(No Model.) 2 Sheets—Sheet 1

I. H. HEGNER.

ELECTRIC ARC LAMP.

No. 584,356. Patented June 15, 1897.

Fig. 1.

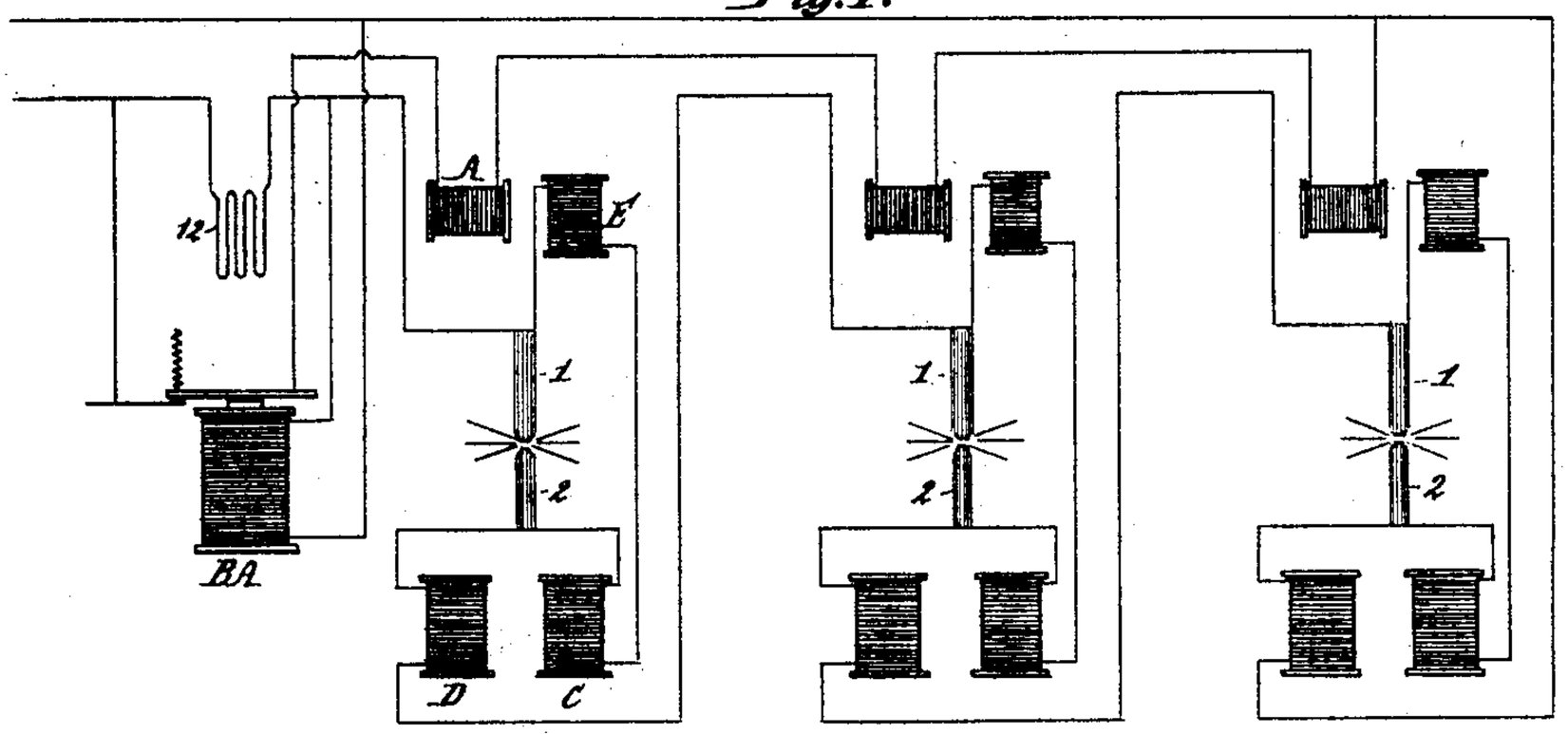


Fig. 5.

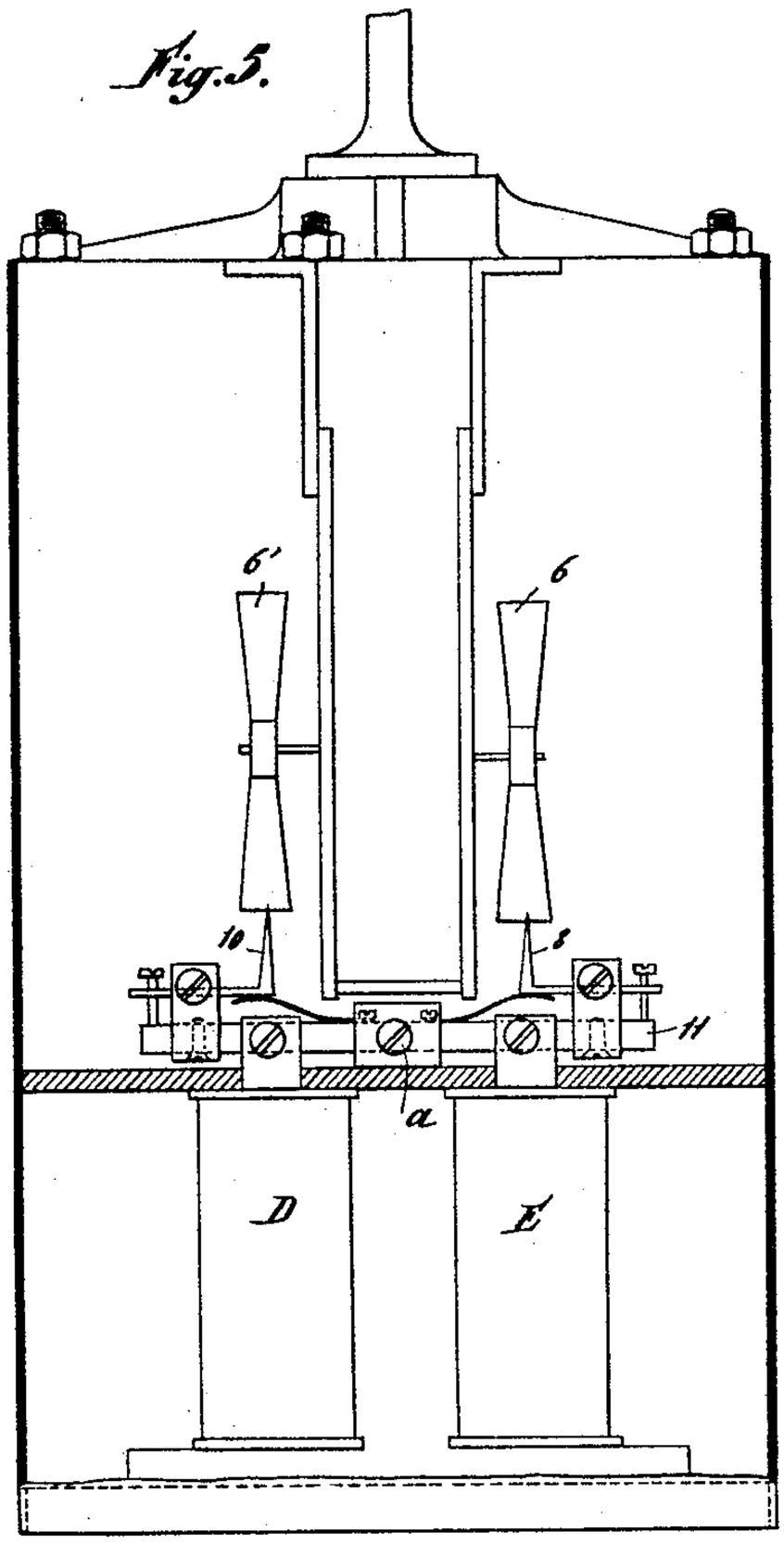
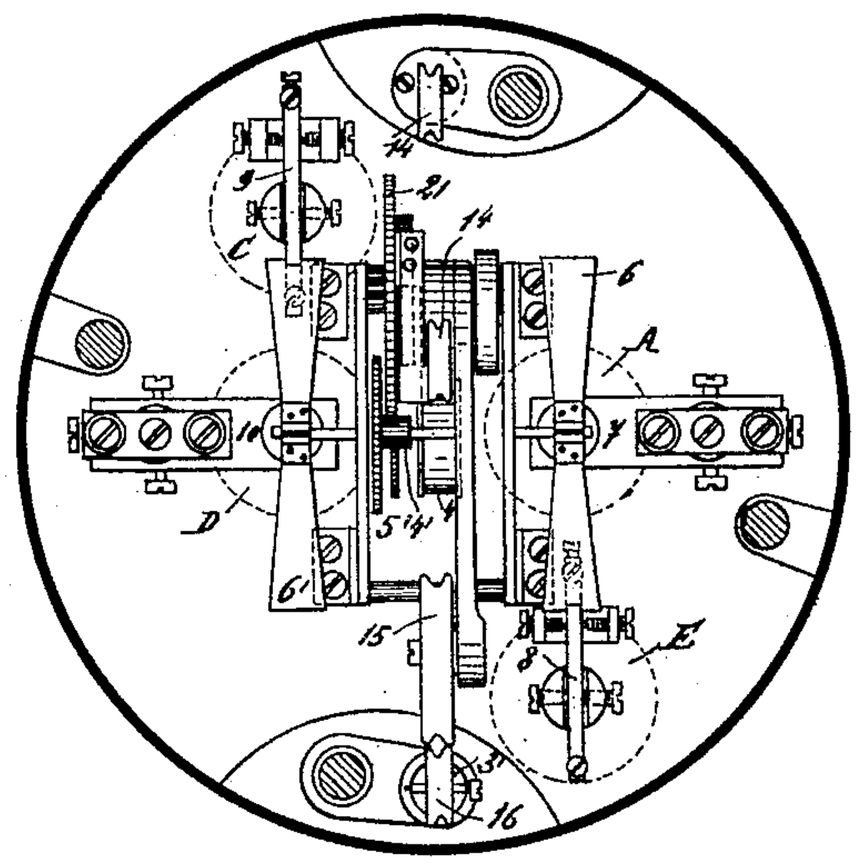


Fig. 4.



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(No Model.)

2 Sheets—Sheet 2.

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Fig. 3.

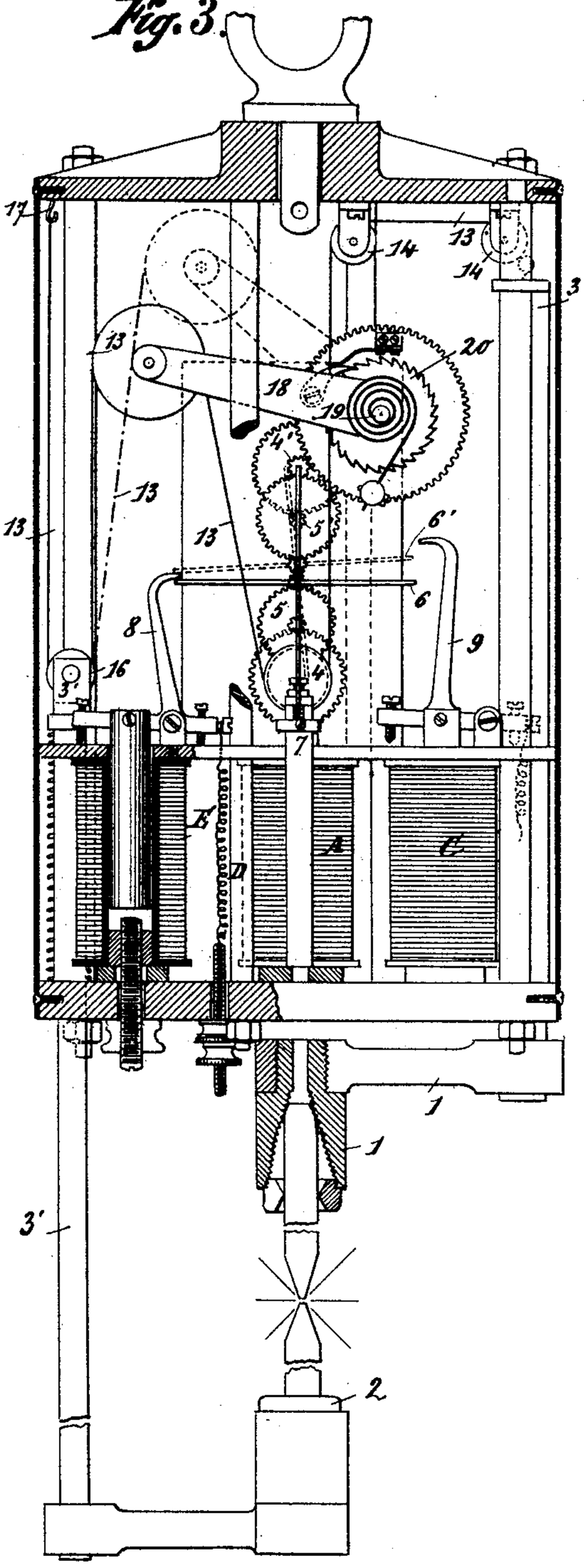
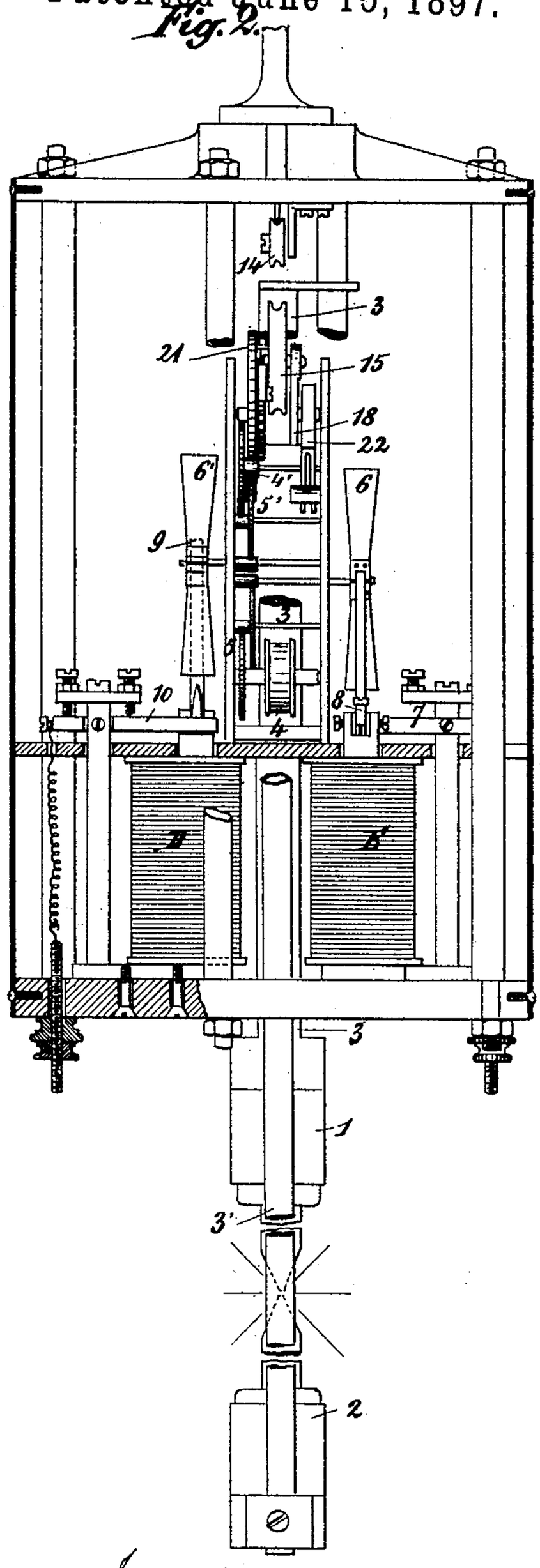


Fig. 2.



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UNITED STATES PATENT OFFICE.

IGNACE HIPPOLYTE HEGNER, OF PARIS, FRANCE.

ELECTRIC-ARC LAMP.

SPECIFICATION forming part of Letters Patent No. 584,356, dated June 15, 1897.

Application filed February 4, 1896. Serial No. 578,028. (No model.) Patented in France June 17, 1895, No. 248,199.

To all whom it may concern:

Be it known that I, IGNACE HIPPOLYTE HEGNER, a citizen of the Republic of France, residing at Paris, in the Republic of France, have invented certain new and useful Improvements in Electric-Arc Lamps, (for which I have obtained a patent in France, No. 248,199, bearing date June 17, 1895;) 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.

This invention has for its object to group together two or more arc-lamps in series or parallel and to regulate the feed according to the total resistance of the group as well as to the resistance of each individual lamp. This arrangement facilitates the use of arc-lamps in parallel or multiple arc distribution, and in this case two or more arc-lamps are arranged in series across the mains, and means are provided for preventing the feeding together of the carbons of any lamp until the total resistance of the group attains the required amount, when each lamp is free to be fed by mechanism controlled by the resistance of its own arc. This arrangement also facilitates the use of smaller power arc-lamps in a series circuit, and in this case two or more arc-lamps are arranged in parallel in a series circuit, and means are provided for preventing the feeding of the carbons of any lamp until the resistance of the group attains the required motion, when each lamp is free to be fed by mechanism controlled by the resistance of its own arc. As applied to three lamps in series on a constant-current circuit of one hundred and ten volts, this system consists in placing a shunt-coil between the rheostat and the terminals of a group of three lamps. This shunt-coil fulfils the office of the coil of thin wire, serving as a regulator of potential in the arc-lamps heretofore used, with this difference, that instead of having in the interior of each apparatus a coil of this kind operating separately on its own account I employ only a single coil for all three lamps, which under these circumstances operate as a single lamp as regards the difference of potential at the terminals of the group. By the application of this system I obtain the following advantages:

First. My shunt-coil, serving as a simple relay having no mechanical work to perform, can, through the intervention of its magnetic parts, possess such sensitiveness that it will operate under the action of the least variations of current, and as the steadiness of the lighting depends only on the regularity of the current which traverses the lamps, and consequently on the precision of their regulating apparatus controlling the approach of the carbons, I obtain by the use of the said regulator under these conditions an ideally perfect state as regards the maintenance of the potential at the terminals of the lamps.

Second. In the interior of the lamps it is necessary to obtain synchronously—that is to say, at the moment when the regulating apparatus performs its function as a regulator—the greatest motive force possible for acting in an absolutely certain manner upon the mechanical movement controlling the approach of the carbons. This force is supplied by electromagnets of comparatively small resistance, suitably arranged in the interior of the lamps, receiving the current sent by the regulator of the potential and acting with very great energy upon the parts which they control.

Third. By the employment of a single regulator of the current for the three lamps in the before-mentioned conditions I can keep the electromotive force constant at the terminals of the three lamps and consequently never reach the one hundred and ten volts of electromotive force at disposal in the circuit. Accordingly I solve by this system the problem of three lamps arranged in series in a circuit of one hundred and ten volts, which has heretofore not been realized with the systems of lamps using only two line-wires each possessing separately their shunt-coils or regulators of potential and each operating on its own account.

In order that the description may be more easily understood, I will hereinafter refer to the accompanying drawings, in which—

Figure 1 is a diagram of three arc-lamps of my system arranged on three wires and regulated by means of a single regulating apparatus. Figs. 2 and 3 are front and side elevations of the lamp proper. Fig. 4 is a horizontal section of the same lamp, and Fig.

5 is an elevation of a modified construction of the same lamp.

Similar letters and numerals of reference represent corresponding parts in the several figures.

The lamp is composed of two mechanisms—that is to say, one for the downward movement of the upper carbon, fixed at 1, and the other for the corresponding backward movement of the lower carbon, fixed at 2. These two mechanisms comprise the following parts:

First. The mechanism for the movement of the upper carbon, comprising a rod 3, suitably guided and terminated by an arm forming a carbon-holder 1. This rod is supported by a cord 13, passing successively round the pulleys 14, 4, 15, and 16 and fastened to the fixed point 17 after having supported, through the medium of the pulley 16, the rod 3′ of the lower-carbon holder. The pulley 4 forms part of a clockwork 5, which terminates in a fly-wheel 6, whose vanes may be stopped by the spring bolts or bars 7 8, actuated, respectively, by the electromagnets A and E.

Second. The movement of the lower carbon is communicated by similar parts. A rod 3′, likewise carrying a carbon-holder 2, moves by its weight and by means of the cord 13, passing round the pulley 15, the lever 18, turning about the axis 19, upon which are mounted on the one hand a ratchet-wheel 20 and on the other hand a spiral spring 22, connected to a fixed point 23, and, lastly, a wheel 21, forming part of a clockwork 4′ 5′, comprising a fly-whee 16′, whose vanes may be stopped by the bolts or bars 9 10, actuated, respectively, by the electromagnets C and D. The three lamps thus constructed are grouped as represented in the diagram of Fig. 1 and comprise for each group a rheostat 12 and a potential-regulator B A, which are designed to effect the regulation of the system.

I will now proceed to set forth how the said system operates. When examining the state of the lamps at the moment when the carbons are placed in their positions, it may be found that all the carbons are in contact or that one, two, or all the carbons are apart. In the first case—that is to say, all the carbons being in contact—if the current is passed through the lamps the apparatus B A does not move, from which it follows that, the bolt 7 preventing the wheel 6 from turning, the upper carbons remain fixed and the coils D liberate the hooks 10, because the whole of the current passing through these bobbins in series with the carbons the masses therein become saturated with magnetism and attract their iron armatures, at the end of which are fixed the catches 10, thus enabling the lower carbons to descend by reason of the displacement of the lever 18, which is drawn downward by the weight of the carbon-holder 3″, because the vane 6′ is on the one hand disengaged by the catch 10 and because the catch 9 has not yet been attracted by the bobbin C, which must only acquire sufficient force when the carbons are so separated that the electromotive force at their terminals reaches twenty-four volts again. At this moment these coils commence to operate and fix the carbons through the medium of the hooks 9, butting upon the fly-wheel 6′, so that the carbons stop and the lighting takes place. The coils C should only have a secondary effect upon the regulation of the lamps. They must only serve to prevent adhesions and too great lengths of the arc with regard to the normal state. The lamps thus lighted burn until the electromotive force at the terminals of the coil B A have, for example, reached ninety volts. At this moment the potential-regulator B A closes the circuit on the coils A and the upper carbons are released. If the three arcs present at this moment the same maximum resistance, the coils E will have drawn their armatures to the end of their movements and the pawls 8 will be in the position for enabling the carbons to descend; but if at this moment, by reason of the unequal combustion of the carbons, one pair of the latter is nearer together than the others the corresponding pawl will prevent the descent of its carbon, since the electromotive force at the terminals of this lamp having dropped below the normal the bobbin C not receiving the necessary number of volts will consequently be weakened, and the catch 8, drawn by its opposing spring, will rest on the vane 6 and arrest the carbons, so that the approach takes place only in the case of carbons which need it.

If at the moment of lighting the carbons are apart, this is what happens: The armature of B A remains in contact, since the carbons not being in contact the current cannot pass this way, the electromotive force will therefore be at its maximum at the terminals of the bobbin B A, the bobbin B A will therefore possess its maximum magnetic strength. The circuit on the bobbins A is thus closed, the bobbins A are excited, and in attracting their armatures they bring and the pawl 7 moves to the released position. On the other hand the coil E acts upon the stop 8 in order to also release the same wheel 6. At this moment the upper carbon descends and the lower carbon moves upward, because they are connected with each other through the medium of the cord 13—namely, until they are in contact. On the carbons thus making contact the lamps are lighted, as previously. When the lever 18 has arrived at the end of its movement—that is to say, in such a position that the lower carbon cannot move back—it is necessary to bring it back to its original position, and for this purpose it is sufficient to slightly raise the rod 3′, in consequence of which the spring 22 as it expands moves the lever 18 to its highest original position.

It will be understood that in the construction of my lamp I do not limit myself strictly to the arrangements shown in the drawings. These arrangements, of the most rudimentary kind, are shown only for the purpose of ren-

dering clearer and easier the explanation of my system, which always remains the same, despite changes of parts and their position, provided that the essential arrangement of the system is maintained, which consists in the combined operation of a shunt electromagnet and of an independent electromagnet fed by the general regulator, completing each other reciprocally for the purpose of allowing the carbons to approach one another only in the lamps which require it and to separate the carbons which may happen to be in contact.

One of the modifications in the construction is illustrated in Fig. 5, wherein the coil C is completely dispensed with and its action replaced by the combination of the coils A and D in differential balance.

The bolts 8 and 10 are mounted upon a lever 11, pivoted by its center at *a*. This balance appropriately equilibrated disengages the fly-wheel 6, when the electromotive force at the terminals of the lamp is increased to a certain maximum amount. In this case the intensity diminishing in the coil D the coil E brings it to the latter, attracts the lever, releases the fly-wheel 6, and the carbons of the lamp can then descend under the action of the coil A and of the potential-regulator B A, respectively. On the other hand, when the carbons have descended to a certain minimum distance—that is to say, when the electromotive force diminishes and the intensity augments—the coil D brings it to the coil E, attracts the lever on its side, and the fly-wheel 6 is again fixed. If owing to an accident the carbons should adhere, the action of the coil D continuing, the fly-wheel 6′ would be released in its turn and would permit the lower carbon to descend until equilibrium was reestablished. The lighting takes place in the same manner. If the carbons are apart at the moment of the closing of the circuit, the coil E disengages the fly-wheel by its proper action, the coil A releasing it under the action of the regulator B A. When once the carbons have come in contact, the coil D attracting the lever on one side engages the fly-wheel 6′ on the other hand and the lower carbon moves back until the arc has reached its normal length.

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

1. The combination with two or more arc-lamps, of a means for preventing the feeding together of the carbons of any lamp until the resistance of the lamp group has attained the desired amount and of a means for feeding the carbons of each lamp controlled by the resistance of its own arc.

2. The combination with two or more arc-lamps, of brakes or stops acting on the feed mechanisms of the arc-lamps, of a means for taking off the said brakes or stops when the resistance of the lamp group has attained the desired amount, and of a means for feeding the carbons of each lamp controlled by the resistance of its own arc.

3. The combination with two or more arc-lamps, of brakes or stops acting on the feed mechanisms of the arc-lamps, of a relay or switch, a means for closing the relay or switch when the resistance of the lamp group has attained the desired amount, an electric device in each lamp in circuit with the relay, stopping the feed mechanism from acting when the relay is open and allowing the feed to take place when the relay is closed.

4. The combination with two or more arc-lamps, in which the carbons tend to feed together of a brake or stop mechanism acting on the feed mechanism, and controlled by the resistance of the arc, of a second brake or stop mechanism also acting on the feed mechanism and controlled according to the resistance of the lamp group, and of means for feeding the carbons of each lamp controlled by the resistance of its own arc.

In testimony whereof I affix my signature in presence of two witnesses.

IGNACE HIPPOLYTE HEGNER.

Witnesses:

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DAVID T. S. FULLER.