(No Model.) 4 Sheets—Sheet 1.

# J. BROCKIE.

## Electric Lamp.

**No. 233,399.** **Patented Oct. 19, 1880.**

Fig. 1.

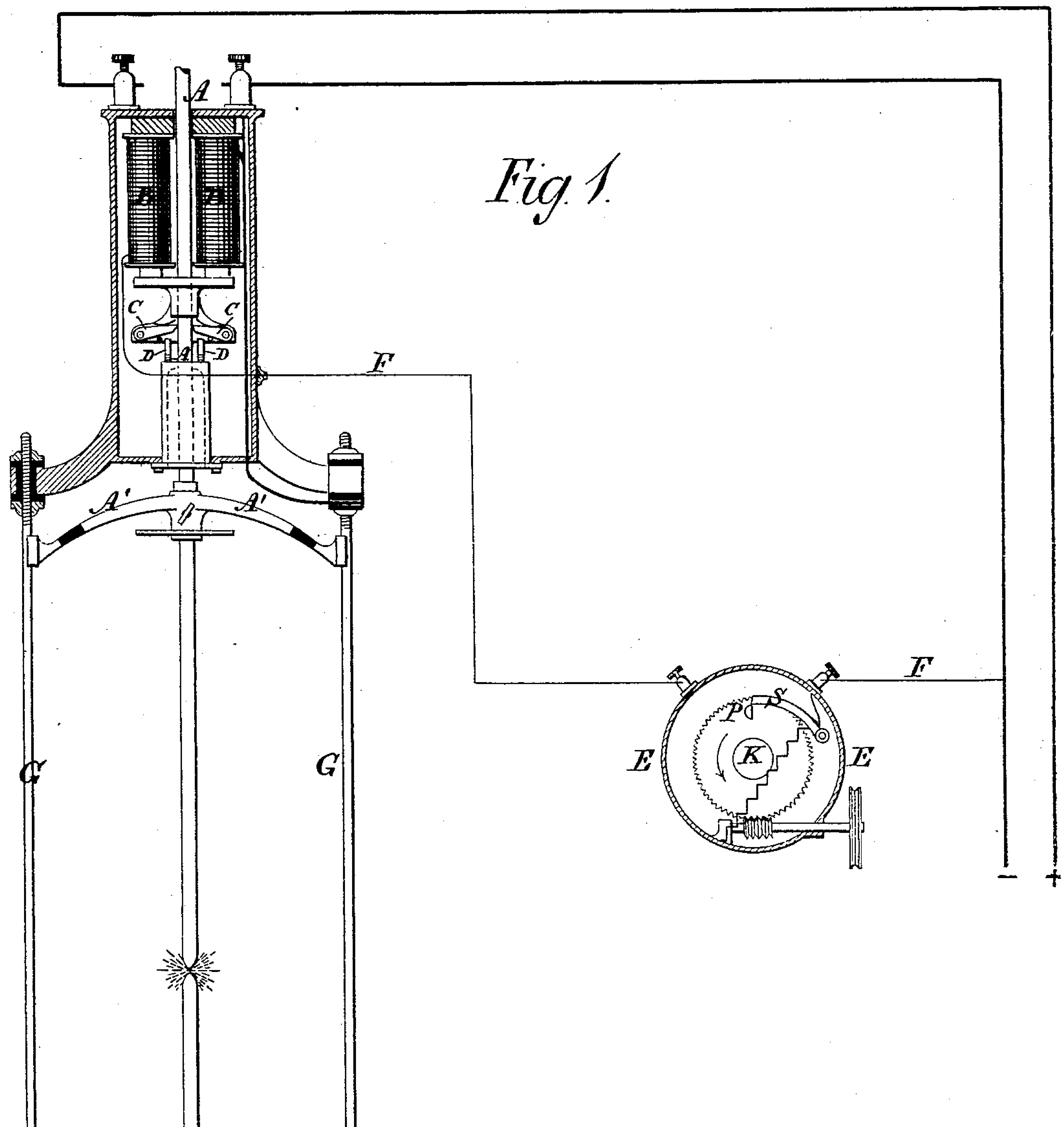
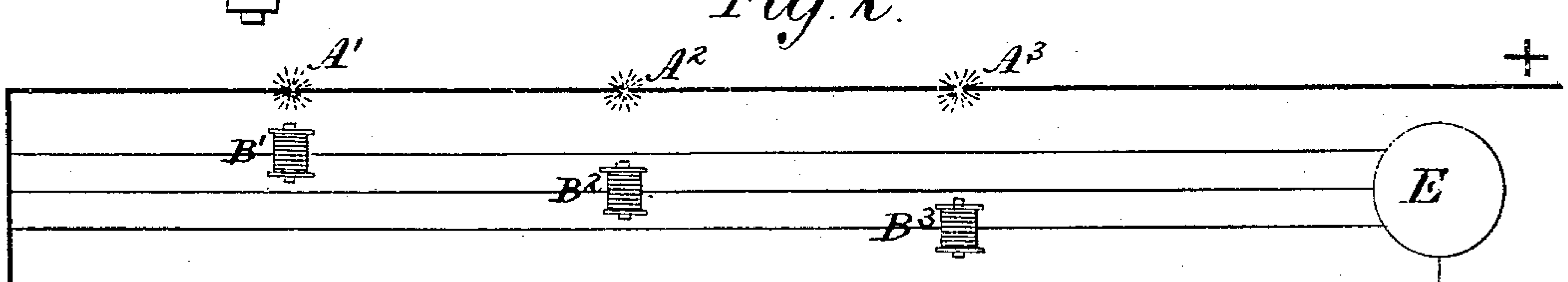



Fig. 2.

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(No Model.)

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Fig. 5.

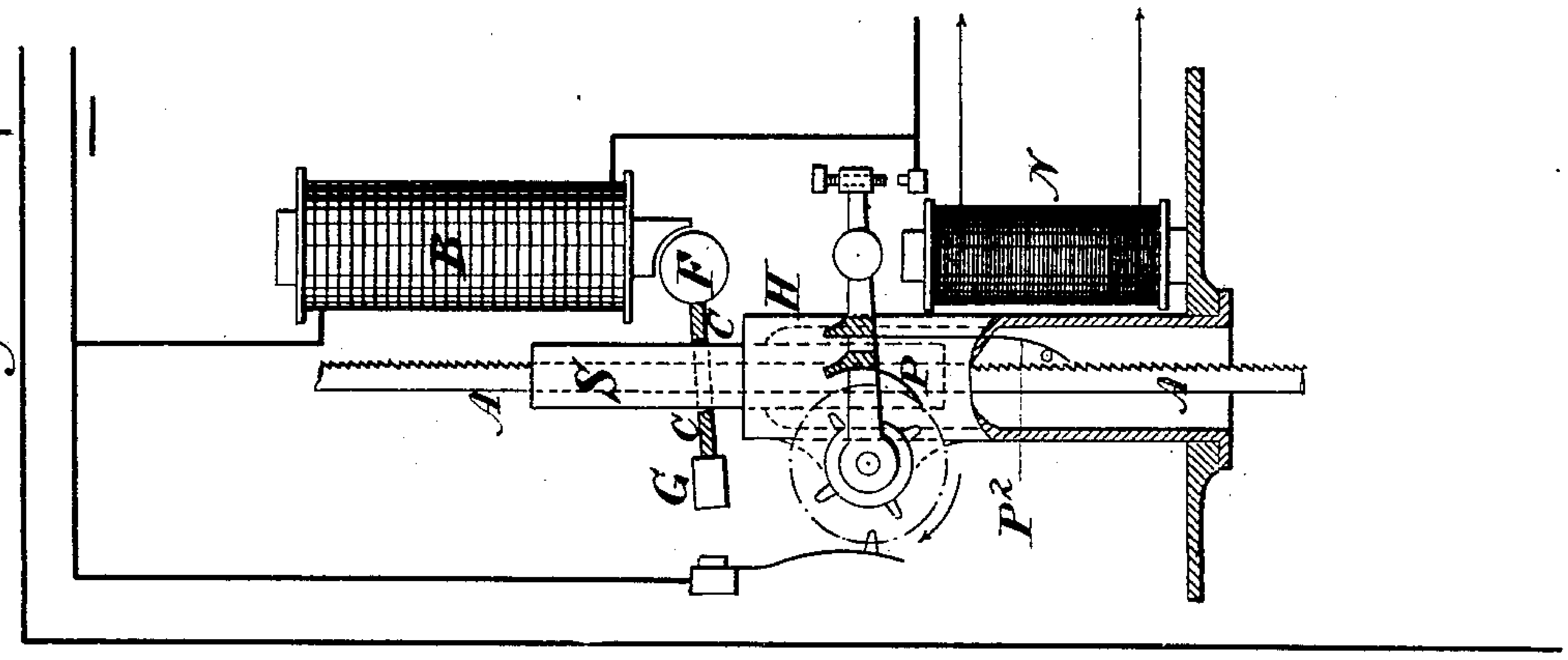


Fig. 4.

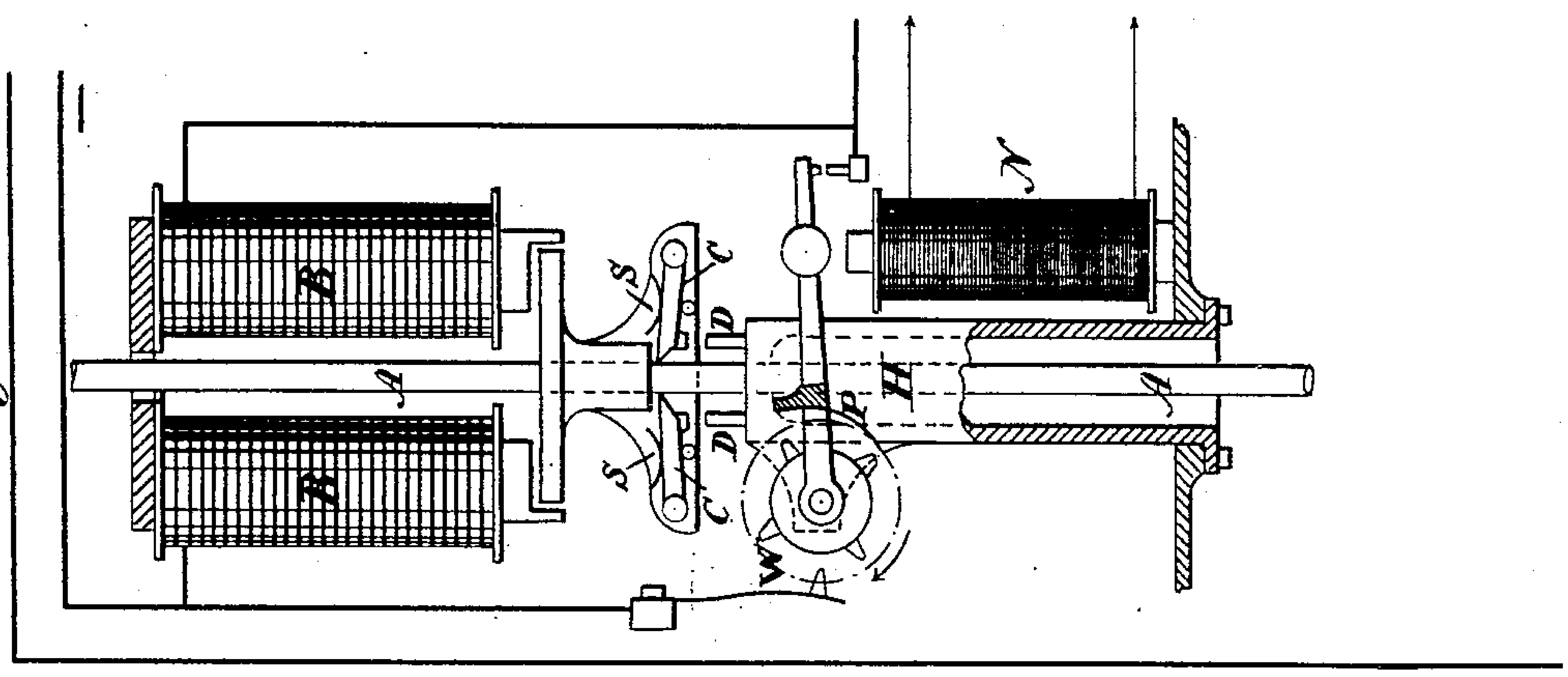
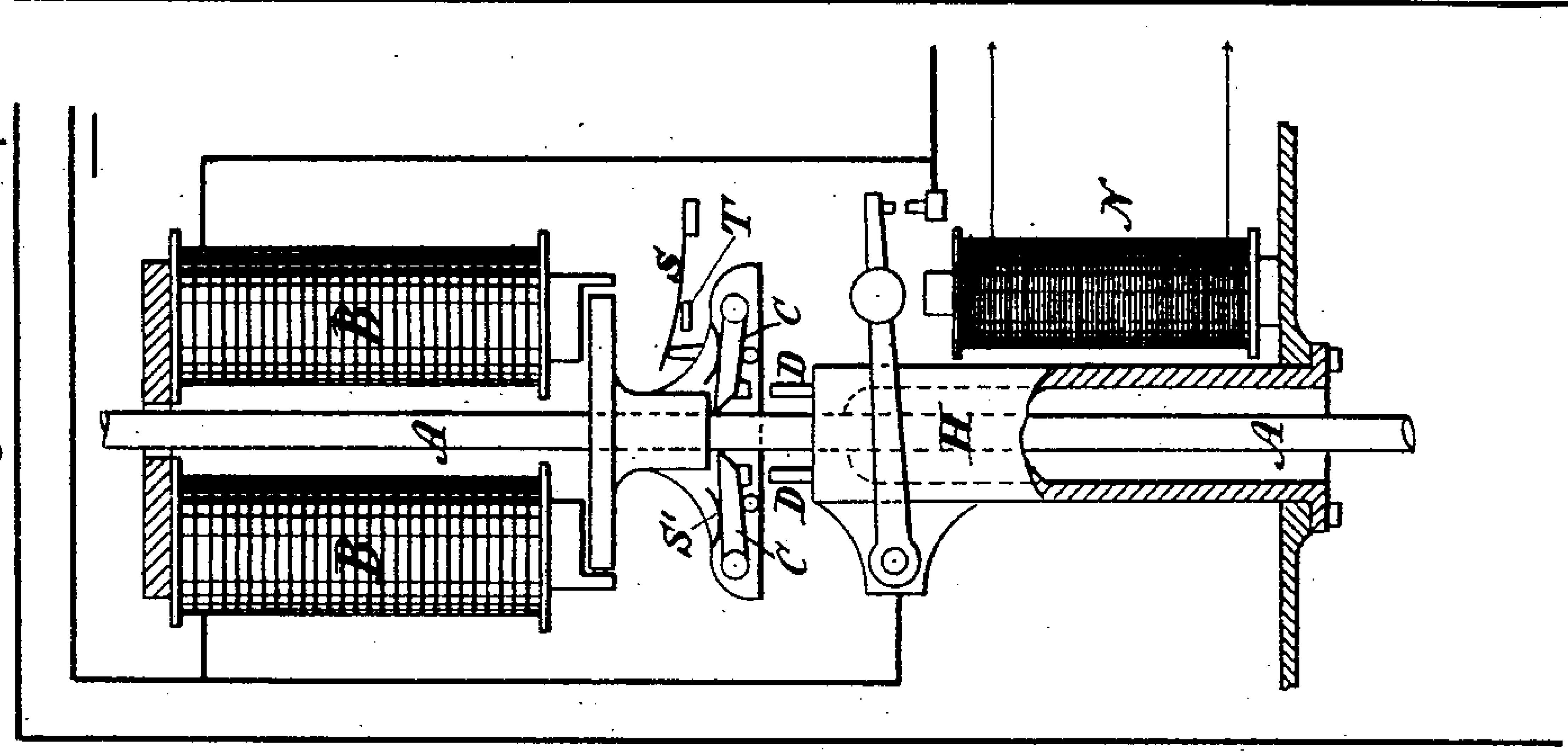


Fig. 3.



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4 Sheets—Sheet 3.

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Fig. 7.

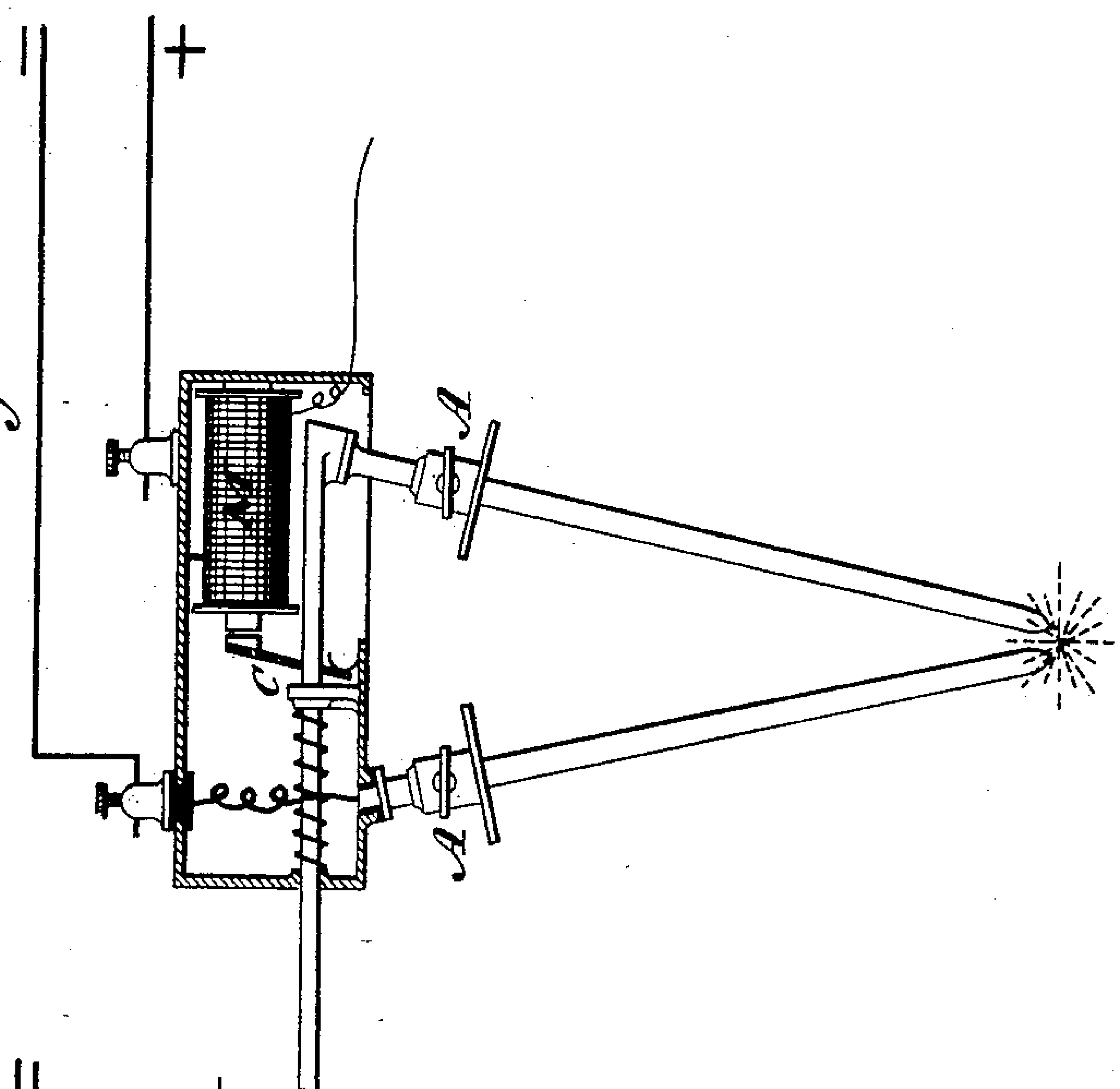
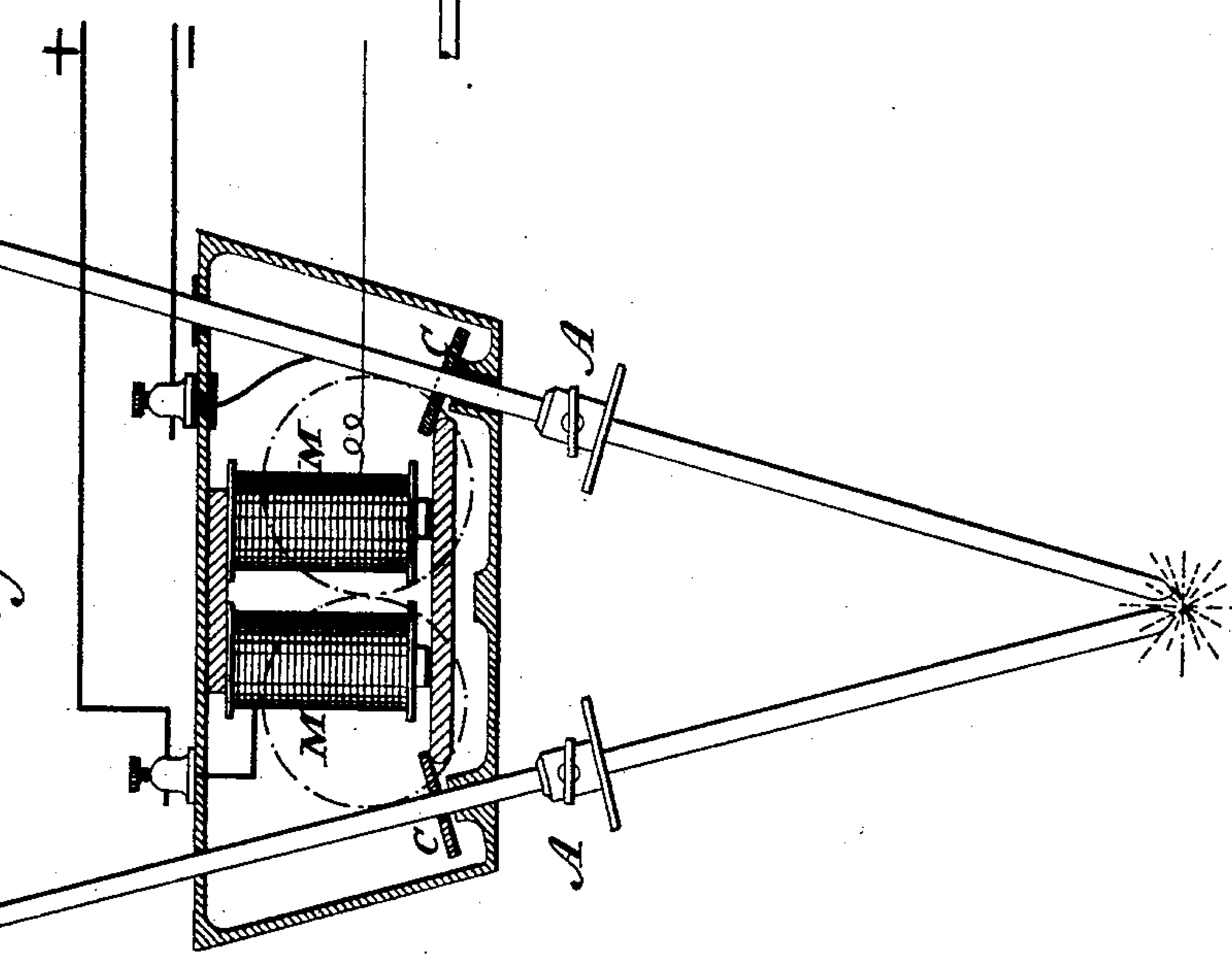



Fig. 6.

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4 Sheets—Sheet 4.

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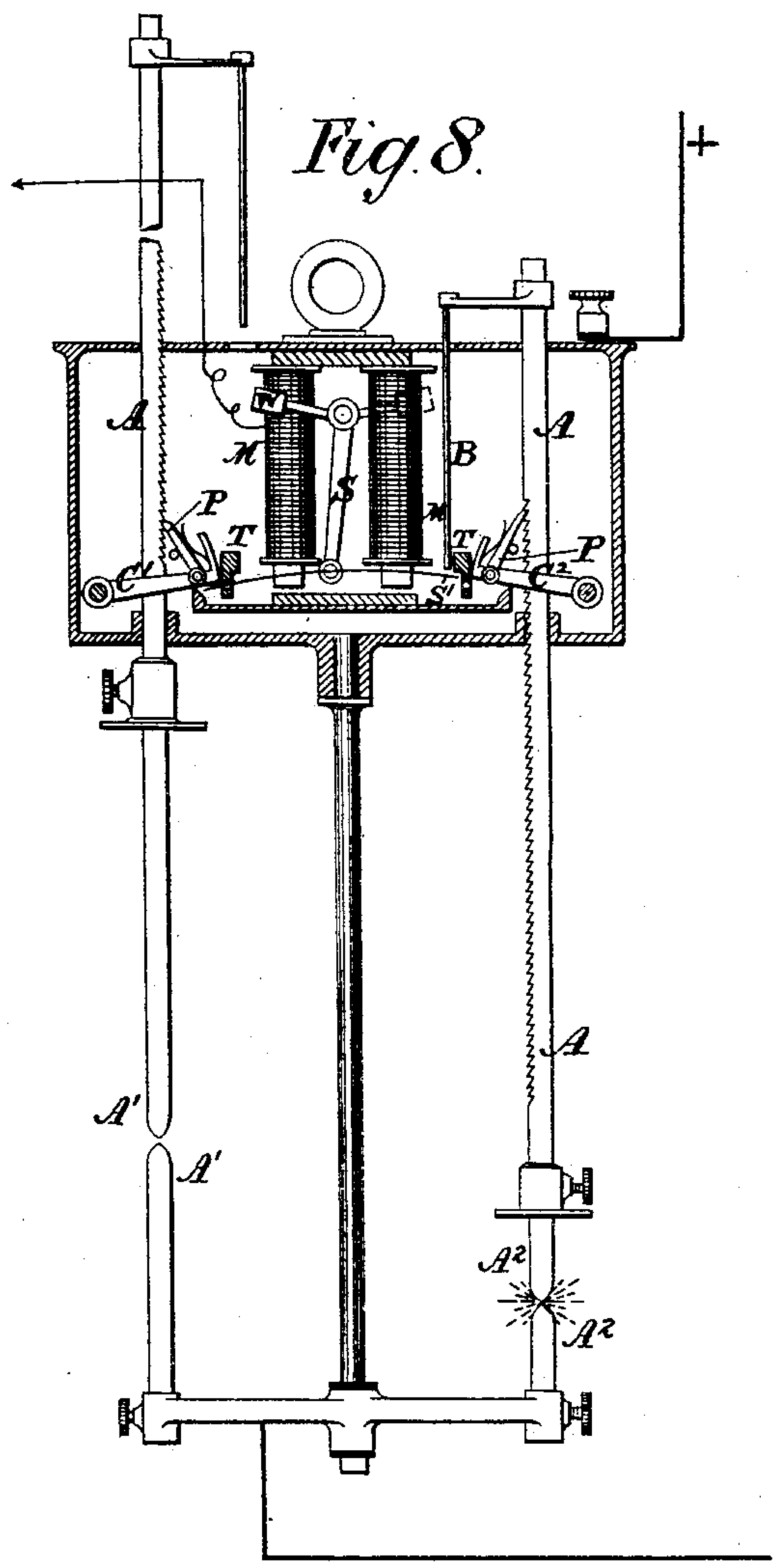
Fig. 8.

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James Brockie

per Lemuel W. Serrell

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# UNITED STATES PATENT OFFICE.

JAMES BROCKIE, OF BRIXTON, ENGLAND.

## ELECTRIC LAMP.

SPECIFICATION forming part of Letters Patent No. 233,399, dated October 19, 1880.

Application filed May 21, 1880. (No model.) Patented in England September 19, 1879.

*To all whom it may concern:*

Be it known that I, JAMES BROCKIE, of Brixton, in the county of Surrey, England, have invented new and useful Improvements in Electric Lamps, (for which I have obtained a patent in Great Britain, No. 3,771, bearing date the 19th day of September, 1879,) of which the following is a specifiation.

My invention refers to a method of constructing and regulating electric lamps, whereby the complicated mechanism usual in such apparatus is to a great extent dispensed with, less attention is needful in working them, and whereby two or more may be put in the same circuit without interfering with the regulation of each other.

I use periodical regulation of the lamps and not the variable strength of the current, as in most lamps hitherto constructed. Thus the regulation is rendered independent of the strength of the current, and therefore two or more lamps may be put in series, so far as difficulties of regulation are concerned.

According to my invention a magnet or solenoid is supplied to each lamp, preferably in a branch of the main circuit, and a commutator cuts out this branch magnet momentarily at stated prearranged periods—say every minute or two minutes, or other short periods, as may be desired. This commutator may conveniently be worked by the engine or electro-machine producing the current, or a separate motor or clock-train may be used for this purpose either in the lamp itself or at a distance from it.

The effect of this momentary cutting out of the magnet is to allow the carbons to meet, after which they are immediately separated the requisite distance for the development of the arc, so that the lamp is readjusted as often as the magnet is momentarily cut out of circuit.

Figure 1 shows the general construction of lamp and commutator embodying the above principles. Fig. 2 shows, in plan, a method of placing two or more lamps in circuit where each lamp-magnet is in a separate shunt or branch circuit. Fig. 3 shows a modification of magnet arrangement. Fig. 4 shows a modified arrangement, when two or more lamps are put in circuit and only one regulating shunt or circuit is employed. Fig. 5 shows general arrangement of lamps having a periodical feed and periodical readjustment of the arc. Figs. 6 and 7 show the method of arranging the carbons at an angle to each other for the purposes of this invention; and Fig. 8 is a sectional elevation of electric lamp having two pairs of carbons.

Referring to Fig. 1, A is the upper or positive carbon-holder, which is preferably supplied with a cross-head, A′, sliding between the guide-bars G G, to insure the carbons being directly opposite and to prevent them overlapping or passing each other.

B is a magnet or solenoid, which is placed in the branch circuit F with the commutator E, driven by the engine or other motor, as before stated. This said magnet operates the sudden-gripe clutch C or equivalent devices, some of which will be hereinafter described. The duty of this clutch or other device is to pull up the upper carbon-holder, A, the requisite distance for the development of the arc when the magnet is active, and when not active the clutch-frame falls and the two pins D D release the two clutches C C, and allow the carbon-holder A to descend until the carbons meet.

The action (see Fig. 1) is as follows: Suppose the carbons are touching each other, a current is now sent through the circuit, the magnet B in the branch F will become active and pull up the clutching arrangement C, which carries the upper carbon-holder, A, a short distance, and the lamp will thus be lighted. After the lapse of, say, one minute, or other short period, as may be arranged, the commutator E momentarily cuts out the branch circuit and magnet B. The clutch C is now free to fall with the carbon-holder, the latter falling until the carbons meet; but as the magnet is immediately put in circuit again, the carbons are instantly separated as at first, and the lamp is thus readjusted after a lapse of a like period of, say, one minute. The commutator E again momentarily cuts out the branch circuit and magnet, and a similar operation takes place, and so on until the carbons are consumed. Thus the lamp is regulated periodically by the commutator E, and not by the varying resistance of the circuit or varying strength of current.

For all practical purposes, the variation or increase in the size of the arc during the period the carbons are locked—say one minute—may be neglected, as, by using carbons of ordinary durability and readjusting frequently, much less variation in the size of the arc takes place than in lamps of the Serrin type, where every alteration in the strength of the current has its reflex in the altered size of the arc, and where a considerable difference in the arc often takes place before the regulating-gear can work. When required, however, even the small increase in the size of the arc during the intervals of readjustment may be prevented or modified by the addition of a spring, as shown in Fig. 3, at S, acting against the armature during the latter part of its stroke. Its action is as follows: When the arc is readjusted, the current being strong, the magnet will overcome the spring S and draw the armature close up to it; but as the arc increases the spring will gradually overcome the magnet and the armature will retire, and thus cause the carbons to approach slightly—say to the extent of one-sixteenth of an inch only—for when the current gets below its normal strength the spring ceases to act as it comes against the dead-stop T. Therefore it cannot permit or cause the carbons to approach farther, as is the case in lamps depending upon current strength acting against a spring for their regulation or readjustment. This spring merely acts during the readjusting intervals to a very prescribed extent, and does not in any way influence the periodical feed or readjustment of the arc, whatever the strength of the current may be or however much it may vary, as the stop T limits the action of the spring to a fractional part of the length of the arc.

Such a spring as I have just described may be used with advantage, in order that when the magnet is momentarily cut out at the readjusting periods the armature may retire instantly or quicker than if no such spring was employed. Instead of applying this spring to the upper carbon-holder armature, as just described, the lower carbon-holder may be made movable to a small extent—say one-sixteenth part of an inch—and be governed by a small magnet in circuit to that amount or other fractional part of the arc.

The commutator E is constructed to cut out and re-establish the branch magnet very quickly, so that the carbons shall only be allowed to touch each other for the fractional part of a second, and the blink or diminution of the light consequent upon the actual contact of the carbons will not be observed. I find in practice that during the fall of the contact-piece S, Fig. 1, from the pin P to the disk K, (only one inch,) the readjustment is effected with certainty and no blink is experienced. It is during this fall that the shunt is interrupted or broken.

When two or more lamps are put in the same circuit I propose to readjust the various lamps at different times to keep the circuit-resistance more uniform than if all the lamps in the circuit readjusted simultaneously. Fig. 2 shows by diagram an arrangement of three lamps, A′ $A^2$ $A^3$, in a circuit where each lamp-magnet B′ $B^2$ $B^3$ is in a different branch circuit and each lamp readjusted at different times by the commutator E. If six lamps were in circuit the lamp-magnets might be grouped in pairs and two lamps regulated simultaneously. However, this may be arranged in many ways, according to expediency or desire; but only one commutator, E, having a suitable number of contact-pieces, need be employed to regulate many lamps.

In some cases, as in Fig. 3, the regulating-magnet B or solenoid is placed in the main circuit, instead of in a branch or independent circuit, as before described, and a second magnet, N, is added to the lamp, which latter magnet is placed in a branch circuit with the commutator. The duty of this second magnet N is to short-circuit the main-circuit magnet B at the regulating periods. In this case the commutator E puts the second magnet N momentarily in circuit, and thus the main magnet B is short-circuited momentarily, and therefore readjusts the lamp, as before described.

This arrangement will admit of a much more feeble branch magnet being used, and also less care need be taken as to the relative resistances of the main and branch circuits, as the only duty devolving upon the branch magnet is to short-circuit the main magnet, which operation may be performed by magnets of very dissimilar powers or resistances.

In cases where more than one lamp is in circuit and they are readjusted at different times, and only one branch circuit is employed, an arrangement shown in Fig. 4 is used. A small wheel, W, is added to the said second magnet N in branch circuit. This wheel is partially rotated by it at each impulse by the pawl P. The duty of this wheel is to prevent the short-circuiting of the main magnet B, except at a definite point or points in its revolution, the said wheel being insulated suitably for this purpose. Thus, by setting the wheels in the various lamps at different points, the lamps will be readjusted at different times, although the magnets, being in the same circuit, are magnetized simultaneously.

Instead of using a second magnet to short-circuit the main magnet B, the main magnet may be wound with two coils, one in the main, the other in a branch with the commutator E. When the branch is put in circuit by the commutator the effect of the main coil is neutralized and the magnet is practically inoperative. Thus the readjustment will take place as if the magnet had been cut out or short-circuited.

When alternating currents are used the carbons may be arranged at an angle to each other, as in Figs. 6 and 7. In Fig. 6 both carbons are free to move up and down, and are readjusted from time to time by the magnet M and any of the clutches, as before explained. This arrangement will secure a fixed focus. The holders may be geared together, so that they may rise and fall equally. In Fig. 7 only one carbon-holder is movable, and that in a lateral direction. In this case the focus will shift as the carbons are consumed.

I also construct lamps having a periodical and well-defined feed to the carbons in addition to a periodical readjustment. I prefer in such cases to give one carbon a step-by-step forward movement by means of a pawl or equivalent device—say every half-minute, for a period of, say, five or ten minutes or less—and then readjust the arc by means of the other carbon, to correct the size of the arc and eliminate any errors arising out of the regular rate and amount of feed; but if this feed is based upon the average rate of consumption of the carbon, no serious difference in the size of the arc can take place between the readjusting periods. Two magnets will be employed in such lamps, one to operate a pawl to feed the carbon, the other to effect the readjustment, as before described.

The two magnets may be commutated at proper intervals, as in the previously-described lamps. Instead of making both carbons or their holders movable, the feed and readjusting may be effected by one carbon—say the upper. Fig. 5 shows the general arrangement of such a lamp, where the carbon-holder A passes through a sleeve, S, fitting it somewhat tightly. The holder is urged forward directly by the pawl $P^2$—say, for example, every half-minute—and the sleeve is actuated by the clutch C—say, for example, every five or ten minutes—to correct or readjust the arc. The said intervals, however, may be modified greatly.

The magnets B and N may be placed in separate branch circuits with the commutator E, which cuts them out at the proper intervals.

In some cases the lamp-magnets are arranged so that the magnet N has the double duty of feeding the carbons and short-circuiting the readjusting-magnets, as shown, and in such cases only one branch circuit and commutator will be required to regulate many lamps.

Various modifications in the construction of such a lamp may be made, and I therefore do not limit myself to the precise arrangements shown. For instance, clock-work may be used to give the feed to the carbons for a definite time, and then the readjusting-magnet may be cut out or short-circuited momentarily by the same train of wheels.

An arrangement of pawl and rack is shown in Fig. 8 to control the carbon-holder, the action of which is as follows: When the magnet is inactive the pawl P is out of the rack, which is cut in the holder A; therefore the holder will be free to fall until the carbons meet. But when the magnet is active the pawl rides over the fixed pin shown, enters the rack, and lifts the holder the requisite distance for the arc. In Fig. 5 a pawl, $P^2$, having a similar action, is shown to urge forward the holder A a definite short distance, as before described. In the same figure another form of sudden-gripe clutch is shown controlling the sleeve S. This device consists of a plate, C, having an armature, F, fixed to it at one extremity, and a weight, G, at the other to counterbalance the said armature. An opening is made in this plate just large enough to allow the sleeve S to pass freely through it when in a horizontal position; but when the plate is at an angle it gripes or jambs the sleeve. The action of this device is as follows: When the magnet B is inactive the plate lies horizontally on the top of the pillar H. The sleeve and holder are therefore free to fall; but when the magnet is active the plate is lifted at one end by the action of the magnet and depressed at the other by the balance-weight G, as shown, and so jambs the sleeve and carries it upward with it. By raising or lowering the top of the pillar H, upon which the clutch rests when the magnet is inactive, the stroke of the clutch may be altered to vary the size of the arc as desired. I sometimes construct lamps on the said periodically-adjusting principle having two pairs of carbons, so that when one pair is consumed the other pair may be put in circuit automatically, and thus a practically-continuous light may be obtained. Fig. 8 shows the general view and principle of such a lamp. The two upper carbons or their holders are connected to the positive pole of the battery or electro-machine and the two lower to the negative; but only one pair is permitted to be in contact at the same time. This is accomplished by the swinging stop S, which, as shown, prevents the pair A′ meeting by locking the pawl-lever C′.

The magnet M, which is commutated, as before described, at proper intervals, works the spring-pawl P, before described, or other clutching device, and so the periodical readjustment of the arc is proceeded with. When, however, the pair $A^2$ is nearly consumed, as shown, the pin B on holder A comes in contact with the swinging spring or stop at S′, pressing it down until it slips past the guard T. The swinging bar S is now impelled forward by the balance-weight W locking the clutch $C^2$ and unlocking the clutch C′. This operation, which is quite automatic, will cause the arc to be established between the new carbons A′ and to disappear from the old at the next readjusting period, because the pair $A^2$ will be then prevented meeting; but the pair A′ will be free to meet. The pair $A^2$ may now be replaced and the balance-weight W turned to the opposite side, as shown by the dotted lines, so that when the pair A′ is, in turn, consumed a similar operation to that just described takes place and the light will be thus kept practically continuous.

Having now described the nature of my said invention, and in what manner the same is to be performed, I declare that, although I have spoken of and described only one carbon-holder as movable to effect the readjustment of the arc when the carbons are arranged vertically, I do not limit myself to that particular plan, as both carbon-holders may be used to attain that end. Indeed, by modifying the construction of many electric lamps now in use which depend upon current strength or variation for their regulation, by taking away the regulating-spring or its action, giving the upper carbon-holders a sudden, instead of a gradually falling, movement, and placing their magnets in a branch circuit, I can adapt them to this new method of periodical regulation by means of an automatic commutator without departing from the essential features or spirit of this invention; and although I have described and shown several clutching devices to actuate the carbon-holders of my lamps, I do not limit myself to the use of such for this purpose, as numerous arrangements may be employed; nor do I claim as novel any of the clutches shown when used to regulate lamps by current strength, (although they may be new,) but I have shown them as various devices suitable in the carrying out of this invention; but

I claim—

1. In electric lamps, giving a periodical and well-defined feed to the carbons in addition to and in combination with a periodical readjustment of the arc, in order to eliminate and provide against serious errors or differences in the size of the arc consequent upon the said regular feed, the said feed and readjustment being accomplished automatically by a commutator, substantially as described, and not dependent upon the variation of the current or resistance.

2. In electric lamps readjusting periodically in accordance with this invention, the arrangement of two magnets and rotating wheel, substantially as described, and shown in Fig. 4, whereby the main or readjusting magnet is short-circuited after a certain number of impulses of the second magnet in the branch circuit with the commutator, in order that two or more lamps in the same circuit may be readjusted at different times by one commutator and one branch circuit, substantially as described.

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