(No Model.) 3 Sheets—Sheet 1.

W. MATHIESEN.

ELECTRIC ARC LAMP.

No. 500,341. Patented June 27, 1893.

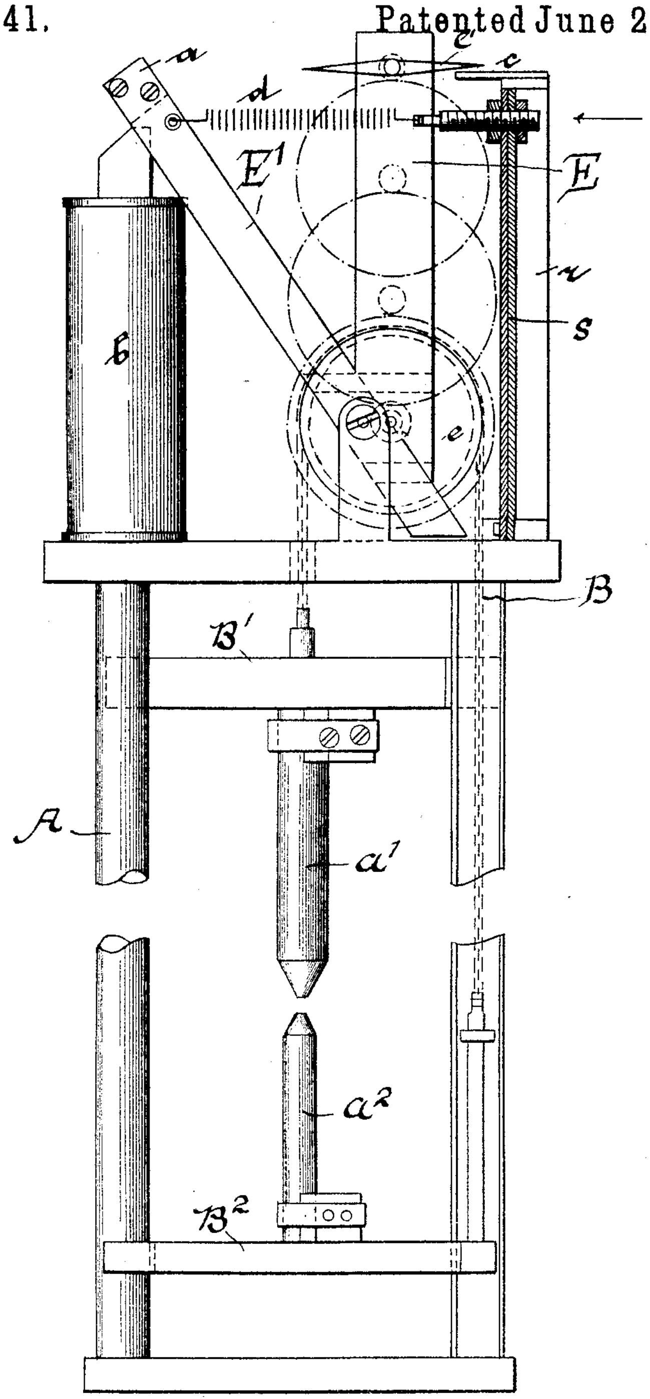

Fig. 1

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THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

(No Model.)

3 Sheets—Sheet 2.

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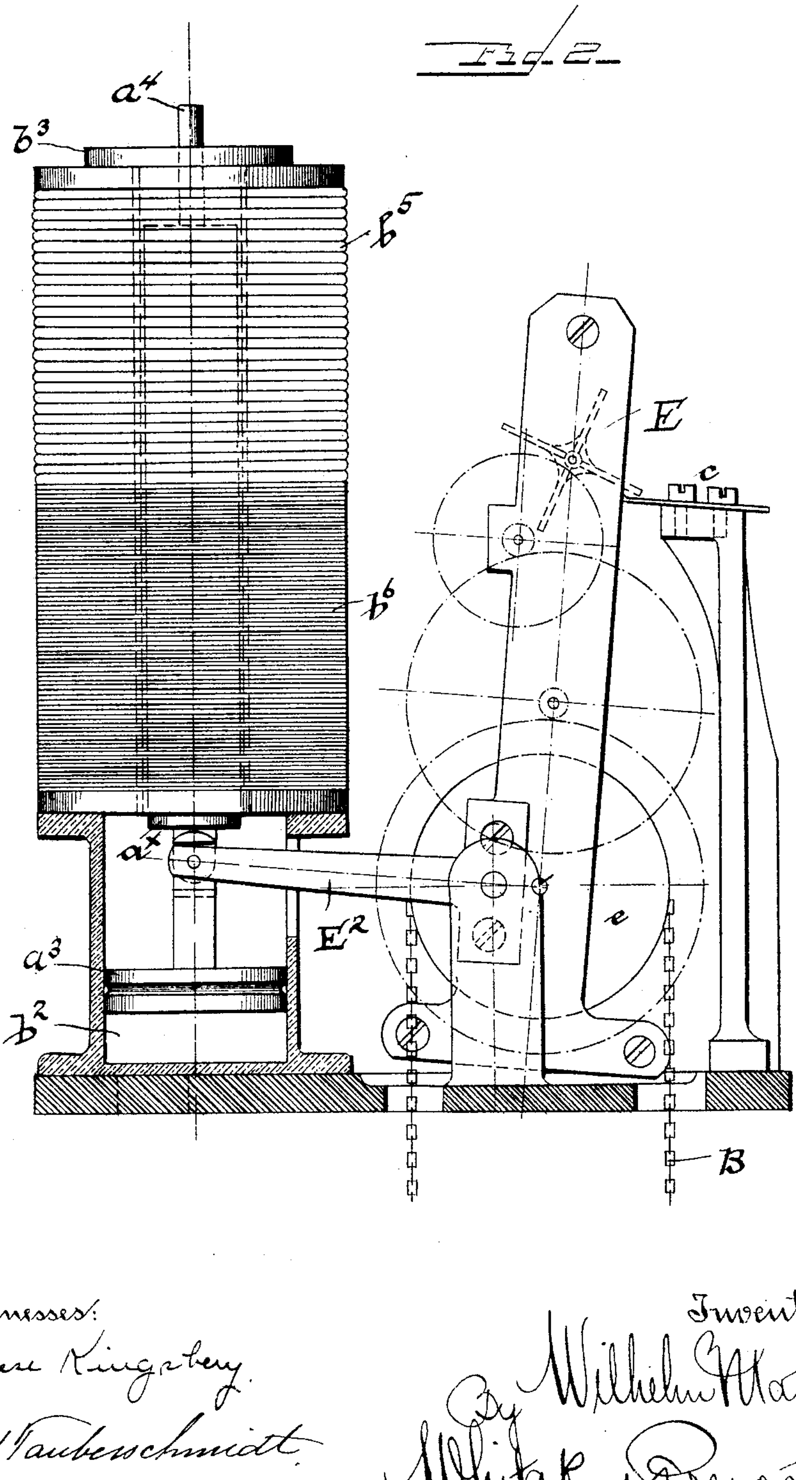
Fig. 2



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(No Model.) 3 Sheets—Sheet 3.

W. MATHIESEN.

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Fig. 3.

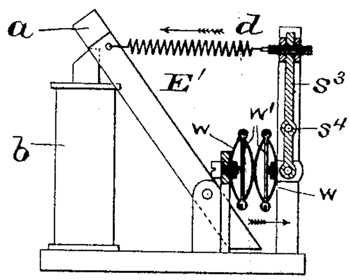


Fig. 4.

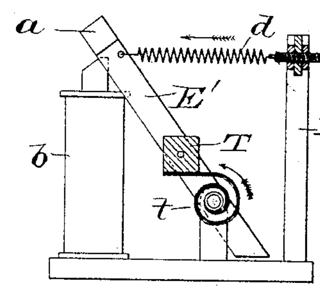


Fig. 5.

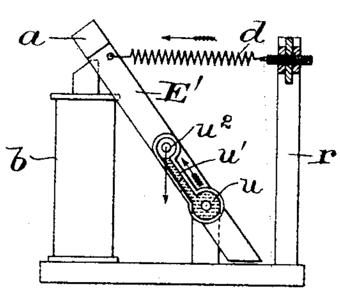


Fig. 6.

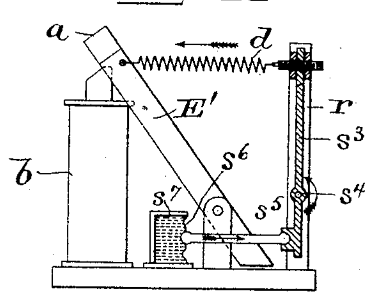


Fig. 7.

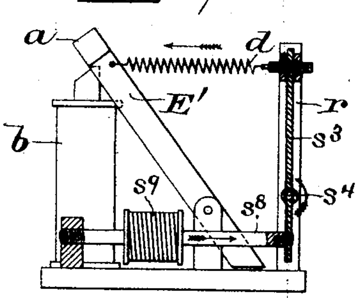
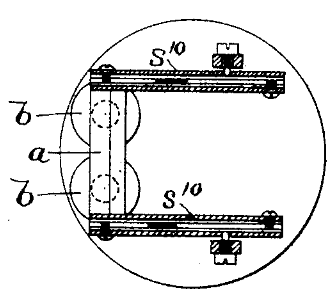


Fig. 8.



Witnesses.

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UNITED STATES PATENT OFFICE.

WILHELM MATHIESEN, OF LEIPSIC, GERMANY.

ELECTRIC-ARC LAMP.

SPECIFICATION forming part of Letters Patent No. 500,341, dated June 27, 1893.

Application filed September 5, 1892. Serial No. 445,157. (No model.)

To all whom it may concern:

Be it known that I, WILHELM MATHIESEN, a subject of the Emperor of Germany, and a resident of Leipsic, in the Kingdom of Saxony, Germany, have invented certain new and useful Improvements in Arc Lamps; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention consists in the novel features of construction and combination of parts hereinafter fully described, reference being had to the accompanying drawings in which I have illustrated several forms of devices embodying my invention and I have fully disclosed said invention in the following description and claims.

Referring to said drawings Figure 1 represents a view of an arc lamp to which my improvements are adapted to be applied. Fig. 2 is a view of the upper portion of a lamp showing a slightly modified form of carbon feeding devices. Figs. 3, 4, 5, 6, 7, and 8 are similar detail views showing modified forms of compensating mechanism.

In Fig. 1, I have illustrated a form of arc lamp in which A represents the main frame and a', a^2 the upper and lower carbons secured to suitable sliding frames B′, B² respectively. In the form of lamp shown the sliding frames carrying the carbons are connected by a cord, chain or other flexible connection B which passes over a pulley e in such a manner that the rotation of said pulley in one direction will cause both carbons to move toward each other, while a movement of said pulley in the opposite direction will cause said carbons to move away from each other as will be seen from Fig. 1. The pulley e is mounted in a pivoted frame E and said frame is provided with a spring actuated train of gears indicated in the drawings by dotted lines, but not specifically shown, which train is connected or geared with the pulley e in such a manner that said pulley will be operated thereby in a direction to move the carbons together. The gear train is provided with a fan or escapement e' which normally engages a fixed projection c on an upright standard r secured to the frame work of the lamp, thus holding the fan and the spring actuated train from movement. The frame E is secured to a pivoted armature lever E′ provided with an armature a in the field of the magnet b secured to the frame work and said armature lever is held away from said magnet by spring d one end of which is secured to the vertical post s and said post is provided with adjusting devices for adjusting the tension of said spring as shown in Fig. 1. The electro magnet b is connected with the circuit passing through the carbons in such a manner that when said carbons have become consumed so as to leave a slight space between them, the electric circuit will be shunted through the coils of the said magnet in a manner so well understood that I have not deemed it necessary for the purposes of this description to show or describe the electrical connection. As soon as said magnet has become energized, it will draw toward it the armature a, thereby moving the train carrying frame E so as to disengage the escapement or fan e' from the stopping projection c thus releasing the fan and permitting the train to feed the carbons toward each other. As soon as said carbons approach each other the required distance the magnet b is again cut out of the circuit in a well known manner and the spring d will restore the armature lever and frames E to their normal positions when the stopping projection c will engage the fan e' and stop the train. By means of this construction the carbons will be kept in the required relation to each other for the proper operation of the lamp.

In the practical operation of a lamp of the form just described it is found that as the coils of the magnet which controls the carbon feeding mechanism, become heated by the heat engendered by the lamp their conductivity is diminished and they offer greater resistance to the passage of the electric current. Hence the magnet will be weakened and will not be as effective in drawing its armature against the resistance of its retracting spring. It is the object of my invention to provide such a lamp with a compensating mechanism which will compensate for the increased resistance and diminished effectiveness of the controlling magnet.

In Fig. 1, I have illustrated one form of compensating mechanism in which the post to which the retracting spring is secured, is composed of two metals s' s^2 which expand unequally under the action of heat. The heat from the lamp acting upon the magnet will decrease its effectiveness as before described, but at the same time will so act upon the bi-metal post as to cause it to bend as shown, thereby throwing the end to which the spring is secured, toward the armature and decreasing the resistance offered by the spring in the same proportion as the strength of the magnet is decreased, thus compensating for the increased resistance of the magnet and rendering the operation of the parts uniform.

In Fig. 3 I have shown a construction similar to those shown in Figs. 6 and 7, except that instead of an expanding fluid or expansion rod I employ the construction of expansion device shown in the drawings, which consists of the bowed or arched bars w having their ends connected to the ends of straight bars w' which expand more slowly than the arched bars w, the said arched bars being connected as shown in the figure to a point of fixed resistance and to one end of the lever s^3. The unequal expansion of the bars w, w' will effect a weakening of the spring d to compensate for the weakening of the magnet b.

In Fig. 4 the spring d is shown secured rigidly at one end to the supporting post r and the pivot of the armature lever is provided with a coiled spring t composed preferably of two metals, as indicated in the drawings, and provided on its free end with a counter balance weight T, which tends to force the armature lever against its retraction spring. The effect of heat upon the spring t will be to cause it to move in the direction of the arrow thereby increasing the leverage of the weight T and compensating for the decrease of the power of the magnet.

In Fig. 5 I have shown a compensating device which consists in a cylindrical vessel u located adjacent to the point of pivoting of the armature lever and connected by a neck u' with a similar vessel placed at a distance from the said point of pivoting. The vessel u is filled with an expansible liquid and the heat from the lamp will cause said liquid (which may be mercury or other preferred material) to pass up through the neck u' into the receptacle u^2 where by its weight it will cause the lever to respond more readily to the action of the magnet and thus compensate for the diminution of the strength of the magnet.

In Fig. 6 I have shown the spring secured to one end of a pivoted lever s^3, pivoted at s^4 and having its opposite end connected by means of a rod s^5 with a diaphragm s^6 which is subjected to the action of an expansible fluid contained in a vessel s^7 secured to the frame of the lamp in a position to be affected by the heat therefrom. As the liquid expands the diaphragm will be pressed to the right, see Fig. 6, and impart its motion to the lower end of the lever a^3 thereby moving its upper end in a direction to weaken the retracting spring.

In Fig. 7 I have shown a construction similar to that shown in Fig. 6 in which instead of the expansible fluid, I employ an expansion rod s^8 secured at one end to a fixed resistance and having its other end connected to the pivoted lever s^3. I may also surround the expansion rod s^8 with a spool s^9 of wire capable of receiving heat and transmitting it to the said rod to facilitate its operation. The action of the expansion rod in Fig. 7 is the same as that of the expansion fluid in the form shown in Fig. 6.

In Fig. 8 I have shown another form of compensating mechanism in which the armature lever consists of two pivoted arms s^{10}, s^{10} constructed of strips of metal secured together in the manner in which the parts of the compensating pendulum in common use are united, the unequal expansion of the different pieces having the effect of moving the armature a into and out of the field of magnetic force of the magnet sufficiently to act as a compensating device.

In Fig. 2 I have shown a slightly different form of mechanism for controlling the pivoted frame E which carries the spring actuated frame. In this figure said frame is provided with an armature lever E^2 to which is pivotally connected the core $a^\times$ which engages the interior of a solenoid b'. The said core is provided in this instance with a disk a^3 which fits within and is guided by the cylindrical casing b^2 which supports the solenoid, and I may also provide said core with a guide rod a^4 for engaging a suitable guiding aperture in a plate b^3 secured to the top of the solenoid. The solenoid is composed of two separate coils of wire. As shown in the drawings the upper part of the solenoid is wound with coarse wire b^5 and the lower part is composed of a coil of fine wire b^6.

In operation the coarse coil will have a constant connection with the electric circuit and will hold the core in its highest position as shown in Fig. 3. When the current is shunted by the separation of the carbons it will pass also through the fine coils b^6 which will draw down the core and allow the gear train to revolve until the carbons are properly adjusted. The effect of heat upon this form of controlling mechanism will be as follows: The heat while it will diminish the conductivity and power of the fine coil, will in a corresponding degree diminish the conductivity and power of the coarse coil, which will therefore offer less resistance to the action of the fine coil in drawing down the core and the devices will thus operate uniformly whether in a heated or in a cool condition.

What I claim, and desire to secure by letters patent, is—

1. In an arc lamp the combination with controlling mechanism for the carbons thereof,

including an electro magnet and its armature lever, of heat compensating mechanism connected with said armature lever, substantially as described.

2. In an arc lamp the combination with controlling mechanism for the carbons thereof, including an electro magnetic coil and an armature therefor, of a resistance device for said armature and a heat compensating mechanism for varying said resistance, substantially as described.

3. In an arc lamp the combination with the controlling mechanism for the carbons thereof including an electro magnet and an armature therefor, of a resistance device for said armature and an expansible heat compensating mechanism for varying the said resistance, substantially as described.

4. In an arc lamp the combination with the controlling mechanism for the carbons thereof, including an electro magnet and an armature therefor, of a resistance spring for said armature and heat compensating mechanism for varying the resistance of said spring, substantially as described.

5. In an arc lamp the combination with the controlling mechanism for the carbons thereof, including an electro magnet, an armature therefor, a spring actuated train provided with an escapement and stop, one of said parts being connected to said lever and adapted to be disengaged by the operation of said magnet, of a resistance spring for said armature lever, an expansible heat compensating mechanism connected with said spring for varying the resistance of the same, substantially as described.

6. In an arc lamp the combination with the controlling mechanism for the carbons thereof including an electro magnet, an armature and armature lever, a spring actuated train having an escapement carried by said lever and a stop adapted to engage said escapement, of a resistance spring for said lever, and a heat compensating mechanism connected with said spring for varying the resistance thereof, substantially as described.

7. In an arc lamp the combination with the controlling mechanism for the carbons thereof, including an electro magnet, an armature and an armature lever, of a resistance spring for said lever, an expansible body connected to said spring for varying the resistance thereof, substantially as described.

8. In an arc lamp the combination with the controlling mechanism for the carbons thereof, including an electro magnet an armature and an armature lever, of a resistance spring for said lever, and a body connected with said spring composed of substances expanding unequally under the influence of heat, for varying the resistance of said spring, substantially as described.

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

WILHELM MATHIESEN.

Witnesses:

HEINRICH HANS BEY,

CARL BORNGRAEBER.