(No Model.)

T. SPENCER.

ELECTRIC ARC LAMP.

No. 588,610. Patented Aug. 24, 1897.

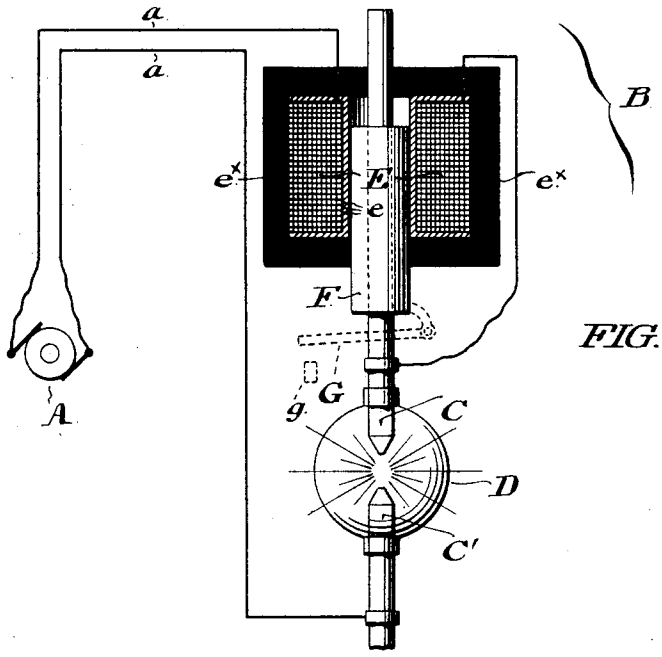
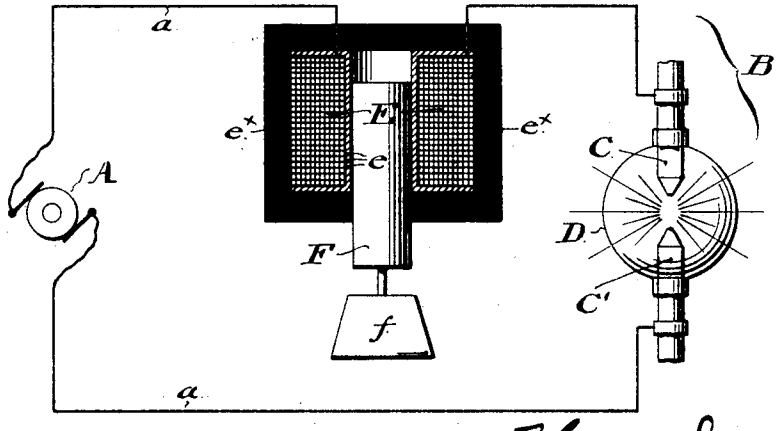


FIG. 1.

FIG. 2.



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ELECTRIC-ARC LAMP.

SPECIFICATION forming part of Letters Patent No. 588,610, dated August 24, 1897.

Application filed November 16, 1896. Serial No. 612,188. (No model.)

To all whom it may concern:

Be it known that I, THOMAS SPENCER, a citizen of the United States, residing in the city and county of Philadelphia, in the State of Pennsylvania, have invented certain new and useful Improvements in the Art of Inclosed Arc Lighting by Means of Alternating Electric Currents and in Lamp Structures Adapted for the Practice of said Art, of which the following is a specification.

It has hitherto been impossible, to produce a commercially successful inclosed arc light by means of an alternating electric current passed between opposed solid carbon-electrodes.

An arc so maintained, frequently breaks or goes out in consonance with minute variations of the electro motive force of the arc. The light thus produced is, therefore, commercially valueless by reason of its lack of uniformity.

It is true that a commercial alternating arc light may be produced by the use of cored carbon electrodes. It is, however, impracticable to inclose such an arc, for the reason that an opaque film of impurities from the core is rapidly deposited upon the inner surface of the transparent inclosure of said arc and its effective luminosity thereby at once diminished.

It is the object of my present invention to automatically regulate the alternating current supplied to an inclosed arc between solid carbon electrodes, from instant to instant, in exact accordance with the fluctuation of electro motive force at said arc, and thus counterbalance the latter,—with the resulting production, at said arc, of a light that is steady, or without apparent fluctuations in luminosity.

To this end my invention broadly speaking, consists, in providing in electric circuit with each individual arc, a choking coil capable of automatic variation as to its magnetic field and consequent variation in its self-induction,—together with means whereby the space between the solid carbon electrodes of the arc may be varied; said variations being occasioned by and being corrective of, variations from the normal condition or relation of the supply of current to the individual arc with which said coil co-operates.

The variations of electro motive force resulting from the physical approach or recession of the solid carbon-electrodes do not interfere with the corrective effect of the variations in current supply occasioned by the aforesaid variations in the magnetic field and self-induction of the choking coil, but, upon the contrary, both means of regulation are inter-dependent and supplemental of each other.

By the term "choking-coil" herein employed, is meant a coiled electric conductor, which,—in addition to the mere ohmic resistance and self-induction inherent in all conductors of electricity, but contingent upon the character, disposition, &c., of the particular conductor of which said coil is composite,—is provided with material of high magnetic permeability inserted within the field of force of said coil, the static co-efficient of self-induction of said coil being augmented by the work done in its magnetic field.

I am aware that coils of the foregoing general character have hitherto been used in the distribution of alternating currents of electricity, and I, therefore, do not claim broadly upon the use of such coils, but only the use of choking coils of the peculiar character, and in the manner and relation herein definitely specified.

In the drawing, Figure 1 is a diagram of my invention applied to an arc lamp, comprising inclosed solid carbon electrodes.

Figure 2, is a primary form of my invention shown in Figure 1, the means for automatically effecting the relative movement of the solid carbon electrodes being omitted.

In Figure 1, A, is an electric generator, and *a*, *a*, the conductors connecting said generator with a lamp structure B.

C, C′, are the carbon electrodes, and D the transparent globe, or case, inclosing them.

In circuit with the electrodes C, C′, is a choking coil E, comprising the hollow coiled conductor *e*, surrounded by material $e^{\times}$ of high magnetic permeability, preferably soft iron, built up in laminations, or comprising closed circuits of wire. Within the hollow

of the coil E, is a core F, also preferably of soft iron.

The core F is adapted for reciprocation within the coil E, and is suitably connected with the electrode C, so that the latter partakes of the reciprocatory movement of the core F.

The device illustrated in Figure 1 is so proportioned that, under normal conditions, the parts stand in the position indicated in said figure.

An increase of electro motive force at the arc, between said electrodes C, C', results in diminishing the total current passing through the entire device. The core F, being only maintained at its normal height by the magnetic effect of a normal current, the diminution of current causes the core to descend, and thereby restores the electrical equilibrium of the device, in a two-fold manner: First, the change in the magnetic field of the coil by reason of the descent of its magnetic core F, decreases the self induction of said coil, thus giving passage to a larger current than the normal current; second, the electro motive force at the arc is reduced by the physical approach of the electrode C to the electrode C'.

If the electro motive force at the arc between the solid carbon electrodes C, C', is decreased below the normal, the reverse of the above described action takes place, the core F, being then raised by the increase of current through the entire device.

The variation in the magnetic field of the coil E, thus produced, increases the self induction of the coil, and the choking action of the coil E, thus augmented, reduces the supply of current.

This regulating action is of course supplemented by the simultaneous increase in the arc space between the electrodes C, and C', which augments the normal electro motive force of the arc.

During the operation of the lamp the core F is almost constantly in motion.

I have omitted from the drawing the details of the ordinary lamp structure, but have indicated in dotted lines in Figure 1, at G, a hinged clutch connective of said core F and the electrode C.

This clutch engages the electrode C by means of an aperture in it through which the electrode is passed. The clutch G, moreover, maintains the electrode C in fixed relation with the core F while the aperture in said clutch is inclined with relation to said core.

When, however, in the downward movement of the core and electrode, the clutch is swung toward the core by contact with the fixed stop *g*, the electrode C is released and dropped a short distance through said clutch before being again gripped.

The feeding action of the carbon electrode described in the foregoing paragraph may be effected by means of any suitable mechanism, but the form of said mechanism is not of the essence of the invention.

In Figure 2, I have shown a primary form of my invention, which differs from the device of Figure 1 in that the means for regulating the lamp by the physical approach and recession of the solid carbon electrodes is omitted, the regulation of the lamp being entirely effected by means of the choking coil E, which operates in the manner described in relation to Figure 1.

The core F may be provided with an auxiliary balance spring, opposed to the sucking action of the coil E, or, as indicated in Figure 2, said core F may be provided with a supplemental weight *f*.

I am aware that attempts have been made to maintain a constant luminosity in an alternating current arc by means of an automatically variable ohmic resistance in electric circuit with said arc.

It is well known, however, that such regulation of a lamp operated by an alternating electric current, is of small value, in that it requires such a period of time for each regulating action of the device as to be visibly manifest in the fluctuation of luminosity of the arc. I have found that the regulation of a similar arc by means of a choking coil of the peculiar character and operation herein set forth, is accomplished with such rapidity as to eliminate said fluctuations in the luminosity of the arc.

According to the commonly accepted theory, choking coils occasion a lag in the place of the alternating electro motive force, presented at their terminals, and thus limit the passage of the alternating current through them. The restricting or choking effect of such a coil upon the electric current differs from the effect of a coil having mere ohmic resistance, in that, within limits determined by the proportions of the choking coil, a greater alteration in the voltage of a current passing through said coil results from a given alteration in the current, than if said current met with the mere ohmic resistance.

It is therefore possible, by the use of choking coils having automatically variable self induction, to more rapidly correct the abnormal variations of electro motive force, which arise in an alternating arc lamp, than if an automatically variable ohmic resistance were provided.

By the use of the herein described system of regulation, with a current the maximum voltage of which is 100, I find it possible to maintain an inclosed alternating arc of constant luminosity, between ordinary one-half inch solid carbon electrodes. The average current at said arc being eighty volts and six amperes.

What I claim is:

In combination, in an inclosed arc lamp adapted to be operated by an alternating current,—opposed solid carbon electrodes,—an

inclosure for the proximal ends of said electrodes,—a choking coil in electric circuit with said electrodes,—an automatically movable core for said choking coil,—and means connective of said core and one of said electrodes, whereby a reciprocatory movement of said core may be imparted to said electrode,—substantially as set forth.

In testimony that I claim the foregoing as my invention I have hereunto signed my name this 11th day of November, A. D. 1896.

THOS. SPENCER.

In presence of—
FRANK MARR,
THOMAS J. JOHNSON.