No. 620,514. Patented Feb. 28, 1899.

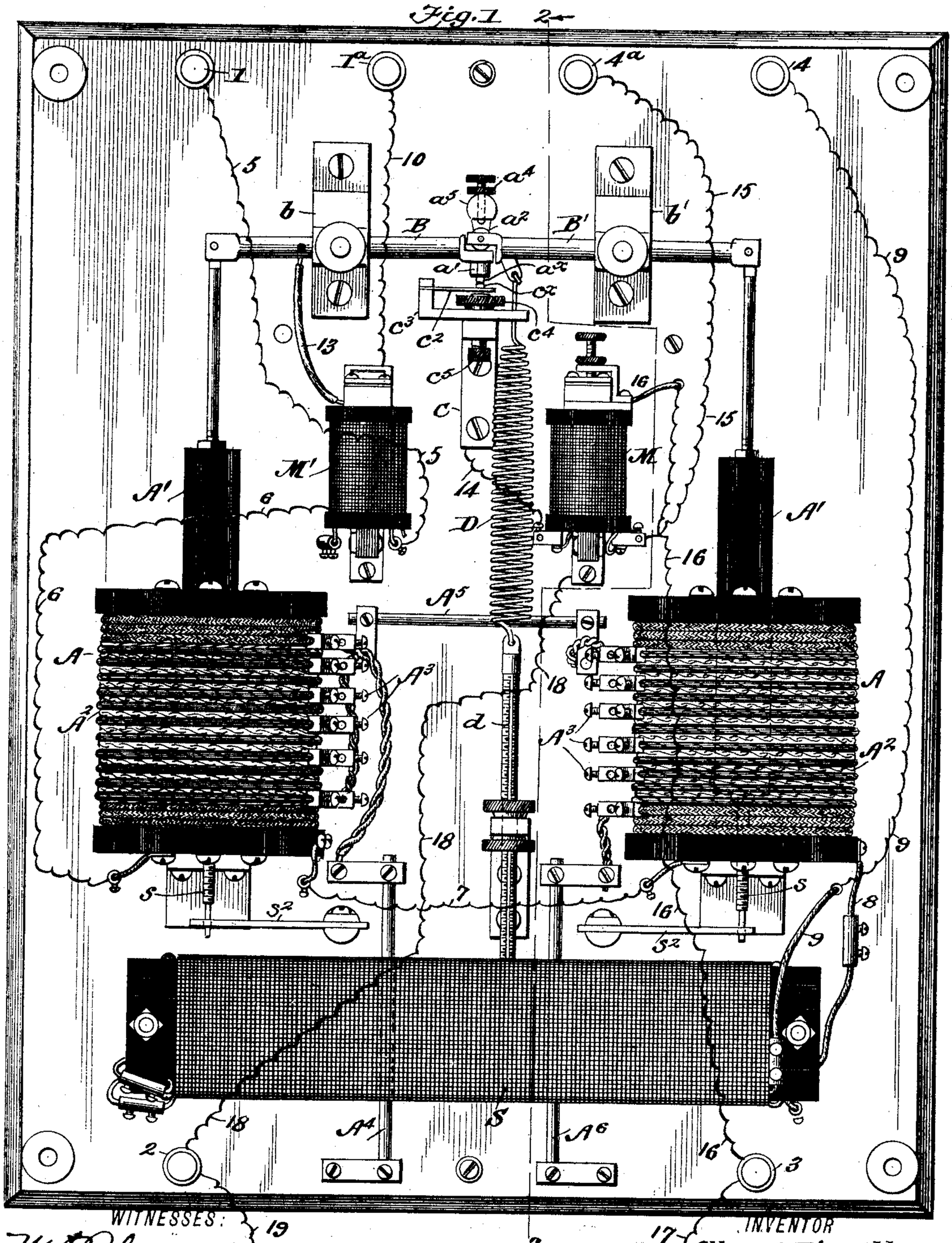
A. A. TIRRILL.

POTENTIAL REGULATOR FOR DYNAMOS.

(Application filed Apr. 28, 1898.)

(No Model.) 3 Sheets—Sheet 1.

Fig. 1



WITNESSES:

W. D. Bloudell,

Edw. W. Byrn.

INVENTOR

Allen A. Tirrill.

BY Munn & Co.

ATTORNEYS.

No. 620,514. Patented Feb. 28, 1899.

A. A. TIRRILL.

POTENTIAL REGULATOR FOR DYNAMOS.

(Application filed Apr. 28, 1898.)

(No Model.) 3 Sheets—Sheet 2.

Fig. 2

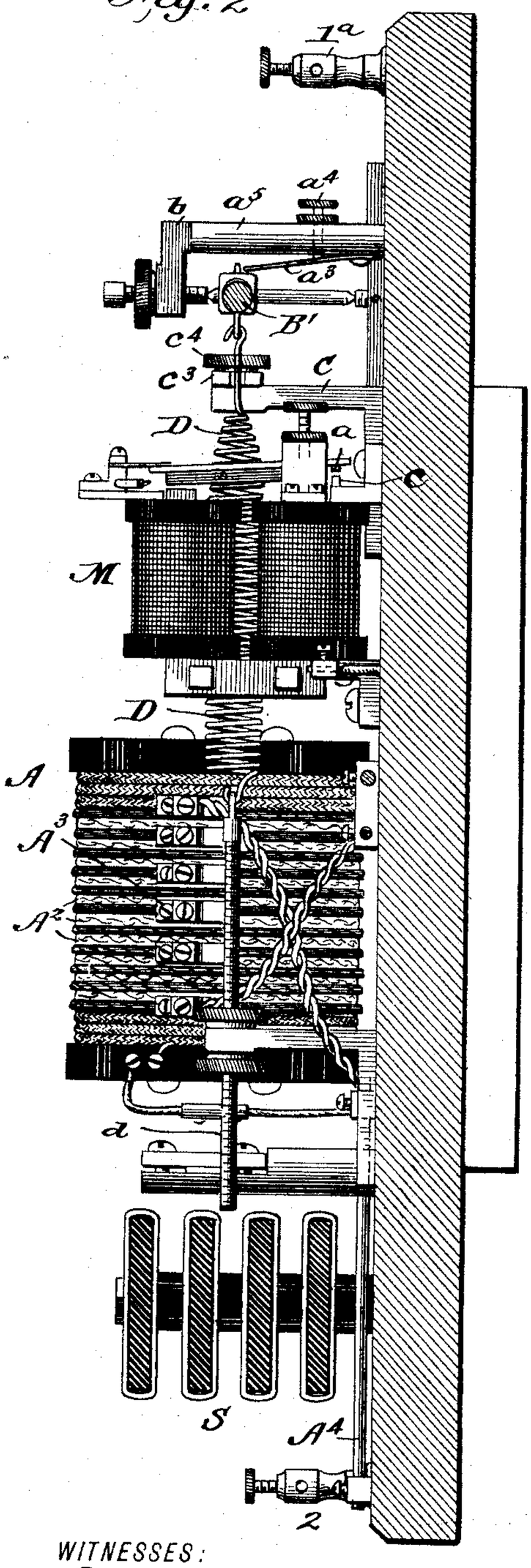
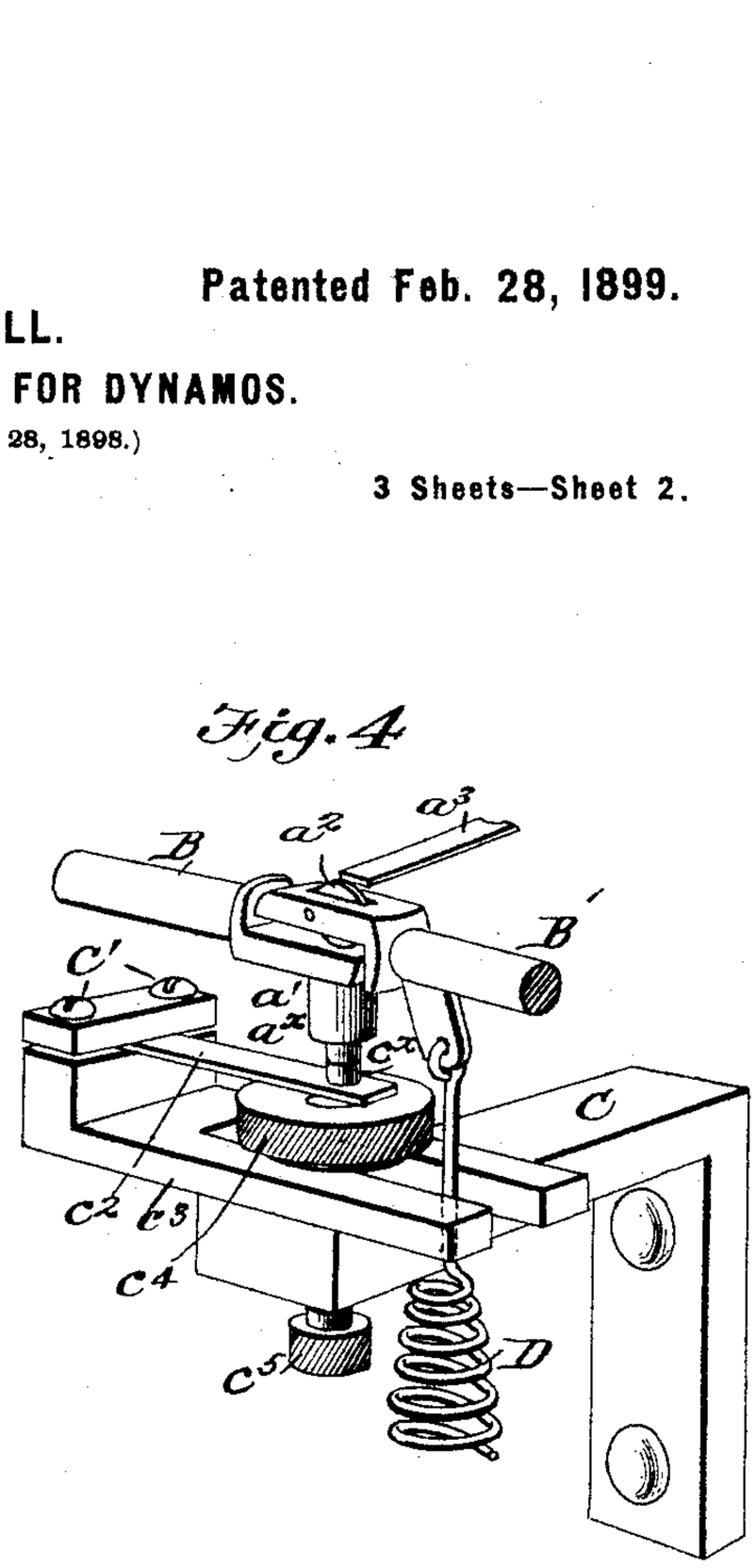


Fig. 4



WITNESSES:

W. A. Blondel.

Edw. W. Byrn.

INVENTOR

Allen A. Tirrill.

BY Munn & Co.

ATTORNEYS.

No. 620,514. Patented Feb. 28, 1899.

A. A. TIRRILL.

POTENTIAL REGULATOR FOR DYNAMOS.

(Application filed Apr. 28, 1898.)

(No Model.) 3 Sheets—Sheet 3.

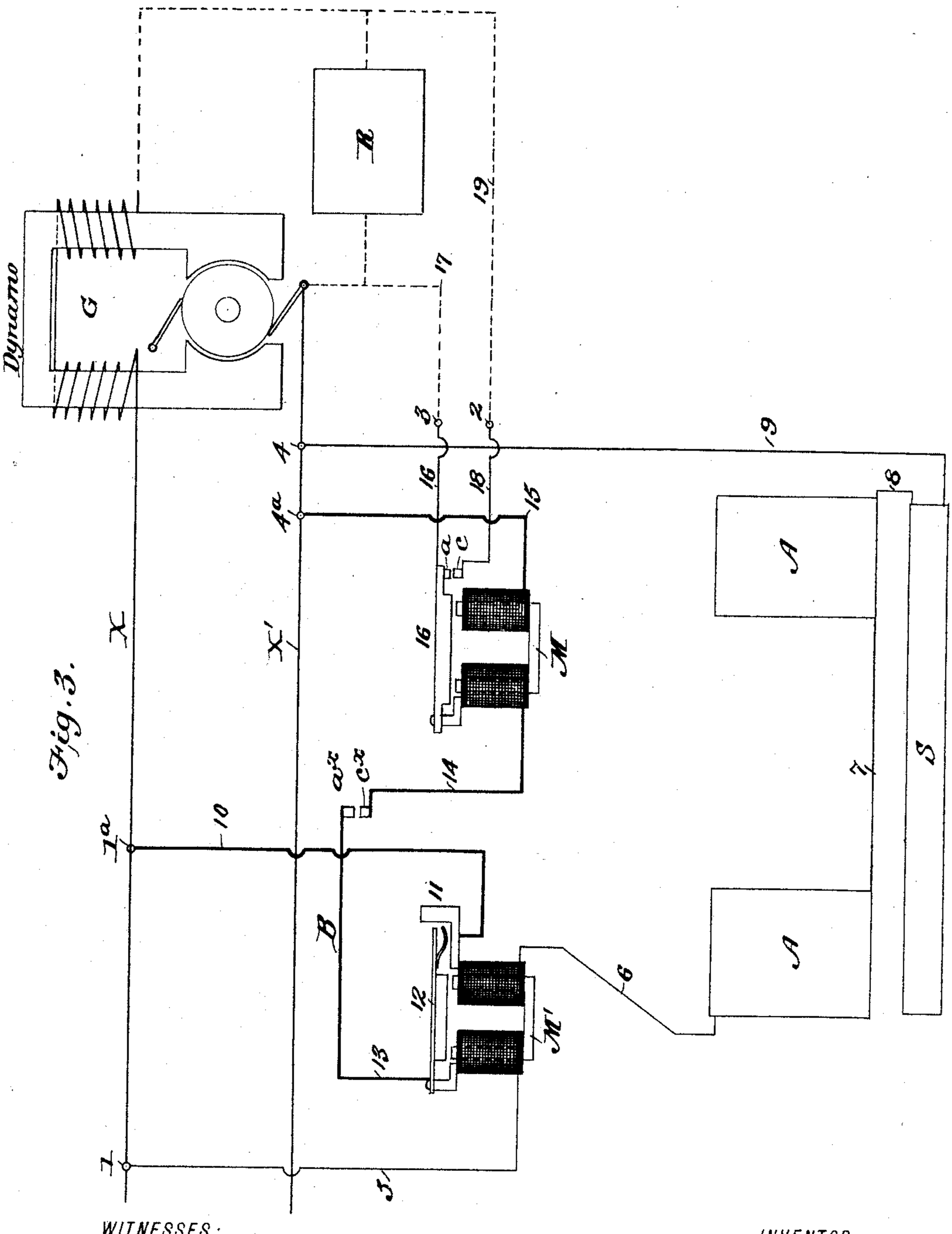


Fig. 3.

WITNESSES:
W. D. Bloodel.
Edw. W. Byrn.

INVENTOR
Allen A. Tirrill.
BY Munn & Co.
ATTORNEYS.

UNITED STATES PATENT OFFICE.

ALLEN AUGUSTUS TIRRILL, OF WHITEFIELD, NEW HAMPSHIRE, ASSIGNOR TO THE TIRRILL AUTOMATIC POTENTIAL REGULATOR COMPANY, OF LACONIA, NEW HAMPSHIRE.

POTENTIAL-REGULATOR FOR DYNAMOS.

SPECIFICATION forming part of Letters Patent No. 620,514, dated February 28, 1899.

Application filed April 28, 1898. Serial No. 679,079. (No model.)

To all whom it may concern:

Be it known that I, ALLEN AUGUSTUS TIRRILL, of Whitefield, in the county of Coos and State of New Hampshire, have invented a new and useful Improvement in Automatic Potential-Regulators for Dynamos, of which the following is a specification.

In a prior patent granted to me in connection with Philip S. Tirrill as joint inventors, January 4, 1898, No. 596,923, we showed and described an automatic potential-regulator for dynamos whose object was to automatically regulate the potential or voltage on the supply-wires, so that an even potential shall always be maintained on said wires notwithstanding the varying tax or demand made upon the supply-wires by the starting and stopping of electric motors or the throwing in and out of circuit electric lights, &c. My present invention is an improvement upon that machine, designed to overcome certain objections which experience has developed and chief among which is the tendency of the solenoid contact-points to stick, in obviating which I employ a relay and a second set of contact-points and a separate or supplemental circuit, and also certain other features which will be hereinafter fully shown and described with reference to the drawings, in which—

Figure 1 is a front elevation of the instrument; Fig. 2, a vertical longitudinal section on line 2 2 of Fig. 1; Fig. 3, a diagram of circuits, and Fig. 4 is an enlarged detail in perspective of the solenoid-contacts.

In the drawings, A A represent the hollow coils of two solenoids, arranged in vertical position and fixed within a suitable case on a non-conducting backing of marble or slate. In the center of these hollow coils there vibrate freely in vertical direction the soft-iron cores A′ A′, made preferably of laminated wire and suitably incased with rubber shells. The tops of these cores are connected by stem to and suspended from the outer ends of delicately-balanced levers B B′, of metal, which are fulcrumed upon pivots within supporting frames or brackets b b', and at their inner ends are lapped for a loose-jointed connection and are pulled down by a spring D, having a stem d and adjusting devices at its lower end. As so far described, the mechanical devices are substantially the same as those referred to in said previous patent. To hold the cores A′ A′ against swinging about and dragging with a friction against the inside of the cores, I extend a stem s from the lower end of each core and cause this to be guided in an arm s^2, so as to always maintain an exactly concentric position to the coils without allowing the cores to touch the inside of the coils at all. The lever B has fixed to it at its inner end a metal boss a', carrying a platinum contact-face $a\,x$. (See Fig. 4.) The other lever B′ where it laps over B is provided with a metal disk or roller a^2, arranged in a vertical plane and bearing upon the end of lever B, so as to roll in contact therewith when the inner ends of the levers rise and fall, so as to reduce friction at the point of articulation.

Just above the end of lever B′ there is arranged a flat spring a^3, adjusted downwardly by a set-screw a^4, mounted in a stud a^5, projecting from the marble back of the instrument. This spring serves to quickly throw down the inner ends of the levers when they rise and strike against the same, and its tension may be adjusted to act sooner or later, as circumstances may render desirable.

Just below the platinum contact-points $a\,x$ there is another, $c\,x$. This is mounted upon a flat horizontal spring c^2, adjusted longitudinally by screws c' in a bracket-shaped piece c^3, whose horizontal member is slotted and clamped to a bracket C, projecting from the marble back, by means of a nut c^4 and screw c^5.

1 and 4 are binding-posts, which connect with the two upper wires of the circuit to be regulated.

2 and 3 are binding-posts connecting with the wires of the shunt-circuit that energizes the field-magnets of the dynamo, these connections being substantially the same as those shown in said previous patent. Instead, however, of connecting the binding-posts 2 and 3 to the terminal contacts at the inner ends of levers B B′, as in said previous patent, I connect them to other contact-points a and c, (see Fig. 3,) controlled by a relay-magnet M, placed in an independent or supplemental circuit taken from the supply-wires through binding-posts 1^a and 4^a. The heavy black lines in Fig. 3 show this supplemental circuit,

which constitutes one of the principal features of my improvement. The light continuous line from binding-posts 1 to 4 shows the main circuit as originally used and which I term the "primary branch circuit," and the dotted line the dynamo shunt-circuit as originally used. Referring now to Fig. 1 again, I will trace these circuits through the instrument and complete the detailed description of the same. For the primary branch circuit the current from one of the supply-wires X, entering binding-post 1, passes by wire 5 to electromagnet M′, (whose function will be hereinafter described,) and through the same to wire 6, solenoid-coil A, wire 7, solenoid-coil A on the other side, then by wire 8 to resistance S, and thence by wire 9 to binding-post 4 and the other one of the supply-wires X′. The resistance S interposed in this circuit is simply for the purpose of preventing the burning out of the coils M′, A, and A from too great electrical energy. This resistance consists of a series of non-conducting slabs, each with a single layer of silk-covered German-silver wire, the spacing of these coils on the separate cores being for the purpose of allowing a thorough ventilation and preventing the heating of the coil, as shown in Fig. 2.

The supplemental circuit, which constitutes one of my added features of improvement, is introduced (see Figs. 1 and 3) through the binding-posts 1^a and 4^a. This is taken off the supply-wires X and X′ as follows: Coming in from supply-wire X to post 1^a to wire 10 it goes to a metal contact 11, which is an insulated stop of an armature 12 of magnet M′. From this stop-contact it passes through the normally-closed armature 12, which is constantly attracted by the constantly-energized condition of magnet M′, from armature 12 to wire 13 and solenoid-lever B, and whenever contacts $a\ x$ and $c\ x$ are closed it passes through them to wire 14, the coils of relay M to wire 15, and the binding-post 4^a to the supply-wire X′ of opposite polarity. The relay-magnet M has an armature 16 with a platinum point a playing upon a platinum point c. The point a is connected by wire 16 with binding-post 3 and wire 17 with one pole of the dynamo field-magnet, and the other point c is connected by wire 18 to binding-post 2 and wire 19 with the other pole of the dynamo. The contact-points a and c, it will be seen, constitute, therefore, the terminals of the shunt-circuit of the dynamo field-magnets, in which shunt-circuit, as shown in said previous patent, is arranged the resistance R, and in the action of the present invention when the current on the supply-wires falls in potential this shunt-circuit is closed through the contacts $a\ c$, and the resistance R being cut out there is a greater energizing of the field-magnets, and the dynamo is made to instantly bring up the potential of the line in an automatic manner to compensate for its reduction made by the throwing in of lights, motors, or other uses of the current. In said previous patent the terminals of this shunt-circuit were closed by the direct action of the solenoid-lever B at $a\ x$. This, however, was found to be objectionable, for the reason that the great amount of energy that they were obliged to carry for the regulation of large dynamos, together with the induction, would cause a spark at the points, and after the spark was broken by the condenser said points would come together and stick hard enough to require from one to three volts above the normal voltage to open them again, thus destroying the sensitiveness of the regulation and causing a flickering of the lights on the line. My present invention is designed to relieve the sensitive contact-points from this great amount of energy, and this I accomplish by the supplemental circuit through the binding-posts 1^a and 4^a and the relay M, the shunt-circuit of the dynamo being controlled through terminals worked by the relay M and the relay M by the supplemental circuit worked by the solenoid contact-points $a\ x$ and $c\ x$.

Referring now to Fig. 3 particularly and remembering that magnet M′ is always energized and the armature 12 always resting normally upon stop 11 whenever the potential on the line X X′ falls, the inner ends of levers B B′ descend and contacts $a\ x$ and $c\ x$ come together. This completes the supplemental circuit through relay-magnet M, and energizing relay-magnet M closes the contact-terminals $a\ c$ of the shunt-circuit of the dynamo field-magnets, cutting out resistance R and at once increasing the potential on the line correspondingly to the tax made upon it When equilibrium is restored and the potential is brought up to normal, the solenoid-coils A A lift the inner ends of levers B B′ against the spring D, break contact at $a\ x$ and $c\ x$, and also instantly breaking contact at $a\ c$ and again throwing in the resistance R into the shunt-circuit. Thus a sensitive automatic regulation is obtained at all times and under all conditions.

I will now describe the function of the electromagnet M′.

It will be seen that if the solenoid-circuit from 1 to 4 be broken at any time by any accident, as the falling of a tree or any similar cause, then the spring D would hold the contacts $a\ x$ and $c\ x$ into permanent closure, rheostat R would be permanently cut out, and the potential on the line would run up to a high and dangerous pitch. To prevent this, the supplementary circuit from 1^a to 4^a is made to be broken by any accidental breakage of the main solenoid-circuit through the instrumentality of the electromagnet M′ and contact-points 11 and 12, for if the main circuit which passes through coils of magnet M′ be thus broken the magnet M′ being demagnetized armature 12 flies up and contact is broken between 11 and 12, and as these are also terminals of the supplementary circuit it will be seen that the supplementary circuit

is broken, contacts *a x* and *c x* are rendered null in effect, and even if they be closed no current flows through the supplementary circuits and the terminals *a c* of the shunt from the dynamo are kept permanently open and the line then works with the constant resistance of the rheostat R.

When more than one dynamo is employed on the supply-wires, it is obvious that the relays M and the shunt-circuits of the dynamos may be multiplied to correspond with the number of dynamos used.

In some applications of my invention it may be desirable to reduce the energy of the solenoid-coils A A, and for this purpose I may compound the same by winding coils of wire A^2 A^2 upon the same in opposite direction to the solenoid-coils. These additional coils A^2 have a series of binding-screws A^3 arranged at different points along their length, and connections A^4 A^5 A^6 are arranged to throw the current through any portion of these added coils to choke or retard the working current in the solenoid-coils to any desired degree.

In illustrating my invention I have shown two solenoid-coils A A and two levers B B′; but it is obvious that my invention might be carried out with only one such coil and lever, and my invention is designed to have this scope. I prefer, however, to use the two coils and two levers for the reason that it is a more efficient and more symmetrical apparatus.

In connection with my regulator as thus described I may also use a condenser as shown in said previous patent referred to.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In a potential-regulator for a dynamo, the combination with the main supply-wires, and a normally-closed primary branch circuit connected to the supply-wires and provided with one or more operating-helices; of a pair of contact-terminals arranged to be opened or closed upon each other by the action of said helices, a supplementary branch circuit connected also to the supply-wires and terminating in the pair of contacts aforementioned, a relay arranged in this supplementary circuit, a shunt-circuit connecting with the dynamo and provided with a rheostat, said shunt-circuit having two terminals extended to the armature of the relay and being opened or closed by the same substantially as and for the purpose described.

2. In a potential-regulator for a dynamo, the combination with the main supply-wires; of a solenoid-regulator circuit connected to the supply, a shunt-circuit from the dynamo field-magnets with rheostat, a supplementary circuit and relay, the relay being worked by this supplementary circuit and controlling the terminals of the shunt-circuit, and the supplementary circuit having terminals operated by the solenoid-circuit, and also an electromagnet placed in the solenoid-circuit and having an armature arranged when attracted to close the supplementary circuit, and to open the same and render it inoperative whenever the solenoid-circuit is accidentally broken substantially as and for the purpose described.

3. In a potential-regulator for dynamos, the combination of the solenoid-coils, their cores, and the levers B B′ bearing contact-point as described, a spring for drawing the inner ends down, and a superposed adjustable spring arranged above the inner ends of the levers to be impacted against by the rise of the inner ends of the levers whereby the latter are made to quickly return substantially as described.

4. In a potential-regulator for dynamos, the combination with the solenoid-coils, their cores, and the levers B B′ having contact-points as described, the inner ends of said levers being lapped and the upper one having a spring to draw it down and a rotary disk or roller resting upon the lower lever, said disk being arranged in the plane of the levers to form a sensitive articulation substantially as described.

5. In a potential-regulator for dynamos, the combination with the solenoid-coils, their cores, and the levers B B′ having contact-point as described, a subjacent spring bearing a contact-point, and a clamping-support for said spring made adjustable to grasp said spring at different positions along its length to vary its range of vibration substantially as and for the purpose described.

ALLEN AUGUSTUS TIRRILL.

Witnesses:
SCOTT H. SLOANE,
RAYMOND E. SMITH.