(No Model.)

A. G. WATERHOUSE.

ELECTRIC ARC LAMP.

No. 345,937. Patented July 20, 1886.

Fig. 1.

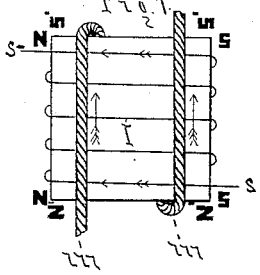


Fig. 5.

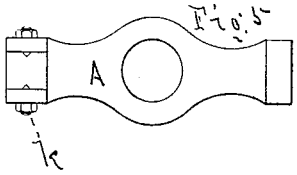
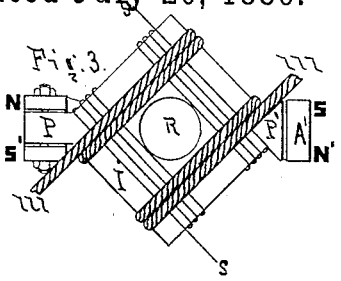


Fig. 3.



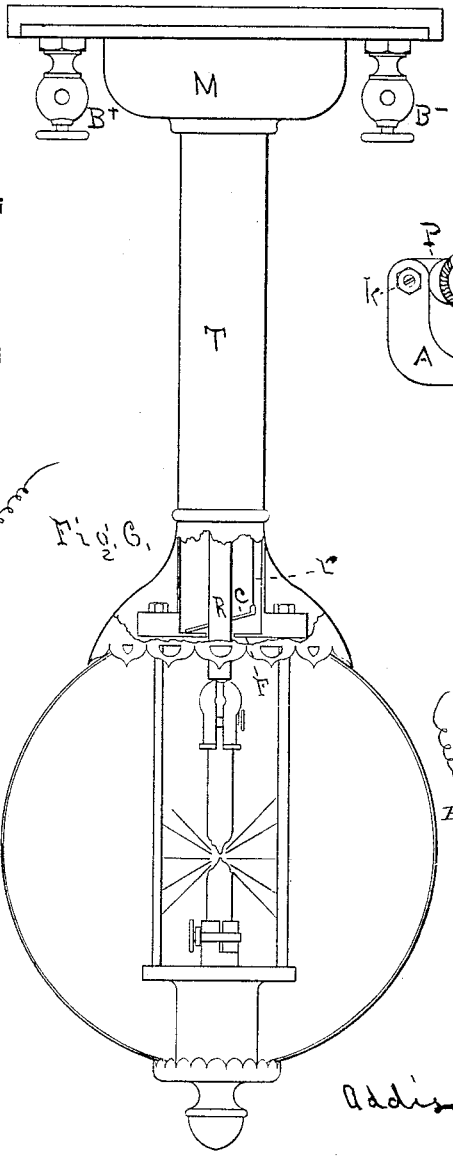


Fig. 2.

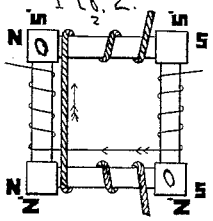


Fig. 4.

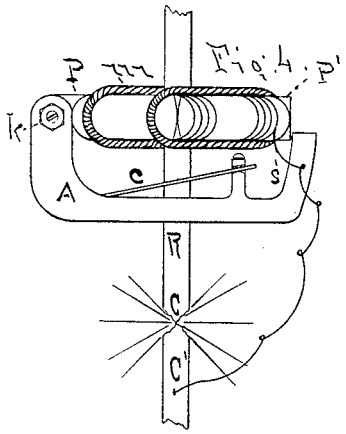


Fig. 7.

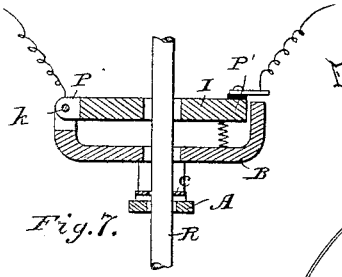
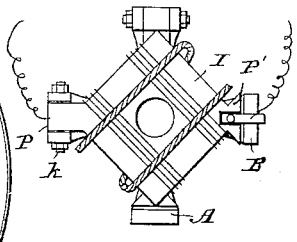


Fig. 8.



Witnesses
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UNITED STATES PATENT OFFICE.

ADDISON G. WATERHOUSE, OF HARTFORD, CONNECTICUT, ASSIGNOR TO THE WATERHOUSE ELECTRIC AND MANUFACTURING COMPANY, OF SAME PLACE.

ELECTRIC-ARC LAMP.

SPECIFICATION forming part of Letters Patent No. 345,937, dated July 20, 1886.

Application filed February 13, 1886. Serial No. 192,324. (No model.)

To all whom it may concern:

Be it known that I, ADDISON G. WATERHOUSE, a citizen of the United States, residing in the city of Hartford, State of Connecticut, have invented certain new and useful Improvements in Electric-Arc Lamps, of which the following is a specification, reference being had to the drawings accompanying and forming a part of the same.

My invention relates to electric lamps, and more particularly to that class known as "arc lamps;" and it relates more especially to the magnets used in regulating and controlling the position of the electrodes and the passage of the current through the lamp.

My invention is based upon an improved electro-magnet I have invented, which, while it may be used for other purposes, is especially adapted for use in arc lamps. The magnet may be of various forms; but preferably I make it quadrangular, and it may consist of a solid block, or be made up of a frame, as of rods or bars properly joined together. The magnet is wound with two independent circuits arranged at an angle to each other, and they join in producing the desired magnetic effect, as more particularly described hereinafter. This magnet may be used in various forms of lamps, and I have shown it applied to one well-known form.

Referring to the accompanying drawings, Figure 1 shows an electro-magnet used for operating the feeding mechanism of an arc lamp, and representing the leading feature of my invention. Fig. 2 is another form of Fig. 1. Fig. 3 shows a plan of an electro-magnet with an armature attached, through which movement is imparted to the carbon rod. Fig. 4 is an elevation of Fig. 3, showing electro-magnet *l*, with an armature pivoted to *l* at K, the clutch which engages and supports the carbon rod R being supported and actuated by the armature A. Fig. 5 is a detail of the armature A. Fig. 6 shows an external view of a complete lamp, with the upper case, M, inclosing the electro-magnet and armature A. Extending down the tube T is the carbon rod R, which passes through the floor F, forming a guide-bearing for the rod R, and a floor upon which the clutch C strikes or rests, the clutch C being connected to the armature A (not shown) in the case M by the rod *r*. Fig. 7 shows one form of cut-out device arranged with the improved magnet, and Fig. 8 is a plan of the magnet, showing the regulating and cut-out levers.

In Fig. 1 of the drawings I have selected, as an illustration of my invention, a flat rectangular piece of iron, I, and around this is wound a conductor, *m*, through which the current flows in the direction indicated by the adjacent arrow, and it will be seen that the iron or core will thereby be magnetized in such a manner as to produce a positive or north pole in one side, as to the left of the circuit, and a negative or south pole at the opposite side, as to the right of the circuit; also, around the core and at right angles to the first conductor is wound a second coil, as *s*, through which the current is directed, as indicated by the arrows. It will thus be seen that a current flowing through this last conductor will tend to produce a magnet in which the positive or north pole will be to the left of the direction of the current and the negative or south pole will be to the right, as indicated in the drawings. If the current flows through either one of the conductors *m* or *s*, above described, the iron or core will be a simple magnet, as stated; but if the currents flow through both conductors at the same time the combined effects of the two currents will produce a state of magnetism in the different parts thereof, depending somewhat upon the relative strengths of the two currents. Thus the tending of both currents is to unite in producing, say, a positive pole at the lower left-hand corner, and at the upper right-hand corner as well, and it will be seen that the polarity of these two parts will not change in kind, whether one or both currents are flowing; but the strength of the pole will be determined by the sum of the effects of the currents of both circuits. At the upper left-hand corner and lower right-hand corner, however, different conditions are found. If the current flows in *m*, only these corners will tend to be magnetized positive and negative respective-

ly, as indicated, and if the current flows in *s* only they will be magnetized as negative and positive, respectively, or just the opposite of the first current. If there are currents flowing in both conductors *m* and *s*, it is evident that these currents will tend to produce at these points poles of opposed polarity, which will tend to neutralize each other, and will do so if the magnetic effects of the two currents are equal upon the core; and if they are not equal the positive or negative magnetic effect will preponderate in accordance with the current flowing through the wires *m* and *s*, respectively. If the effect of the current through *m* is the greater, there will be a negative pole at these points, and if the effect of the current in *s* is greater a positive pole will be produced at these points.

In Fig. 2 I have shown another form of core, consisting of a rectangle made up of bars joined to pole-pieces at their ends, and the coils are wound around the bars in a manner clearly indicated, to produce the effects precisely similar to those described in reference to Fig. 1. Other forms might be described; but the above are sufficient to clearly indicate the essential features of my arrangement of magnet and coils. This magnet may be used in connection with arc lamps, for instance, in various ways, and one that I have found convenient is shown in Figs. 3 and 4, in which one of the poles, as P, is extended to form a bearing for the bent end of the armature A, which is shown as pivoted thereto at K, the other end, A′, of the armature extending in front of the diagonally-arranged pole P′ of the magnet. A suitable opening is made in the armature and magnet for the passage of the carbon-carrier R, and a carbon-controlling device, (shown as a simple clutch, C,) is carried or controlled by the armature. The main or light circuit of the lamp passes through the coil *m* of the magnet, while the shunt-circuit includes the coil *s* of the magnet, which is wound at right angles to the first coil.

The operation of this arrangement is apparent. The current passing normally through the light circuit energizes the magnet I, so as to produce a certain polarity at the point P′—say negative—and the armature is attracted, raising the carbon and establishing the arc. The current through the shunt-coil tends to produce an opposite polarity at the point P′, as positive, and the effect of this tendency depends upon the relative amount of current flowing through the two circuits, so that any excess of resistance in the arc circuit causes more current to flow through the shunt circuit and the negative pole P′ becomes more or less neutralized, allowing the armature A to fall more or less and feed the carbon to regulate the arc. As the arc becomes normal the excess of current is withdrawn from the shunt and the point P′ again becomes strongly magnetic and attracts the armature, and the arc is thus regulated in a well-known manner. The effect of the current through the shunt-wire *s* upon the corners or poles 2 2′, as before stated, is to augment the polarity of these parts, as the currents through both coils tend to produce like poles, and I make use of this effect to operate a suitable cut-out device, which may be of any usual construction, that shown consisting of a spring-controlled armature, B, arranged substantially like the armature A, and adapted when attached to close the short or cut-out circuit around the lamp, as shown in Fig. 7.

Other arrangements of the magnet and lamp will readily suggest themselves to those skilled in the art that need not be particularized here, as they are embraced within my invention.

What I claim is—

1. In an electric lamp, an electro-magnet having two poles of a constant polarity and two poles of variable polarity, substantially as described.

2. In an electric lamp, an electro-magnet wound with two conductors at right angles to each other, one connected in the main circuit and the other in the shunt-circuit, substantially as described.

3. In an electric lamp, an electro-magnet having two conductors wound at right angles to each other, whereby parts of the magnet will be subject to the united magnetic effect of both currents, and other parts will be subject to the difference in the magnetic effects of the two currents, substantially as described.

4. The combination, with an electric lamp, of an electro magnet of quadrangular form, having two conductors wound at right angles to each other, one included in the main and the other in the shunt circuit, and carbon-regulating devices controlled by said magnet, substantially as described.

5. The combination, with an electric lamp, of a magnet wound with two conductors and having two poles of a strength relative to the sum of the currents in the two conductors, and two other poles of a strength relative to the difference of the two currents, and circuit-controlling devices operated by said poles, substantially as described.

6. The combination, in an electric lamp, of a quadrangular electro-magnet, conductors wound at right angles to each other upon the magnet, an armature pivoted to one pole and controlled by the diagonally-opposite pole, and circuit-controlling devices connected to said armature, substantially as described.

7. In an electric lamp, the combination of a quadrangular electro-magnet, two conductors wound in opposite directions upon said core, whereby parts of the magnet are similarly affected by both currents and other parts are oppositely affected, cut-out devices controlled by the augmented poles, and feed devices controlled by the differentiated poles, substantially as described.

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Witnesses:

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