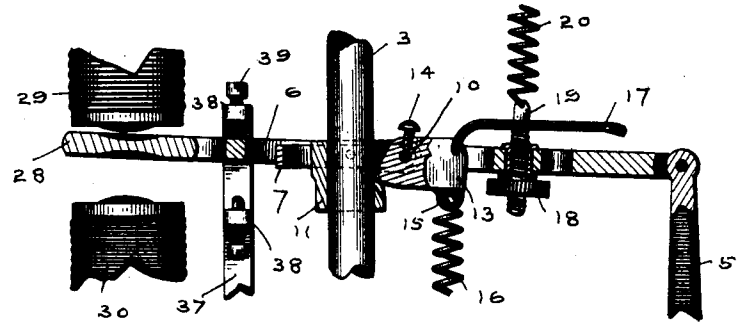

FIG. 5.

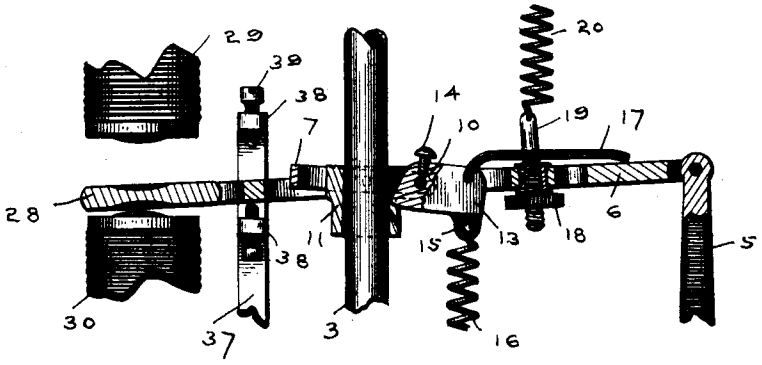

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FIG. 6.

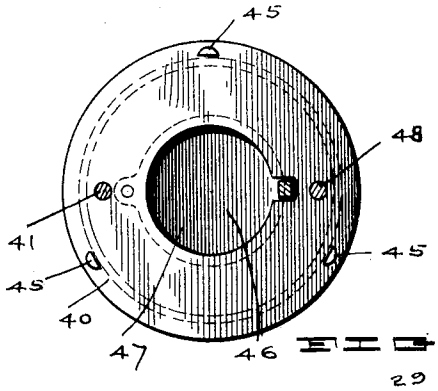


FIG. 7.

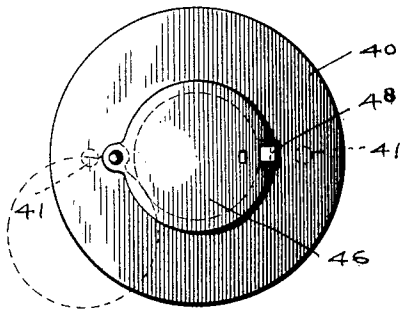


FIG. 1.

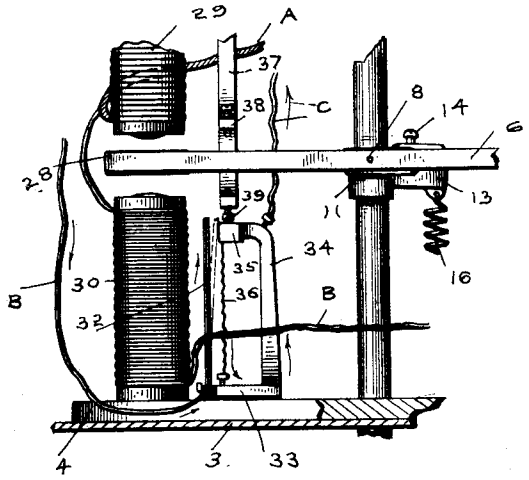


FIG. 10.

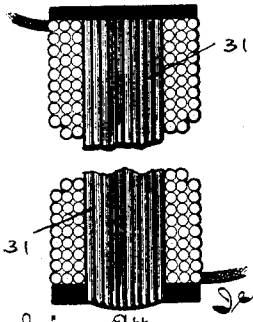
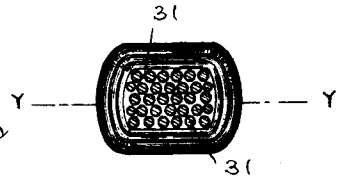


FIG. 9.



Witnesses

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UNITED STATES PATENT OFFICE.

JESSE F. KESTER, OF TERRE HAUTE, INDIANA, ASSIGNOR TO THE KESTER ARC LAMP AND MANUFACTURING COMPANY, OF CHICAGO, ILLINOIS.

ELECTRIC-ARC LAMP.

SPECIFICATION forming part of Letters Patent No. 482,253, dated September 6, 1892.

Application filed May 11, 1892. Serial No. 432,680. (No model.)

To all whom it may concern:

Be it known that I, JESSE F. KESTER, of Terre Haute, county of Vigo, and State of Indiana, have invented certain new and useful Improvements in Arc Lamps; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, in which like figures and letters refer to like parts.

My invention relates to new and useful improvements in electric-arc lamps of the single-carbon type, wherein the upper or positive carbon is fed toward the lower one, which is stationary, the arc being maintained through suitable mechanism operated by the electric current, which in this case is preferably the alternating.

There are several features of my invention, all of which are necessary for the complete and perfect operation of the lamp, as hereinafter described, the first and main one being the clutch mechanism, which operates to feed the upper carbon and which is electrically operated and controlled. The second is the globe-holder, which is a movable framework secured to the upper or main frame of the lamp and upon which the globe rests, its object being to provide means whereby the carbons may be changed without removing the globe from the lamp, as is the case in most of the present lamps, the holder itself being let partially down, but at the same time being in connection with and supported by the upper framework. The third feature is the construction and arrangement of the thermostat and its coacting parts for cutting the lamp out of the main circuit should the carbons be burned out or broken from any cause. The fourth feature is the use in arc lamps of a laminated armature and laminated cores in the magnets to increase their power and efficiency and prevent undue heat.

In the drawings, Figure 1 represents a view, partly in section and partly in elevation, of my improved lamp. Fig. 2 is an enlarged detached plan view of the clutch mechanism for feeding the upper-carbon holder and its carbon. Fig. 3 is a central sectional view through the same and its connecting parts, showing its normal position after the arc is formed. Fig. 4 is a similar view showing its position as the carbon-holder is raised and the arc is being formed. Fig. 5 is a similar view showing the position before the arc is formed. Fig. 6 is a cross-sectional view on the line *x x*, Fig. 1, showing in plan the base-plate of the globe-holder. Fig. 7 is a plan view of the under side of the same. Fig. 8 is an enlarged elevation of the thermostat, the controlling-magnets, and their connecting parts. Fig. 9 is an enlarged cross-section through one of the magnets. Fig. 10 is a central vertical section through the same on the line *y y*, Fig. 9.

In detail, 1 is a cylindrical casing having a central extension 2 on its top, through which the upper end of the carbon-holder 3 passes, and 4 is a framework supported within the casing.

5 is a bracket formed on one of the lower arms of the framework 4, and 6 is an armature-frame pivoted to the upper end of the same.

7 is a yoke pivoted inside of the frame 6 at 8, the ends of the yoke-arms being rigidly secured at 9 to the ends of a pin 10.

The clutch itself is formed in two pieces, one in the shape of a collar 11, which surrounds the carbon-holder and is cut out on one side and has two arms 12 formed thereon, these arms being pivoted on the pin 10. The other piece of the clutch is in the form of a block 13, having an angular face which operates by friction on the carbon-holder between the arms 12 of the collar 11, and is rigidly secured to the pin 10 by means of the set-screws 14, 15 being a lug or projection on the under side of the block 13, and to which the coiled spring 16 is secured, its lower end being attached to one of the lower arms of the framework 4.

17 is a finger, formed preferably of wire, attached to the friction-block 13, and its object is to regulate by contact of its free end with the armature-frame 6 the downward movement of such block as it swings with the yoke on the pivots 8.

18 is a thumb-screw secured on the end of a collar, working loosely in an opening formed in the armature-frame 6, its inside being screw-threaded to operate on the screw-pin

19, which passes through it, and to whose upper end is secured a coiled spring 20, the opposite end of this spring being attached to one of the upper arms of the framework 4.

The carbon-holder 3 has a suitable clamp 21 secured to its lower end, by which the positive carbon 22 is held, 23 being the lower or negative carbon, which is held in a stationary clamp 24, insulated from the frame, secured to the cross-piece 25, supported by the hollow arms 26 from the casing 1 of the lamp.

The outer end of the armature-frame 6 has two arms 27, and between these is a laminated armature 28, formed of alternate layers of soft iron and paper or other suitable material. (Shown in Fig. 2.) Above and below and in line with this armature are the non-differentially-wound electro-magnets 29 and 30, their outer ends being secured to the framework 4 and insulated therefrom and their like poles N being placed end to end and preferably about five-eighths of an inch apart, the upper being known as "series magnet," being in connection with the main-line wires A, with which the carbons are in circuit, the lower being a shunt-magnet and connected in shunt B with the main-line wire. Both of these magnets are wrapped in the usual and ordinary manner, but have laminated cores formed, as shown in Figs. 9 and 10, of soft-iron wires 31, each surrounded and insulated from the others by a coating of varnish or other suitable material, the ends of the cores projecting slightly from the ends of the magnets toward the armature 28 in its frame 6, which, as before mentioned, carries the clutch mechanism.

32 is a thermostat formed of a flat strip of steel and a similar strip of brass welded or riveted together, the lower end of the same being secured to the base-plate 33, the thermostat insulated from such plate and supported a short distance from and in a vertical line with the shunt-magnet 30. On the base, which is insulated from the framework 4, is formed a vertical arm 34, having on its upper end the contact-piece 35, with which the thermostat is adapted to contact, as hereinafter described, a wire 36, preferably of German silver, connecting this contact-piece with the base-plate 33. To the arm 34 is attached a wire C, which at D is formed into a resistance-coil and is then connected to the main-line wire A, as shown in Fig. 1.

37 is a bracket secured to either the upper or lower arms of the framework 4 and has two projections or arms 38 thereon, one above and the other below the pivoted armature-frame 6 near its outer end, set-screws 39, passing through these and adapted to contact with such frame as it rises or falls, forming, practically, stops to limit the upward and downward movement of the same and preventing the armature from coming in contact with the cores of the magnets. These stops are shown in Fig. 1, but more fully in Figs. 3, 4, 5, and 6.

As before mentioned, the vertical arms 26, which form the connections between the upper and lower parts of the lamp, are hollow, and support the globe-holder, which consists of a base-plate 40, having two vertical rods 41 secured on its top, the rods working loosely in the hollow arms 26, a lug or projection 48, formed on the cross-piece 25, passing through an opening in the base-plate 40 and having a notch therein with which the outer edge of the pivoted cover or latch 46, which closes the central circular opening 47 in the plate 40, engages, and thereby connects the globe-holder and its parts with the upper or main framework of the lamp, whereby the globe-holder is supported.

42 is an elongated notch or groove cut in one of the rods 41 of the globe-holder, and 43 is a screw or pin passing through the corresponding hollow rod 26, and when the globe-holder is drawn down the screw or pin is adapted to engage with the upper end of or stop at the upper end of the groove and support the same while the carbons are being changed, or for any other purpose, the globe 44 resting on the base-plate 40 outside of the arms 26 and is held in place by lugs or projections 45 on the top of the plate, as shown in Figs. 1 and 6.

Having mentioned the various parts of my lamp, I will now describe the manner of its operation: Before the electric current is turned into the lamp the carbons are in contact with each other and the armature-frame 6, which carries the clutch mechanism, is in the position shown in Fig. 5, the clutch bearing loosely upon the carbon-holder; but upon the turning on of the current the electro-magnets become charged, and owing to the contact of the carbons the series magnet will be more strongly magnetized than the shunt, and it will naturally draw toward it the armature 28, lifting up that end of the frame 6 and at the same time lifting up the clutch mechanism, the beveled face of the block 13 engaging with the side of the carbon-holder and through increased frictional contact lifting it up, thereby separating the carbon points and forming the arc, at which time the series magnet will lose some of its stength, and the attraction of the armature to it will thereby be lessened, the armature then falling into about the position shown in Fig. 3, the springs 16 and 20, attached, respectively, to the clutch-block and the armature-frame, being of such tension as to aid in keeping the parts in this position. Until the arc is widened the parts will operate as just mentioned; but as the carbons are consumed and the arc becomes too long the series magnet becomes so weakened and the shunt magnet proportionately stronger as to draw the armature down, thereby releasing differentially the clutch mechanism, and thus bringing the carbons closer

together. At the same time the action of the clutch is gradual, loosening to a degree the frictional contact of the friction-block 13 and collar 11 against the carbon-holder, and allowing the carbons to come together, making the arc shorter; but the upper carbon does not fall into actual contact with the lower one, as is the case with many of the ordinary lamps, and by preventing this contact the life of the carbons is thereby lengthened and a more steady light is given and sputtering prevented. As soon as the carbons come into close proximity the strength of the series magnet will be increased, thereby lifting up the armature 28 and its frame with the clutch mechanism, and through the increased frictional contact the clutch 13 will lift up the carbon-holder and carbon, supporting it, as shown in Fig. 3, and the parts will remain in this position until the carbons are consumed to such a point as to effect the magnetism of the two magnets, when the same operation will be repeated.

The clutch mechanism, as before mentioned, is a differential one—that is, working very easily and slowly—and very seldom will the movement of the end of the armature be more than one-fourth of an an inch at the greatest to properly feed the upper carbon, owing to the attraction of the opposing magnet; but to prevent it from being drawn into actual contact with either of the magnets the bracket 37, having arms with the set-screws 39 therein, is provided, and when in its lower position, before the current has started through the lamp, the armature-frame rests on the lower screw; but after the lamp has started, as before mentioned, it is very seldom that these are in use.

Should at any time the carbons be burned out or break, the lamp is automatically cut out of the main circuit by the increased magnetism and heat of the shunt-magnet 30, the thermostat, which is in a vertical line parallel with that magnet, being repelled or caused to bend outward, for, it being formed of a thin strip of steel and brass, the steel being nearest the magnet, the heat will cause the steel to expand and the brass to contract, thereby forcing the upper end of the thermostat into contact with the contact-piece 35, formed on the arm 34, and the current from the main circuit will then pass through the wire C, through the thermostat, into the contact-piece 35, down through the wire 36, which is of German silver, into the base-plate 33, and up through the arm 34, and on through the continuation of the wire C into the coil D, whose resistance is practically the same as that of the arc. It will be understood that the effect of the current as it passes through the wire 36 is to heat the same, and this causes the thermostat to remain in contact with the piece 35 after the shunt-magnet has ceased to be hot, and it remains in such contact until the current is cut off from the lamp, when the parts will resume their normal position.

Where a single isolated arc lamp is in circuit on an incandescent line, the operation of cutting out the lamp would be directly opposite to the manner just described, the shunt-circuit being broken instead of closed, and this would be accomplished with the same mechanism and parts, but by reversing the movement of the thermostat, so that it would be held in contact with the contact-piece 35 as long as the circuit through the lamp was unbroken; but upon the breaking of the current the shunt-magnet would be so placed as to attract the thermostat and draw it from the contact-piece, thus completely cutting the lamp out of circuit with the main wire. In some cases it might be desirable to change the form of the thermostat, making it circular or spiral in form instead of straight; but this would be no departure from the principle of my invention, for the operation would be the same.

The manner of operating the globe-holder is as follows: When new carbons are to be put in place in the lamp, by moving the lower cover or latch 46 out of engagement with the notch in the lug 41 on the cross-piece 25 the globe-holder may be dropped down until the notch 42 in the rod 41 engages with the end of the stop screw or pin 43, which may be screwed in to make it hold more securely, when the change of carbons may be made, and after which by loosening the screw 43 the globe-holder may be moved up in place and the cover or latch 46 swung in place, locking the globe-holder to the framework of the lamp. The opening 47 also serves another purpose, for in most of the present lamps, so far as I am aware, the globe must be detached from the lamp to remove the accumulated dirt and insects, and this takes much time and trouble, while in the construction herein shown after opening the cover or latch 46 and lowering the globe-holder all the refuse within the globe can be readily cleaned out through the opening 47.

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

1. In an electric-arc lamp, a clutch mechanism consisting of a friction-block to contact with or grip the carbon holder or rod, such friction-block set in the arms of the collar surrounding the carbon holder or rod, such collar set within a centrally-pivoted yoke, all set within a single armature-frame, which is pivoted at one point, a trip-arm attached to such friction-block and releasing the same by operation with such armature-frame, and an armature set in such frame and between two non-differentially-wound electro-magnets, one above and one below such armature, to control such armature and operate such armature-frame and clutch-mechanism, substantially as shown and described.

2. In an electric-arc lamp, a clutch mechanism carried in a frame pivoted at one end to a single bracket, the opposite end provided with two arms, an armature held in place by

such arms, and non-differentially-wound electro-magnets in line with and on each side of such armature, one magnet set in the main circuit and the other in the shunt-circuit, whereby through the magnetizing of such magnets the armature-frame is actuated and the clutch is operated to feed the upper-carbon holder, substantially as shown and described.

3. In an electric-arc lamp, a clutch mechanism carried in a frame, one end pivoted to a bracket, an armature on the opposite end, electro-magnets in line with and on either side of such armature, their same poles together, a bracket secured to one of the arms of the framework, such bracket provided near its end with two projections, one above and the other below such pivoted armature-frame, and set-screws passing through such projections, adapted to contact with such armature-frame as it rises or falls to limit the upward and downward movement of the same, one of such magnets set in the main circuit and the other in a shunt-circuit, whereby the current passing through such magnets operates to move the armature-frame and its clutch mechanism, and thereby feed the upper-carbon holder, substantially as shown and described.

4. In an electric-arc lamp, a clutch mechanism consisting of a pivoted frame, a yoke centrally pivoted within such frame, its arms rigidly mounted on the ends of a pin, a collar surrounding the carbon-holder, having arms loosely mounted on such pin, a friction-block having a beveled face adapted to contact with the side of the carbon-holder and rigidly mounted on the pin, and electrical means for actuating the armature-frame, whereby the clutch mechanism is adapted to feed the upper-carbon holder, substantially as described.

5. In an electric-arc lamp, a clutch mechanism within an armature-frame pivoted at one end and having an armature in the opposite end, the clutch mechanism consisting of a yoke centrally pivoted in the armature-frame, its arms rigidly mounted on a pin, a collar fitting about and adapted to loosely contact with the upper-carbon holder, its arms loosely mounted on such yoke-pin, a friction-block rigidly mounted on the yoke-pin between the arms of the collar and adapted to engage frictionally with the carbon rod, an arm formed on the friction-block to limit its downward movement, a spring secured to the under side of the friction-block and to the lamp framework, an adjustable spring secured to the top of the armature-frame, its opposite end secured to the lamp-frame, and electrical means for actuating the armature-frame through its armature, whereby the upper-carbon holder and rod are fed through the friction-clutch mechanism, substantially as shown and described.

6. In an electric-arc lamp, an automatic cut-out mechanism consisting of a thermostat so placed as to be acted upon by the heating of the shunt-magnet coil and a resistance-coil whereby such thermostat, should the carbon rod stick or be broken or burned out, will cut the lamp out of the main circuit and cut in the resistance-coil, substantially as shown and described.

7. In an electric-arc lamp, a framework carrying therein a friction-clutch adapted to contact with and feed the upper-carbon rod and holder to such lamp, one end of such framework pivoted to a bracket, and an armature formed in the opposite end, adjustable stops for limiting the movement of such frame, electro-magnets having laminated cores set one above and one below such armature, one of such magnets set in the main circuit and the other in a shunt-circuit, and a thermostat and a resistance-coil set in the shunt-circuit, the thermostat operated on by the shunt-magnet to cut in the main circuit into a resistance coil when the circuit through the carbons is broken, substantially as shown and described.

8. In an electric-arc lamp, a pair of carbon-holders, a clutch carried in a pivoted frame, an armature in such frame actuated by electro-magnets, one set on each side, one of such magnets set in the main circuit and the other in a shunt-circuit, a thermostat consisting of a welded strip of steel and brass mounted on a base and insulated therefrom, a bracket on such base having a contact-piece and insulated therefrom, a wire connecting such contact-piece with the base, and a wire leading from such bracket to the resistance-coil, such thermostat and resistance-coil set in a shunt-circuit, whereby upon the breaking of the circuit through the carbons and the heating of the shunt-magnet the thermostat will contact with and be held against its contacting piece, thereby throwing the main circuit into the resistance-coil until the current is cut off from the lamp, substantially as shown and described.

9. In an electric-arc lamp, a thermostat consisting of a welded strip of steel and brass set in a vertical line with a shunt-magnet, such thermostat secured to a base-plate and insulated therefrom, a bracket formed on such plate having at its top a contact-piece, such piece insulated from such bracket and connected with the same by a wire adapted to be heated by the electric current, and a shunt-circuit from the main-line wires, connected at one end to the thermostat and its opposite end connected to the bracket and to a resistance-coil, whereby when the circuit through the carbons is broken the heat of the shunt-magnet will force the thermostat to contact with its contact-piece, thereby throwing the main-line current into the resistance-coil, the resistance of which is equal to the arc, substantially as shown and described.

10. In combination, a thermostat consisting of a welded flexible strip of steel and brass secured at its lower end to a base-plate and insulated therefrom, such thermostat in close proximity with a shunt-magnet, a bracket having on its upper end a contact-piece which is

insulated therefrom, and a wire adapted to be heated by the electric current, connected to such contact-piece and to the base, such thermostat set in a circuit of its own, one end connected to the thermostat and the other to its bracket, such thermostat adapted to contact with its contact-piece when heated by the shunt-magnet and be retained in contact by the heat of the wire connecting the contact-piece with the base, substantially as shown and described.

11. In an electric-arc lamp, in combination with the framework of such lamp having two hollow vertical arms connected at their lower ends by a cross-piece therefrom as a holder for the lower carbon, a globe-holder consisting of a plate with vertical rods mounted thereon, such rods adapted to work within the vertical arms of the lamp-frame, one of such rods having a groove therein which does not extend to either end of such rod, such groove adapted to engage with a pin through one of the lamp-arms, and a lug formed on the cross-piece of the lamp-frame, adapted to engage with a latch on the bottom of the globe-holder for locking such globe-holder to the main frame of the lamp, substantially as shown and described.

12. In an electric-arc lamp, a lower-carbon holder mounted on a cross-piece connecting the hollow arms of the framework of the lamp, a globe-holder formed of a plate upon which the globe rests, two rods formed on the top of such plate, adapted to work in the hollow arms of the lamp-frame, one of such rods having an elongated notch therein and adapted to engage with a pin through one of the arms of the lamp-frame, an opening through the bottom of the globe-holding plate, a pivoted door or latch adapted to close such opening, a lug or pawl formed on the cross-piece of the lamp-frame and adapted to pass through such base-plate of the globe-holder, and the pivoted door or latch of the base-plate, adapted to engage with the notch in such lug and thereby support the globe-holder in position, substantially as shown and described.

13. In an electric-arc lamp, a framework consisting of two hollow vertical arms secured to the casing of the lamp and connected at their lower ends by a cross-piece carrying thereon a holder for the lower carbon, and a globe-carrier consisting of a plate having vertical rods mounted on the upper side, such rods adapted to work within the vertical arms of the lamp-frame, such rods having elongated notches therein adapted to engage with set-screws through the lamp-arms, whereby such globe-holder is held in position when raised or drawn down, substantially as shown and described.

14. In an electric-arc lamp, a globe-holder having in its base-plate an opening, a pivoted door or latch adapted to close such opening, a lug projecting from the lamp-frame, adapted to pass through such base-plate of the globe-holder, and the pivoted door or latch of the base-plate, adapted to engage with the notch in such lug and thereby support the globe-holder, substantially as described.

In witness whereof I have hereunto set my hand this 4th day of May, 1892.

JESSE F. KESTER.

Witnesses:
THOS. W. HAYMOND,
J. R. NIXON.