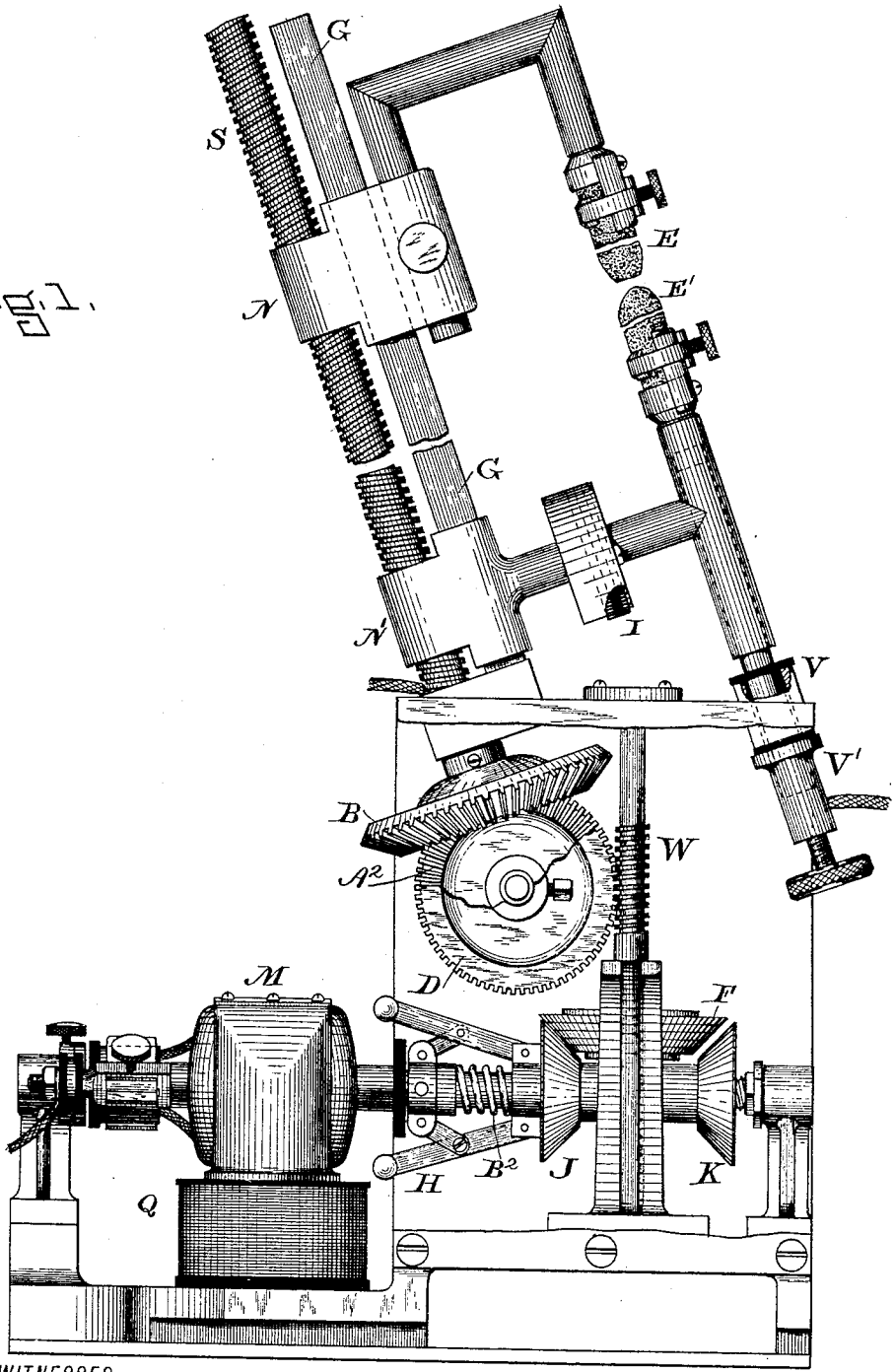
(No Model.). 3 Sheets—Sheet 1.

E. THOMSON.

ELECTRIC ARC LAMP.

No. 478,145. Patented July 5, 1892.

Fig. 1.



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(No Model.)

3 Sheets—Sheet 2.

E. THOMSON.

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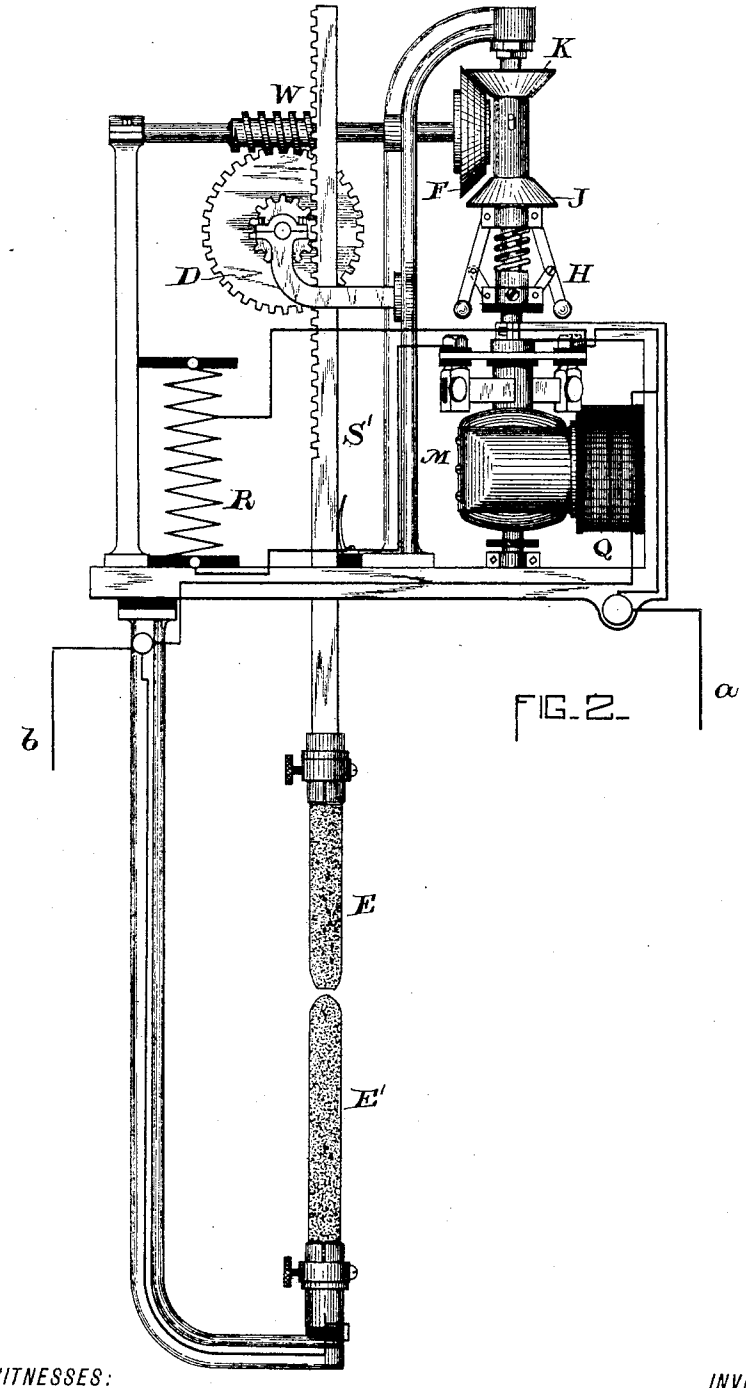

FIG. 2.

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(No Model.) 3 Sheets—Sheet 3.

E. THOMSON.

ELECTRIC ARC LAMP.

No. 478,145. Patented July 5, 1892.

Fig. 3.

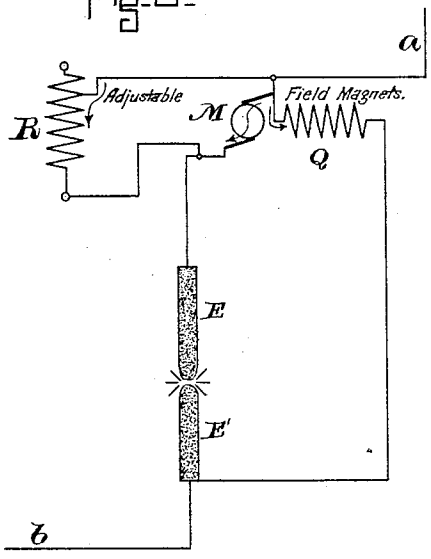


Fig. 4.

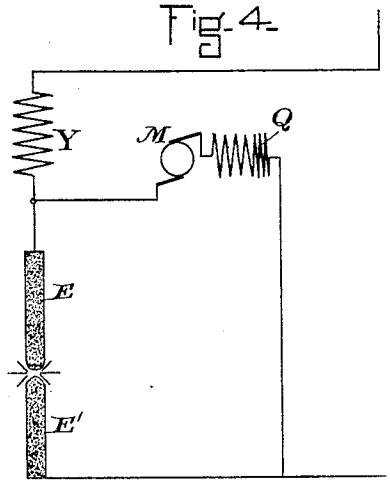


Fig. 5.

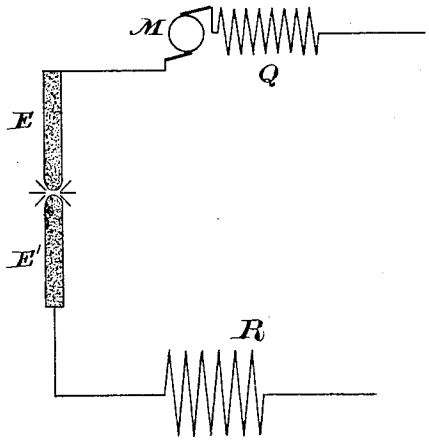
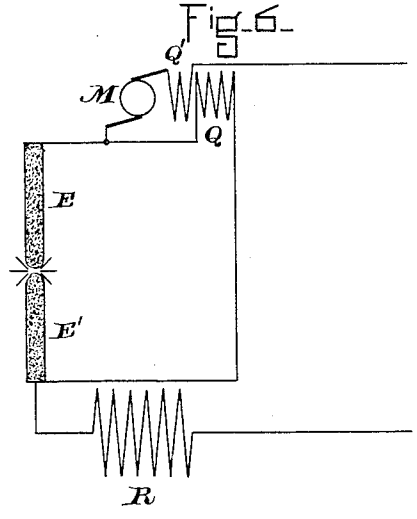


Fig. 6.



WITNESSES:

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UNITED STATES PATENT OFFICE.

ELIHU THOMSON, OF LYNN, MASSACHUSETTS, ASSIGNOR TO THE THOMSON-HOUSTON ELECTRIC COMPANY, OF CONNECTICUT.

ELECTRIC-ARC LAMP.

SPECIFICATION forming part of Letters Patent No. 478,145, dated July 5, 1892.

Application filed March 22, 1890. Serial No. 344,936. (No model.)

To all whom it may concern:

Be it known that I, ELIHU THOMSON, a citizen of the United States, residing at Lynn, county of Essex, State of Massachusetts, have invented certain new and useful Improvements in Electric-Arc Lamps, of which the following is a specification.

My invention relates to an improved mechanism for feeding carbons of an arc lamp.

In principle it consists in the application of a constantly-running electric motor whose speed depends directly on the condition of the arc, the motion being accelerated when the feed of the carbon is to take place and retarded when a separation of the carbons is to take place. The reverse process will be used when the motor is in series with the arc from that employed when it is in shunt. During the normal condition of the carbons and the arc no feeding is going on, the motor then running at a normal speed and not actuating the carbons either way. Any suitable mechanism for accomplishing this result may be used; but preferably I combine with the motor a centrifugal governor or speed-responsive device, which, when the speed of the motor is above a certain normal point, gears the motor with mechanism for moving the carbons in one direction and when it is below the normal point gears the motor with the mechanism for moving it in the other direction.

My invention is especially applicable to arc lamps used with reflectors in which the arc is focused positively and in which it is desirable that the movements of the carbons shall be steady and positive.

Search-lamps in particular may be constructed embodying my invention, since by it one is able to control a lamp of large power, so as to secure a steady normal arc without manual attention, the practice having hitherto been to operate such lamps by hand and adjust the distance of the carbons apart by the eye.

I will proceed to describe the invention by reference to the figures of the drawings.

Figure 1 is an elevation of a focusing-lamp suitable for search-light purposes embodying the invention, the upper part being at an angle to accommodate the figures to the sheet. Fig. 2 is an elevation of a lamp of the ordinary kind in which there is a non-focusing arc. In this case the mechanism feeds only the upper carbon. Figs. 3, 4, 5, and 6 show electrical connections which may be made in varying the conditions under which my invention is put into use.

In Fig. 1, E E′ are the carbon electrodes of an arc lamp, constructed, as shown, to be separated and approached by the rotation of a screw S in nuts N N′, the upper part of the screw having a right-hand thread and the lower part a left-hand thread of half the pitch, so as to feed the upper carbon nearly double the distance traversed in the same time by the lower. The nuts N N′ are carried on a guide-rod G and sustain the carbons by adjustable brackets affixed in the usual manner. Of course it will be understood that the carbons have to be insulated and contact devices applied to convey the current to them, the lower carbon being shown in this instance as insulated at I from the nut N′, which carries it, while the current passes to the upper electrode from the general frame-work of the lamp. The lower electrode E passes through an insulated box V and is connected with the binding-post V′, to which the circuit-wires are attached. The beveled gear-wheel B is carried on the screw-shaft S, which shaft turns in a suitable bearing preventing end motion. The gear-wheel B has a correspondingly-beveled wheel A^2 gearing with it, which is carried on a horizontal shaft, upon which shaft is also carried a worm-wheel D, into which the worm of the screw W engages. The worm W is carried on a vertical shaft, which also bears the friction-wheel F, with a beveled lower face. This friction-wheel is preferably made of some material like compressed leather and cut to form. It rests in between two other friction wheels or pinions J and K, one or the other of which may be thrown into engagement with the friction-wheel F, according to the position of the governing appliance H, carried on a shaft of motor M. The friction-wheels J and K are put upon a sleeve which slides along the shaft on a spline, and the governor H is constructed to expand by centrifu-

gal action against a spring B^2 and to draw the sleeve and wheels J and K along with it, so that on a high speed K will be thrown into engagement with F and on a low speed J will be in engagement. On an intermediate speed both the parts J and K will just clear the disk F, neither of them turning it. The electric motor M is furnished with a commutator and an armature and field-magnet wound to carry the necessary current. The connections of these portions will be described farther on.

It will be readily understood from the mechanism thus shown that if the motor runs at a definite normal speed it will neither feed nor retract the carbons E E′ to or from one another, but that if it rises or falls in speed one or the other of the pinions J or K will be thrown into engagement with the beveled friction-wheel F and turn the screw W, giving motion to the wheels D and A^2, the latter of which drives the gear B of the screw-shaft S to approximate or retract the carbons E E′.

In Fig. 2 the corresponding parts are designated by the same letters and will be readily understood. The only difference is that the screw-shaft S is replaced by a rack-shaft S′, carrying the upper carbon E, and the worm W engages with the wheel B, on the shaft of which is carried the pinion of the rack-shaft. The electromotor M, as before, controls the action of the governor H to throw one of the pinions J or K into contact with the wheel F.

The connections shown in Fig. 2 and in diagram Fig. 3 are as follows: The current enters at *a*, and a branch is taken therefrom through a fine wire or shunt winding on the field Q of the motor M. The circuit from *a* is also branched through the armature of the motor M and through a resistance R, whose amount can be varied in adjusting the lamp. The current leaving the resistance R passes directly to the rack-rod S and to the upper carbon E, thence to the lower carbon E′ and out at *b*, while the field-magnet winding shunts the arc.

Assuming the lamp to be connected across the mains of a constant-potential circuit, a condition to which the positive action assured by my invention is especially adapted, the carbons when together would be traversed by a considerable current, and therefore the armature of the motor M will also be traversed by a considerable current, while the field Q will be comparatively weak. This will set the motor running at once at a high speed and will bring into engagement the pinion K to separate the carbons by rotation of F. A counter electro-motive force will be set up in the armature of the motor M, which tends to keep out the current and turn it into the resistance R. If now by an elongation of the arc by combustion the field be increased, being a shunt around the arc, this counter electro-motive force will still further reduce the current flowing in the armature of the motor and the speed will fall, which will bring the pinion J into contact with F and positively feed the carbons toward each other by a reverse motion to that which separated them. These actions will be repeated at intervals, as required.

Fig. 4 is a modification of the connections in which the arc is in circuit with a dead-resistance Y when it is used on a constant-potential circuit. This dead-resistance is a steadier of the current, and the motor is connected around the circuit, so as to shunt the arc. In this case variations of speed of the motor will occur by variation of the distance apart of the carbons, and these variations may be utilized, as pointed out above, to regulate the position of the carbons.

In Fig. 5 the motor M is in series with the carbons E E′, the current through which varies, and it will be understood that here the operation will be a response to increasing or decreasing current in the lamp-circuit, the connections being such as to cause a decreasing current to feed the carbons by affecting the speed of the motor correspondingly and an increasing current to separate them, the lamp being adapted to work on constant-potential circuits, as before.

Fig. 6 shows the motor having a compound field, part of it Q in shunt to the circuit and part of it Q′ in series with the armature, so that the action is now one of differentiation, a response of the motor taking place on an increase or diminution of the current in the lamp-circuit. These two influences act together to cause the variations of speed in the motor which is used by the governing appliances before described to regulate the position of the carbons.

What I claim as new, and desire to secure by Letters Patent, is—

1. The combination, with an arc-lamp carbon, of a constantly-running motor controlled by and responsive to the current or electromotive force between the terminals of the arc or lamp and a speed-responsive device connecting the carbon with the motor, so as to cause the motor to operate the carbon on a variation from normal speed.

2. The combination, with an arc-light carbon, of an electric motor constantly in operation and a speed-responsive device connecting said carbon with the motor, so as to be actuated thereby upon a variation from the normal speed of the motor.

3. The combination, with an arc-light carbon, of an electric motor on the same circuit and depending upon the electrical conditions of the arc and a speed-responsive device actuated by the said motor and adapted to connect the carbon with the motor, so as to be actuated thereby upon a variation from the normal speed of the motor.

4. The combination, with an arc-light carbon, of operating mechanism therefor, an electric motor constantly in operation and depending upon the electrical condition of the arc, and a speed-responsive device driven by said motor and adapted to connect the said

motor with the said mechanism upon a variation from the normal speed of the motor.

5. The combination, with two arc-light carbons, of a common actuating mechanism therefor, an electric motor actuated constantly and depending upon the condition of the arc, and a speed-responsive device adapted to connect the motor with the said mechanism on a variation from the normal speed of the motor.

6. The combination, with an arc-light carbon, of an electric motor constantly in operation, speed-reducing mechanism through which the motor may act upon said carbon, and a speed-responsive device for mechanically connecting the motor and the carbon through said mechanism upon a variation from the normal speed of the motor.

7. The combination, with an arc-light carbon, of actuating mechanism therefor having a friction-wheel for driving the same, an electric motor, two pinions driven by the motor, and a speed-responsive device adapted to bring one or the other of said pinions in contact with said friction-wheel upon a variation from the normal speed of the motor.

8. The combination, with two arc-light carbons, of a shaft having two screw-threads thereon of different pitch, a nut connecting each of the said carbons with the two screw-threads, respectively, an electric motor in continuous operation, and a speed-responsive device connecting the said motor with the said shaft upon a variation from its normal speed.

9. The combination, with a constant-potential circuit, of an arc lamp included therein, a constantly-running electric motor having driving connections with a carbon of said lamp and having its armature in circuit with the arc, and speed-responsive devices connected to such motor and changing or reversing its driving relation to said carbon.

10. The combination, with a constant-potential circuit, of an arc lamp included therein, an electric motor also included in said circuit, and a speed-responsive device connecting the said motor with the said carbons either to approach or to separate them upon a variation from the normal speed of the motor.

ELIHU THOMSON.

Witnesses:
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W. J. PHUNSTEAD.