

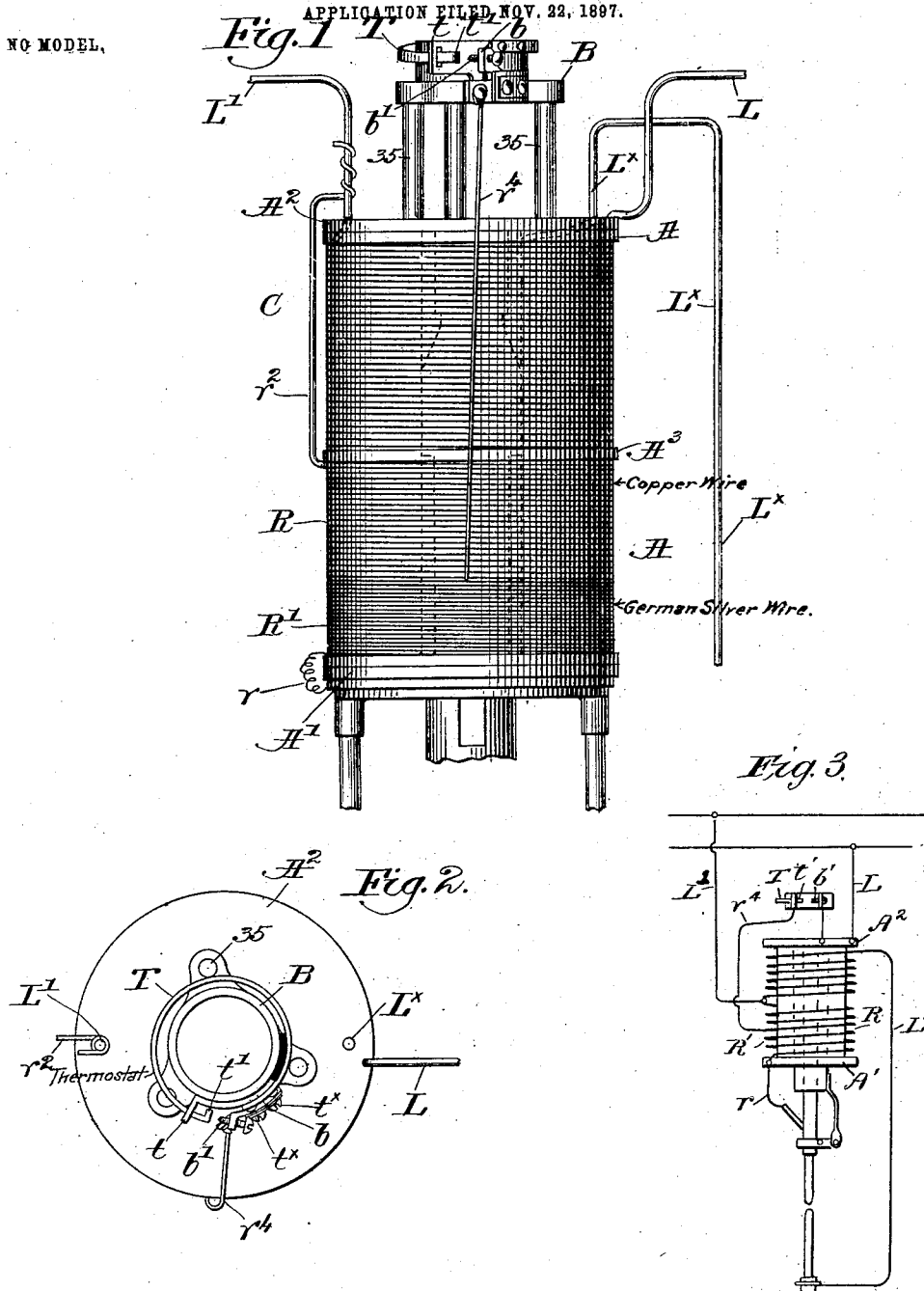
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APPARATUS FOR MAINTAINING UNIFORM RESISTANCE IN
ELECTRIC CIRCUITS.

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NO MODEL.



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UNITED STATES PATENT OFFICE.

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APPARATUS FOR MAINTAINING UNIFORM RESISTANCE IN ELECTRIC CIRCUITS.

SPECIFICATION forming part of Letters Patent No. 727,611, dated May 12, 1903.

Application filed November 22, 1897. Serial No. 659,391. (No model.)

To all whom it may concern:

Be it known that we, FREDERICK A. GILBERT, of Brookline, county of Norfolk, and EMIL O. LUNDIN, of Beachmont, county of Suffolk, State of Massachusetts, have invented an Improvement in Apparatus for Maintaining Uniform Resistance in Electric Circuits, of which the following description, in connection with the accompanying drawings, is a specification, like characters on the drawings representing like parts.

In electrical apparatus it is often very desirable to maintain a substantially uniform resistance in a circuit which, owing to some extraneous cause or causes, is liable to have its resistance changed or varied—that is to say, if a resistance medium having a certain resistance under normal conditions is included in a circuit some extraneous cause—as, for instance, a change in temperature—will so vary that resistance that it will be greater or less than the normal resistance. Now in such case the resistance of the circuit may be maintained substantially normal if the effective extent of such resistance medium is varied inversely to and to compensate for the change effected in the specific resistance of such medium, so that if the resistance be increased the effective extent of the medium will be decreased, and vice versa. One common instance of the variation in resistance in a circuit by extraneous causation is in the electric-arc lamp. When the current is turned on, the carbons will be separated to form the arc, and the feed-controlling circuit has a certain resistance. After the lamp has burned for some time the resistance of the feed-controlling circuit will increase by the rise in temperature of the lamp and a change in the sensitiveness of feed results. Besides this, heating of the lamp or its circuits changes the point at which feed is effected. In order to obviate this objectionable feature, the present practice is to make the normal resistance of the feed-controlling circuit less than that required to attain the proper length of arc, so that the proper resistance will not be reached until the lamp has become heated. As a result the arc is too short during the time the

lamp is heating, with a correspondingly poor light.

In our experiments to improve the service of electric-arc lamps, so that the light will be good when the lamp is started, we have discovered that the resistance of a circuit may be maintained substantially uniform by varying the effective extent of the resistance medium included in such circuit inversely to and to compensate for the change in the specific resistance of such medium due to an extraneous cause.

In our present invention we have made a practical embodiment of our discovery in an electric-arc lamp, and we are enabled thereby to employ the proper resistance at the start, so that the proper separation of the carbons is attained at once.

When the resistance increases by reason of the heating of the lamp, the effective extent of the resistance medium is reduced, so that the arc is shortened and the normal or proper resistance is again attained under such changed conditions and retained while the lamp is burning. After the arc has been so shortened the subsequent regulation thereof is effected in the usual manner.

Figure 1, in elevation, represents a sufficient portion of an arc-lamp frame to be understood with one embodiment of our invention applied thereto. Fig. 2 is a top or plan view of the apparatus shown in Fig. 1, and Fig. 3 is a diagrammatical representation of the circuits through the thermostat and arc-lamp.

Referring to Fig. 1, a metal body portion A (see dotted lines) is provided with a base A' and top A², the upper carbon passing through the body, top, and base, substantially as shown in United States patent granted to us, No. 603,630, of May 10, 1898. In our present invention, however, we have shown the series coil C as wound upon a suitable core at the upper portion of the lamp-body, the coil being included between the top A² and a plate A³ of insulating material located about midway between the top and base, the current acting through the series coil to raise the upper carbon by any usual or desired mechanism. The current enters

the lamp by the line-wire L, electrically connected with the metal body, and passes thence to the upper carbon by suitable contacts, then from the lower carbon by wire L^x to one end of the series coil C, through the latter, and back to line at L'. The shunt-coil is located between the base A' and the partition A³, and while it is practically a single coil it is preferably made in two parts R and R', the former of copper wire and the latter of German-silver wire, as the resistance of the latter is so much greater than copper wire that a very much smaller quantity of it is required, the part R' being cut out or short-circuited under ordinary circumstances after the lamp has been burning for some time, as will be described. The coil as a whole is in shunt with the arc, one end being connected at r with the lamp-body and the other end with the line-wire L' by wire r². The adjacent ends of the two coils are connected by a wire r⁴ with a metal terminal support b, insulated from and mounted upon a metallic ring B, secured to standards 35 on the top A² of the body. One end of a thermostat T is attached by suitable screws t^x to the ring B, its free end passing through a guide t and preferably being bent over, as at t', to form a movable terminal adapted to cooperate with an adjustable fixed terminal b', (shown as a screw mounted in the support b,) which permits a predetermination of the point at which the lamp shall feed when hot. When the lamp is cold, the thermostat contracts, separating the terminals b' t', so that the entire resistance due to both coils will be effective when the lamp-current is turned on, and consequently the current passing through the shunt-coil R R' will be decreased, so that the current passing through the series coil C will lift the upper carbon with a strong pull and form the arc.

The total resistance of the coils R R' is such that when the lamp is started the full separations of the carbons is permitted; but after the lamp has been burning long enough to necessitate feed of the carbon to compensate for the burning away thereof the heating of the lamp will have acted to raise the resistance in the coils R R', so that sufficient current cannot pass through the shunt-coil to draw the carbons together and the arc will be too long. By our invention, however, we are enabled to automatically reduce the resistance so that the proper length of arc can be attained.

As the lamp heats, the rise in temperature acts upon the thermostat T, expanding it so that the terminals t' and b' are brought together, and the part R' of the shunt-coil is short-circuited or cut out, so that only the

resistance of the coil R is effective. This reduction of the resistance in the shunt-circuit permits more current to pass therethrough and the upper carbon is drawn down to shorten the arc to the proper length, and after such action the resistance will be sufficient to properly control the feed of the carbon.

It will be obvious that if the lamp is in an exposed position during cold weather the resistance of the shunt-coil will not be materially increased, because the surrounding cold air will obviate heating when the lamp is burning. As a matter of fact, however, a great number of lamps are in sheltered localities or in buildings, and whenever the heating of the lamp is sufficient to unduly increase the resistance our invention is extremely valuable in increasing the effectiveness of the lamp.

While we have herein shown one practical embodiment of our invention, the same may be modified or altered in various particulars without departing from the spirit and scope of our invention.

Having fully described our invention, what we claim, and desire to secure by Letters Patent, is—

1. Means for compensating change of resistance of an electric circuit due to heating, comprising a normally open short circuit around a part of the circuit, an adjustable thermostat for predetermining the point of action, and a circuit-controller operated thereby at a definite temperature for which the device is set to close the short circuit.

2. The combination, with an arc-lamp, of an adjustable thermostat, a short circuit for part of the lamp-shunt, and means controlled by the thermostat for controlling said short circuit by reducing the turns of the shunt-regulating magnet relatively to the series magnet at a predetermined temperature for which the thermostat is set.

3. An arc-lamp having a series coil, a shunt-coil, composed of two conductors of different specific resistance, and means for cutting out one coil at a determinate temperature.

4. An arc-lamp having a series coil, a shunt-coil having two sections, one of German silver, and the other of copper, and a cut-out for the German-silver coil acting at a determinate temperature.

In testimony whereof we have signed our names to this specification in the presence of two subscribing witnesses.

FREDERICK A. GILBERT.
EMIL O. LUNDIN.

Witnesses:

SAMUEL S. SIAS,
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