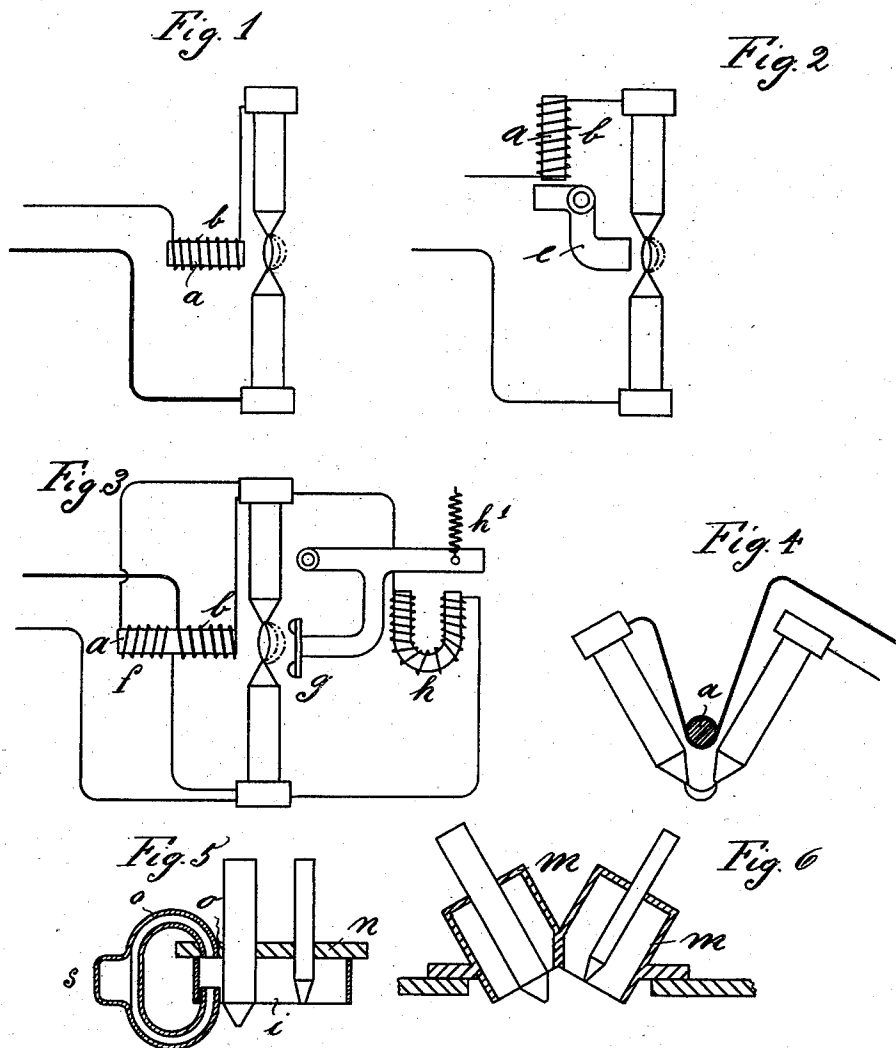


H. BREMER.
ELECTRIC ARC LAMP.
APPLICATION FILED MAR. 7, 1900.

NO MODEL.



Witnesses

Otto Bremer.
Alfred Dicker.

Inventor
Hugo Bremer
by A. Danneberg
applicant's atty

UNITED STATES PATENT OFFICE.

HUGO BREMER, OF NEHEIM, GERMANY.

ELECTRIC-ARC LAMP.

SPECIFICATION forming part of Letters Patent No. 743,237, dated November 3, 1903.

Application filed March 7, 1900. Serial No. 7,753. (No model.)

To all whom it may concern:

Be it known that I, HUGO BREMER, a subject of the Emperor of Germany, residing at Neheim, in the Province of Westphalia, Germany, have invented certain new and useful Improvements in Electric - Arc Lamps, of which the following is a clear and exact specification, which will enable others skilled in the art to make and use the same.

In arc-lamps it has been customary to regulate the lamp exclusively by acting upon one or both of the electrodes, so as to cause them to approach or recede one with respect to the other. This is true of arc-lamps in general, and it has also been the practice in connection with arc-lamps operating with a long arc, either by reason of the electrodes being inclosed within a suitable globe or by reason of the addition to one or both of the electrodes of a greater or smaller proportion of metallic salts.

The present invention relates to an arrangement in which a part of the lamp regulation is effected by means of a magnet or solenoid which is caused to affect the arc between the electrodes either by being moved toward or away from the same or by an increase or decrease of the intensity of the magnetic field.

It is well known that a magnetic field acting upon an electric arc will deflect it laterally or project it toward the opposite side. Through the lengthening of the arc thus produced the resistance between the electrode-points is considerably increased, whereas if the magnetic field be removed or weakened the arc will become shorter and the lamp resistance will be decreased. This action of a magnetic field upon the electric arc can be utilized to secure a partial regulation of the lamp resistance, it being, further, necessary when the electrodes have burned away too far to cause a feeding of the electrodes in any suitable manner. In other words, within certain limits of distance between the electrode-points the variations of resistance due to magnetic action upon the arc may be relied upon for an adequate regulation of the lamp resistance, such regulation requiring to be supplemented by the feeding of one or both the electrodes when a certain limit of distance between the electrode-points has been reached.

The magnet may be moved toward or away from the arc by means of a shunt or series coil, or one or more coils in either of the relations named may operate to increase or decrease the magnetic strength of a fixed magnet located in operative proximity to the arc.

Various embodiments of my invention are illustrated in the accompanying drawings, in which—

Figure 1 is a diagram showing in elevation a pair of lamp-electrodes having an arc-deflecting magnet in proximity to the electrode-points. Fig. 2 is a modification showing the employment of an armature in connection with the magnet. Fig. 3 is a diagram of another modified construction, the magnet being acted upon differentially by a coil in the main circuit. Fig. 4 illustrates a special arrangement of the electrodes with relation to each other, and Figs. 5 and 6 illustrate details.

In Fig. 1 a bar-electromagnet *a*, wound with a coil *b* in series with the electrodes, is shown, the carbons appearing at *c c'*.

In Fig. 2 the electromagnet is shown provided with an armature *e*, the relations being otherwise the same as those illustrated in Fig. 1. The end of the magnet *a* in Fig. 1 or the extreme end of the armature *e* in Fig. 2 acts upon the arc between the electrode-points and causes a greater or smaller lengthening thereof, depending upon the magnetic strength of the magnet or the armature, as the case may be. Should the current through the lamp become too strong on account of the small resistance between the electrode-points, the magnet in series with the carbons will be more strongly energized and cause a correspondingly larger deflection of the arc, thus reestablishing the normal resistance.

It will be understood that the outer end of the armature *e* in Fig. 2 will have the same pole as the nearer end of the magnet *a* through the action of the laws of magnetic distribution.

In Fig. 3 I show the bar *a* wound with a series coil *b* and also with a shunt-coil *f*. With this arrangement in case the resistance of the arc should become excessive correspondingly more current would pass through the shunt-coil, while a smaller current would be passing through the series coil. The dif-

ferential action of the two coils would accordingly reduce the strength of the magnet and lessen its action upon the arc. On the other hand, if the current between the electrode-points should become too strong the series coil would energize the magnet, and inasmuch as little current would be passing through the shunt-coil the magnet would be strongly energized and the arc deflected, so as to increase the resistance at that point. Accordingly the lamp resistance is subject to regulation by the action of the magnet upon the arc in each of the three forms already described.

In lamps of this class the electrode-holders are often made stationary without any special devices for bringing the electrodes into contact for starting the lamp. For this reason a special igniting arrangement is required, and this is illustrated at the right-hand side of Fig. 3, where a bar *g*, of carbon or metal, is arranged to bridge the electrode points and establish the arc when the lamp-circuit is first closed. The operation of the bar *g* is caused in one direction by an electromagnet *h* in a shunt-circuit to the electrodes and in the opposite direction by a spring *h'*, which comes into action for removing the bar *g* as soon as the circuit is established through the electrodes.

The invention herein described is particularly available for arc-lamps in which both the electrodes are arranged point to point horizontally or vertically side by side or converging toward each other in a downward direction. Either of these arrangements permits the magnet to drive the arc in a downward direction, and as none of the lamp mechanism is necessarily placed below the arcing-point the entire lower hemisphere may be lighted by the arc without obstruction to the light-rays. This is illustrated in Fig. 4, where the magnet *a* is arranged between electrodes which are inclined toward each other, as shown.

In carrying out my invention care should be taken to provide a sufficient number of series windings upon the magnet to cause a strong magnetization of the core or bar *a* when the maximum current is passing through the lamp. Generally the shunt-coil should be so wound as to produce an opposite effect upon the bar from that caused by the series coil, whereby the two coils will act differentially upon the bar, as already described in connection with Fig. 3.

It will be understood that the application of my invention presupposes a lamp operating with a long arc, as otherwise the arc would be blown off by the action of the magnet in consequence of the slight distance between the electrode-points.

As before stated, the regulation of the lamp resistance within certain limits of distance between the electrode-points is adequately secured by the magnetic action described. It is necessary, however, to cause

a periodical feeding of the electrodes, one or both, provided the lamp remains in use for a considerable time. In other words, ordinary internal lamp resistances are regulated by means of a magnet or solenoid—such, for instance, as the magnet *a*; but when the electrodes burn away to a prohibitive limit the necessity for feeding the carbons supervenes. Before this necessity arises, however, the resistance of the lamp will have become very great, and this fact may be utilized to excite an electromagnet by means of a resistance, armature, or the like which sets in motion a clockwork or one or more weights arranged in the usual way for feeding the electrodes, or instead of the electromagnet a body may be employed in connection with the regulating work, the structure or conductivity of which is altered by the heat of the deflected arc, such alteration being utilized to put the feeding mechanism into operation, or the heat of the gases developed by the arc may close an electric regulating-current between two electric poles in the neighborhood of the electrodes. These means for feeding the electrodes are especially adapted for electrodes placed pointing downward and placed either parallel to or converging toward each other. The top plate also supports a vertical rod *E*, to which a bar-magnet *F*, wound with a coil *G* in shunt to the electrodes, is attached. The shunt-circuit extends from the electrode-holder *B'* through the coil *G* to a contact-piece *H*, supported upon the lower end of the rod *E*, the rest of the circuit to the electrode-holder *B* being made up of a wire *L*, running from the said holder to a contact-terminal *I* near the terminal *H*. The part *I* may be a hollow metal tube secured to a plate *p*, through which the electrodes extend, such plate forming the bottom plate of the lamp. The lower end of the tube *I* reaches nearly to the arc. If now when the electrodes have been burning for a considerable period the arc is in the natural operation of the lamp caused to approach the metal body *I*, the heat of the arc will expand the tube *I*, so that contact will ultimately be made between the parts *I* and *H* and the shunt-circuit through the coil *G* will be closed. The pole of the magnet *F* is in operative proximity to the metallic holder *B'*, which may have an armature formed on it and extend into proximity to the pole of the magnet. At all events the arrangement is such that when the shunt-circuit through the magnet is closed, as already described, the electrode-holder *B* is drawn forward, thereby causing a shock to the apparatus, which is adapted to cause the feeding of the two electrodes.

Instead of being a metallic tube the part *I* might be a rod or tube composed of one or more second-class conductors, such as magnesia. In this case the part *I* would normally be in contact with the part *H*, but would not become conductive until it had

been heated to the proper temperature by the arc.

In general the operation is the same whether a metal tube or a stick of magnesia or the like is used.

It has been said that the described regulation is especially adapted for parallel carbons placed vertically side by side, an arrangement which is illustrated in Fig. 5. When using such an arrangement, the vertical electrodes may be surrounded by a chamber *i*, of glass or other suitable material, which is closed at its top by a cap, thus preventing fresh oxygen from entering the chamber except at the bottom. In the operation of the lamp the chamber becomes filled with the heated gases or vapors of combustion. This tends to keep the arc in a fixed position even though the burning away of the carbons is unequal on account of the different cross-sections which is usually given to them. By making the end of one of the electrodes extend below the bottom of the chamber it may be caused to burn away faster than the other electrode, the end of which is protected by the hot gases within the chamber, while the first-named electrode burns in air.

In Fig. 6 I show a device for the same purpose in connection with electrodes converging toward each other in a downward direction. Here the electrodes are of unequal cross-section and each is provided with a separate chamber *m*, closed at the top. Here also one of the electrodes is made to project below the bottom of the chamber, thus causing it to burn away at a more rapid rate than the other electrode. The described arrangement may be employed for electrodes of every description, whether made wholly of carbons or mixtures of carbon with metallic salts or other substances. It is particularly of value, however, for electrodes having additions of metallic salts or metalloids.

By the use of a chamber or chambers such as shown in Figs. 5 and 6 the free circulation of air is prevented, and in this way the formation of scoria or scorified secretions is mainly prevented. The same result in lesser degree would be accomplished if instead of the chamber *i* in Fig. 5 we simply used a horizontal plate, such as *n*, arranged over the arc and having perforations through which the electrodes pass. This horizontal plate would itself interfere sufficiently with the free circulation of air to produce some of the beneficial results of the chamber. It is also true that either the chamber or the horizontal plate is available for use in connection with electrodes arranged in any of the well-known ways—as, for instance, when the electrodes are arranged vertically end to end.

The metallic vapors produced by the use of the mixed electrodes described may be led away—say through a tube *g*, fitting into an opening *o* and leading back into the lower part of the chamber, as shown in Fig. 5. An

enlargement *s* may be provided at some portion of the circuit of the gases for condensing the same.

It is not necessary that both electrodes should be provided with an admixture of metallic salts or metalloids, as a long arc capable of being controlled by magnetic action will be produced when one of the electrodes is an ordinary carbon and the other is a mixed electrode, as described herein.

I claim as my invention—

1. In an arc-lamp, the combination with a pair of conducting-pencils, one or both containing an association of carbon and metallic salts or alkaline earths, and an electromagnet in the circuit of the lamp, such magnet being in proximity to the arc for regulating its resistance and spreading the luminous surface.

2. In an electric-arc lamp, the combination with a pair of conducting-pencils, an arc between them, a pivoted or movable armature in proximity to the arc, and an electromagnet in the circuit of the lamp for controlling the said armature, whereby the resistance of the arc is regulated.

3. In an electric-arc lamp, the combination with a pair of conducting-pencils, one or both containing an association of carbon and metallic salts or alkaline earths, and a differentially-wound magnet in proximity to the arc for regulating its resistance.

4. In an electric-arc lamp, the combination with a pair of conducting-pencils, one or both containing an association of carbon and metallic salts or metalloids, of an arc between them, and a magnet controlling the arc, said magnet being differentially wound with a shunt and a series coil.

5. In an electric-arc lamp, the combination with a pair of normally separated electrodes, of an arc-starting device for bridging the separation, and an electromagnetic device in a shunt around the arc, controlling the arc-starting device.

6. In an electric-arc lamp, the combination with a pair of conducting-pencils, one or both containing an easily-vaporizing metallic salt such as calcium, magnesium, or the like, of an arc between the pencils, a chamber surrounding the pencil-points, a tube projecting from the top of the chamber and leading to its bottom, and a bag adjacent to said chamber.

7. In an electric-arc lamp, the combination with a pair of electrodes, one or both containing metallic salts or metalloids, and an arc between them, of a chamber surrounding the electrode-points, a tube projecting from the top of the chamber and leading back into the chamber, and a condensing-chamber fed by the said tube.

8. In an electric-arc lamp, the combination with a pair of downwardly-pointed parallel or converging electrodes, one or both containing an association of carbon and metallic salts or alkaline earths, of an electromagnet in the circuit of the lamp, and placed above

the arc to regulate its resistance and spread the luminous surface.

9. In an electric-arc lamp, the combination with a pair of downwardly-pointed parallel or converging carbons, of a chamber surrounding the arcing-points, the arrangement of the electrodes being such that one of each

pair is pushed downward until its point passes out of the chamber, while the other electrode-point remains within its chamber.

HUGO BREMER.

Witnesses:

WOLDEMAR HAUPT,
HENRY HASPER.