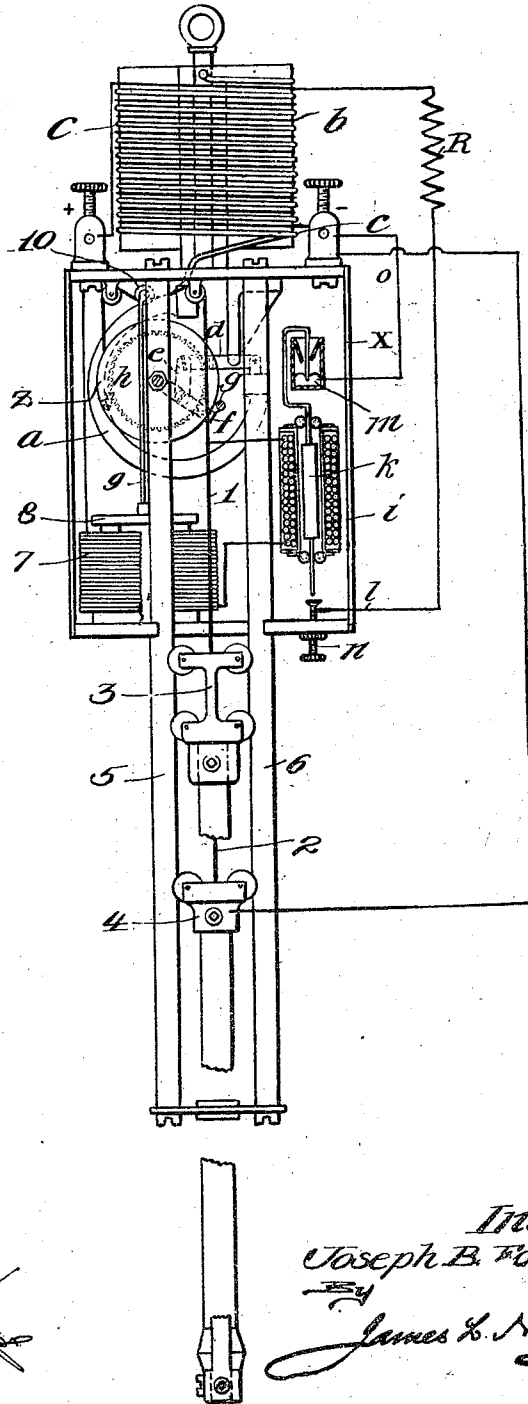


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ELECTRIC ARC LAMP.

APPLICATION FILED NOV. 21, 1903. RENEWED JUNE 7, 1909.

932,773.

Patented Aug. 31, 1909.



Witnesses:

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UNITED STATES PATENT OFFICE.

JOSEPH BARBE FOURNIER, OF PARIS, FRANCE.

ELECTRIC-ARC LAMP.

932,773.

Specification of Letters Patent.

Patented Aug. 31, 1909.

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To all whom it may concern:

Be it known that I, JOSEPH BARBE FOURNIER, citizen of the French Republic, residing at 62 Quai des Orfèvres, Paris, France, have invented certain new and useful Improvements in Electric-Arc Lamps, of which the following is a specification.

This invention relates to electric arc lamps and particularly to regulators therefor, and the primary object of the same is to bring the mechanism of regulators into operation by the electro-magnetic or electro-dynamic action of the current.

The regulator forming the subject of this invention is controlled by the heat evolved from the current and is based as to its operation on the principle of the manometric tube which loses its form under the variable action of the pressure which is exerted on its walls.

The drawing shows an elevation of an arc lamp embodying the features of the invention.

If a certain quantity of a volatile liquid be confined within a curved elastic tube and if one of the ends of this tube be fixed, the other end will remain motionless so long as the elastic force of the vapor in the interior of the tube remains constant. To each value of this elastic force there corresponds a determined position of the free extremity. As, on the other hand, this elastic force depends on the temperature, it will be readily understood that if the temperature of the tube be caused to vary, its free end will be displaced by an amount proportional to the difference of temperatures and to the length of the tube; when heated, the free extremity moves away from the fixed point and when cool the extremity draws near to the fixed point. Another arrangement which has the advantage of not appreciably heating the automotor tube and which therefore obviates all fear of fusing the solderings on this tube is the following:

The automotor tube *a* communicates with a spiral tube *c* of suitable diameter, and is completely filled with a suitably selected liquid, the volume of which is such that it entirely fills the automotor tube plus a portion of the capacity of the spiral tube *c*. A spirally wound resistance wire *b* which may be of ferro-nickel or other metal of suitable resistance, furnishes the heat necessary for the movements of the automotor tube. This resistance is interposed in the spiral *c* so

that its coils or spires alternate with the spires of said spiral *c*. This resistance is electrically insulated from the spiral *c* by any suitable means.

It will at once be understood that if the system is constituted in such a way that the body of the manometric tube *a* is filled with liquid, and the spiral tube *c* is only partially filled with the same liquid, the vapor of the liquid which is formed in the small tube *c* pressing upon the slender liquid column which it contains, and in consequence of the slight calorific conductivity of the greater part of the liquids, the automotor tube does not become appreciably heated. It is the same when the body of the manometric tube is filled with mercury or with any other material not miscible with the volatile liquid contained in the spiral tube *c*.

A coil *i* is connected in series with magnet 7 and the arc, and in the interior of this coil is a bar *k* of soft iron, said bar being free to oscillate in the direction of its axis under the influence of the variations of the intensity of the current. This bar is connected to a mercury cup *m* and when the intensity of the current diminishes the lower extremity of said bar comes into contact with an aligned extremity of the regulating screw *n* connected electrically to the conductor as at *l*. When this contact is established the current flows through the conductor *o*, *m*, *k*, *l*, and a small portion only of the current continues to traverse the resistance *b*, a resistance *R* being interposed in the line *l*. The tube *a* then closes, thus causing the carbons to approach, and when the intensity of the current increases the bar *k* is raised and contact between the lower extremity thereof and the screw *n* is broken and the whole current then passes into the spiral coil or resistance *c*. The separation of the carbons and their movements can be regulated at will by operating the screw *n*. The several parts are electrically connected as shown and will positively operate to attain the result sought. The tube being arranged as just mentioned, constitutes a powerful automotor apparatus controllable by heat. To utilize the movements of the free end of the tube, it is preferred that the free end of the tube act upon one of the ends of a system of articulated levers *d*, *e*, *f*, the other extremity of which carries a pawl *g* which turns the ratchet wheel *h*.

This ratchet wheel *h* is prevented from

turning backwardly or having back lash by a suitable stop pawl *g'* so as to avoid movement of the carriage 3 and its carbon after adjustment and which might ensue from gravitation due to the weight of the said carriage and carbon. It will be understood in the operation of the ratchet wheel and pawls cooperating therewith that the pawl *g'* will freely ride over the teeth of the ratchet wheel in moving in one direction and positively engage and actuate the said ratchet wheel when moving in the opposite direction.

To apply this automotor apparatus as a regulator for arc lamps, it is sufficient to control the carbons by the rotation of the ratchet wheel *h*, and to expose the spiral *c* to action of heat.

The force produced by the displacements of the tube *a* and the amplitude of these displacements may be regulated by suitably choosing the liquid to be introduced into the tube, and by giving to this latter an appropriate length. The following liquids may be employed: glycerin, water, alcohol, ether, chlorid of ethyl, chlorid of methyl, ammonia, carbonic acid, etc.

The automotor tube *a* and its resistance tube *c* are fixed to the cover of the casing *x*. On the axis of the ratchet wheel *h*, which is actuated by the tube *a*, are mounted two pulleys *z* over which pass the cords 1 and 2 supporting the carbon holders. These latter are insulated from the adjacent parts by rings of steatite or other insulating substance, and are connected to two carriages 3 and 4 provided with friction wheels, rolling between two vertical uprights 5 and 6. The bobbin *i* which controls the motion of the tube, is suitably insulated and is fixed to the bottom of the casing *x*. An electro-magnet 7 acts on its armature 8 and attracts the rod 9. If while the carbons are in contact, the current be switched on, the pulley 10 fixed at the upper part of this rod will cause the cord 1, supporting the positive carbon holder, to bend and separate the carbons. The travel of this electro-magnet, combined with the amount which the tube while cooling causes the carbons to advance, is such that these latter always return to contact, when the tube has cooled. This type of lamp may be employed indiscriminately with continuous currents or with alternating currents; it is sufficient to suitably choose the diameters for the pulleys over which the carbon holder cords 1 and 2 pass.

The complete cycle of operation of the lamp is as follows: Let it be assumed that the lamp is burning, and under such conditions when the intensity of the current di-

minishes the oscillating bar *k* in the coil *i* comes into contact with the regulating screw *n*, as hereinbefore noted. When this contact is established the current flows through the conductor to which the screw *n* is electrically connected and only a small portion of the current continues to traverse the resistance *b*, and the tube *a* then closes or contracts, thus actuating the ratchet wheel *h* and pulleys *z* to cause the carbons to approach through the movement of the cords 1 and 2 engaging the pulleys. When the intensity of the current increases, the oscillating bar *m* in the coil *i* is raised, and contact with the screw *n* is broken, and the whole current then passes into the resistance *b*, and under the latter conditions the free end of the automotor tube *a* opens and the carbons are separated.

Having thus described the invention, what is claimed as new is:

1. A regulator for arc lamps including an automotor tube, a spiral tube connected to the automotor tube, a resistance conductor interposed between the spirals of the latter tube and insulated therefrom, the said automotor tube being filled with a volatile liquid, a ratchet wheel cooperating with the automotor tube, an arm pivotally associated with said ratchet wheel and carrying a pawl for engaging the ratchet wheel, a plurality of levers having connection with the pivotal arm and the free end of said automotor tube for regulating the lamp, pulley devices actuated by the ratchet mechanism, and movable carbon controlling means having flexible connections engaging the pulley devices.
2. A regulator for arc lamps including an automotor tube, a spiral tube having connection with said automotor tube, a resistance conductor interposed between the spirals of the latter tube and insulated therefrom, a rotatable device carried by one end of the automotor tube and movable in accordance with the expansion and contraction of said automotor tube, pulley devices operated by said rotatable device, movable carbon carriers having flexible means engaging the said pulley devices, and means operated by an electro-magnet for modifying the tension on the said flexible means to move one of the carbon carriers and separate the carbons.

In testimony whereof I have hereunto set my hand in presence of two subscribing witnesses.

JOSEPH BARBE FOURNIER.

Witnesses:

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