No. 697,834. Patented Apr. 15, 1902.

J. J. GHEGAN.

CIRCUIT CONTROLLER.

(Application filed Aug. 20, 1901.)

(No Model.) 2 Sheets—Sheet 1.

Fig. 1.

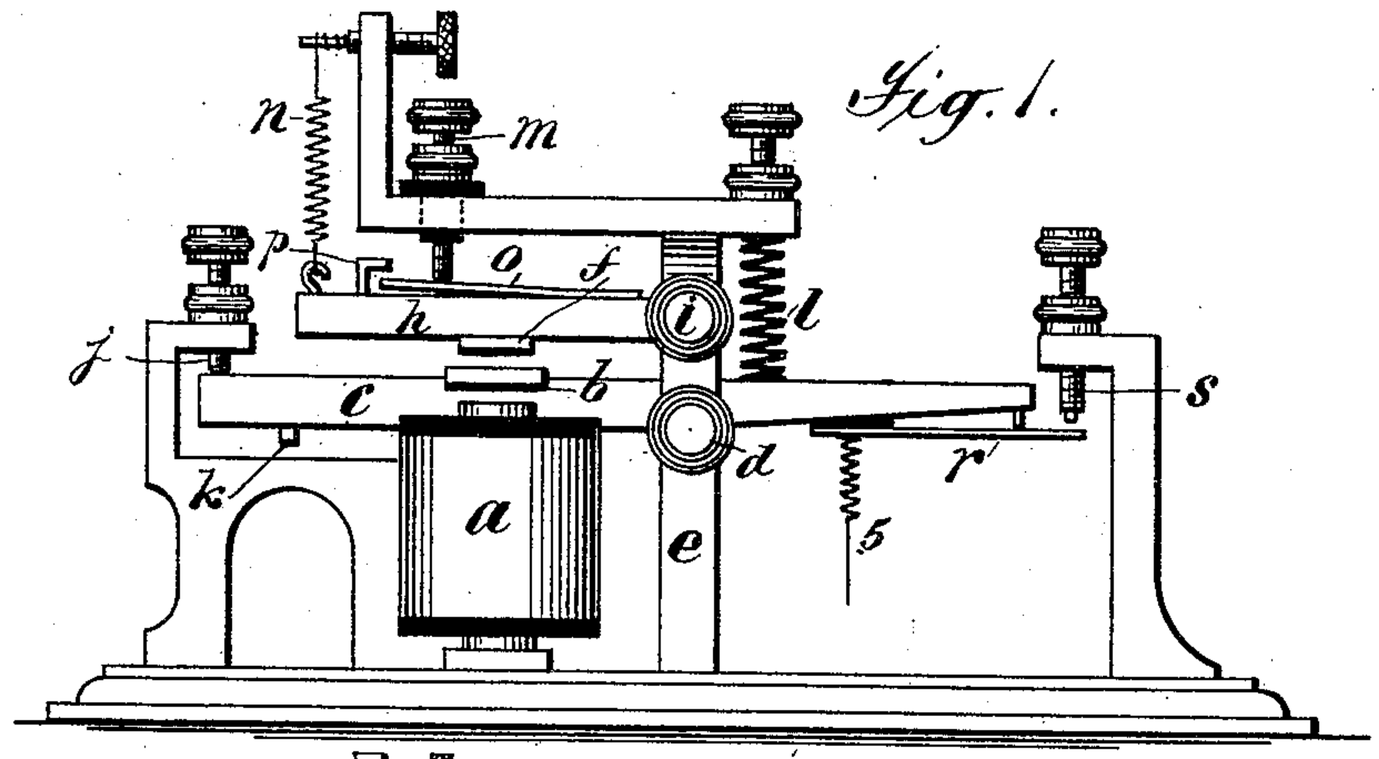


Fig. 2.

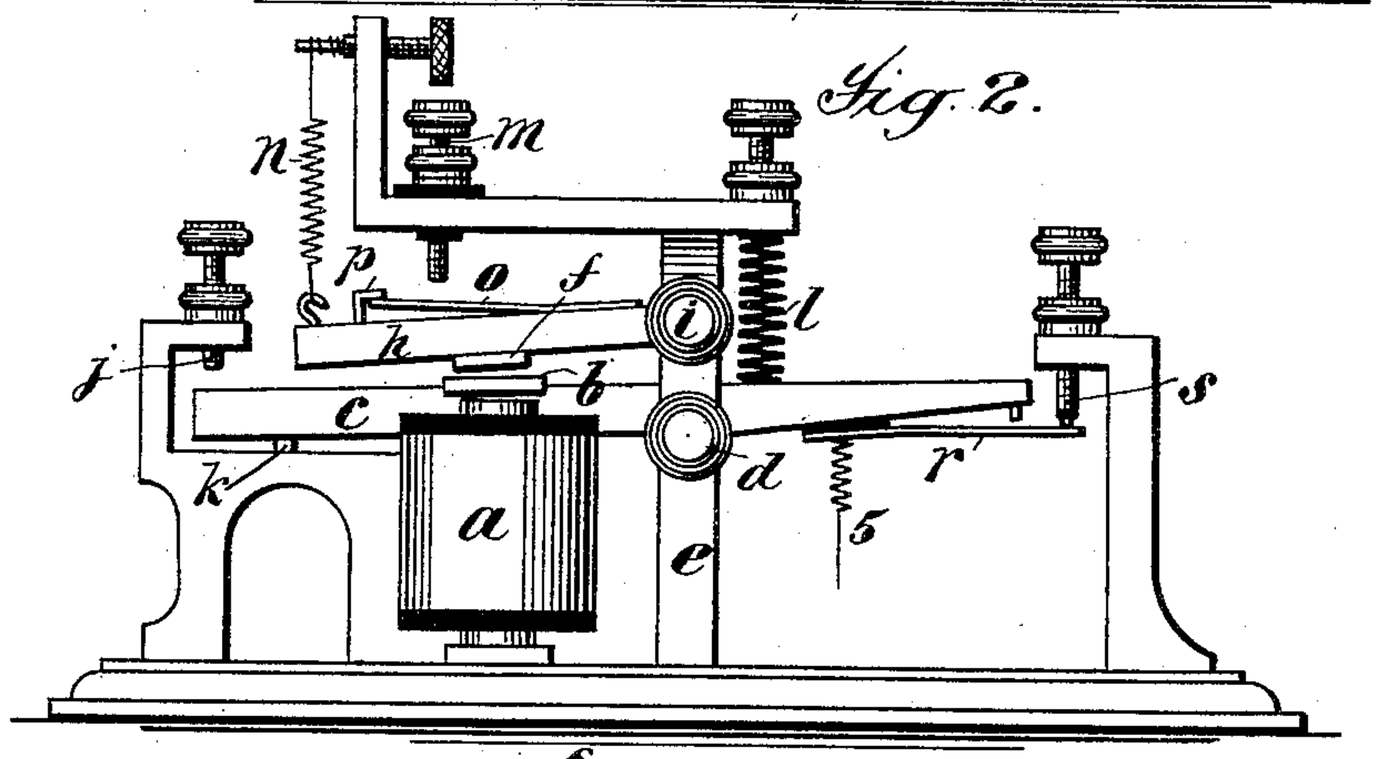
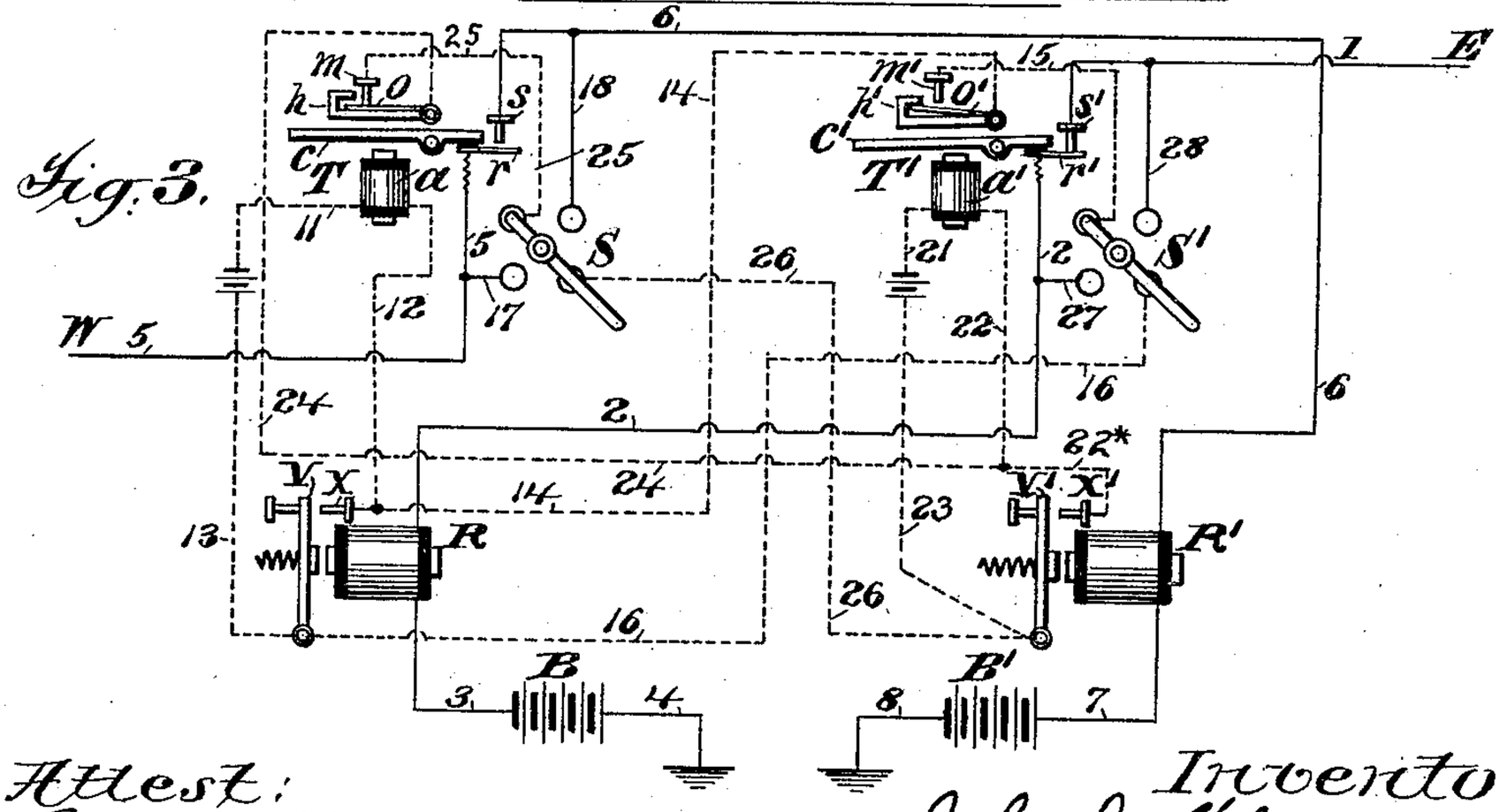


Fig. 3.



Attest:
Geo. H. Botts
Eliza MacRoberts

Inventor:
John J. Ghegan
By Edith J. Griswold
Atty:

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Fig. 4.

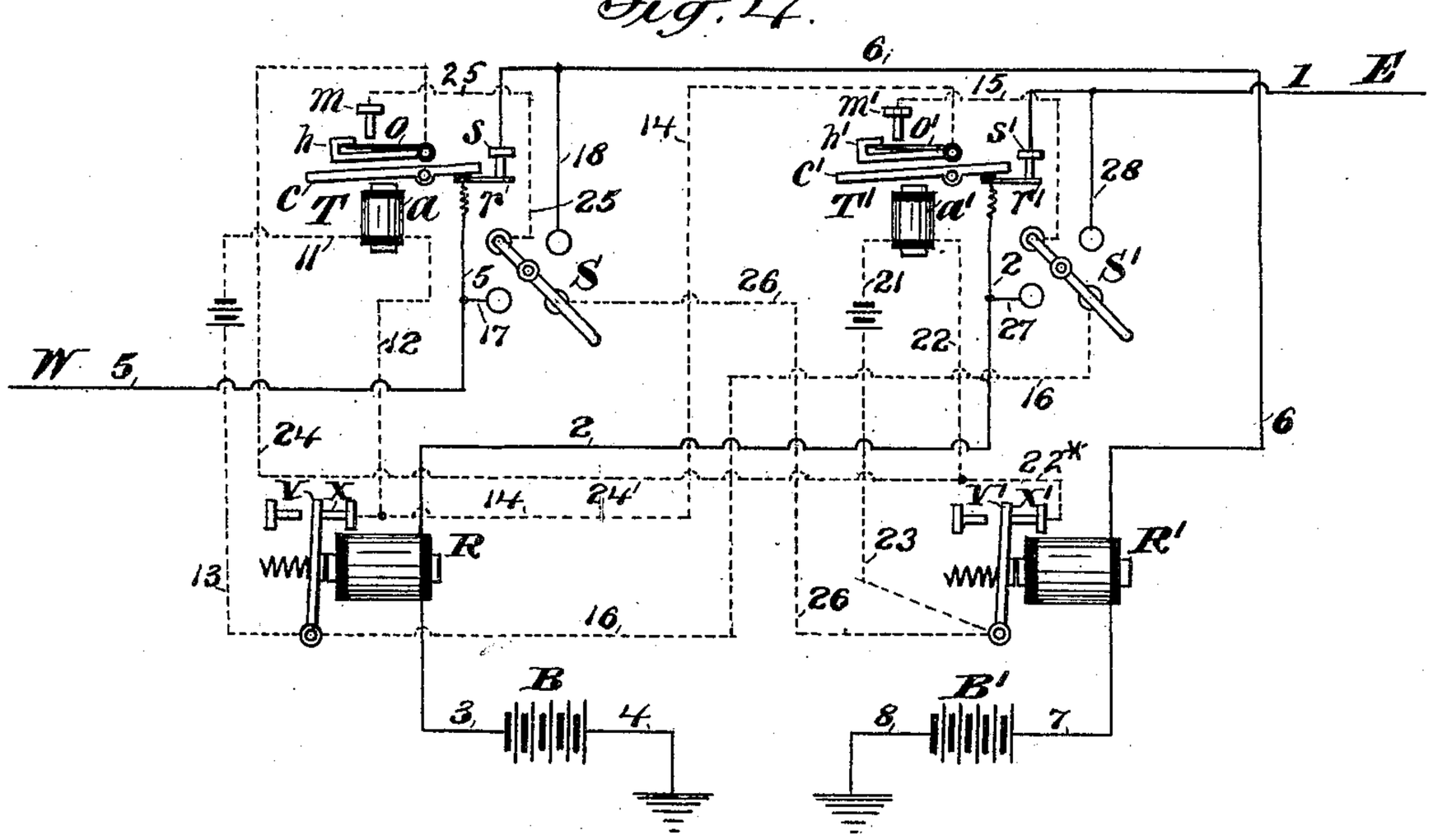
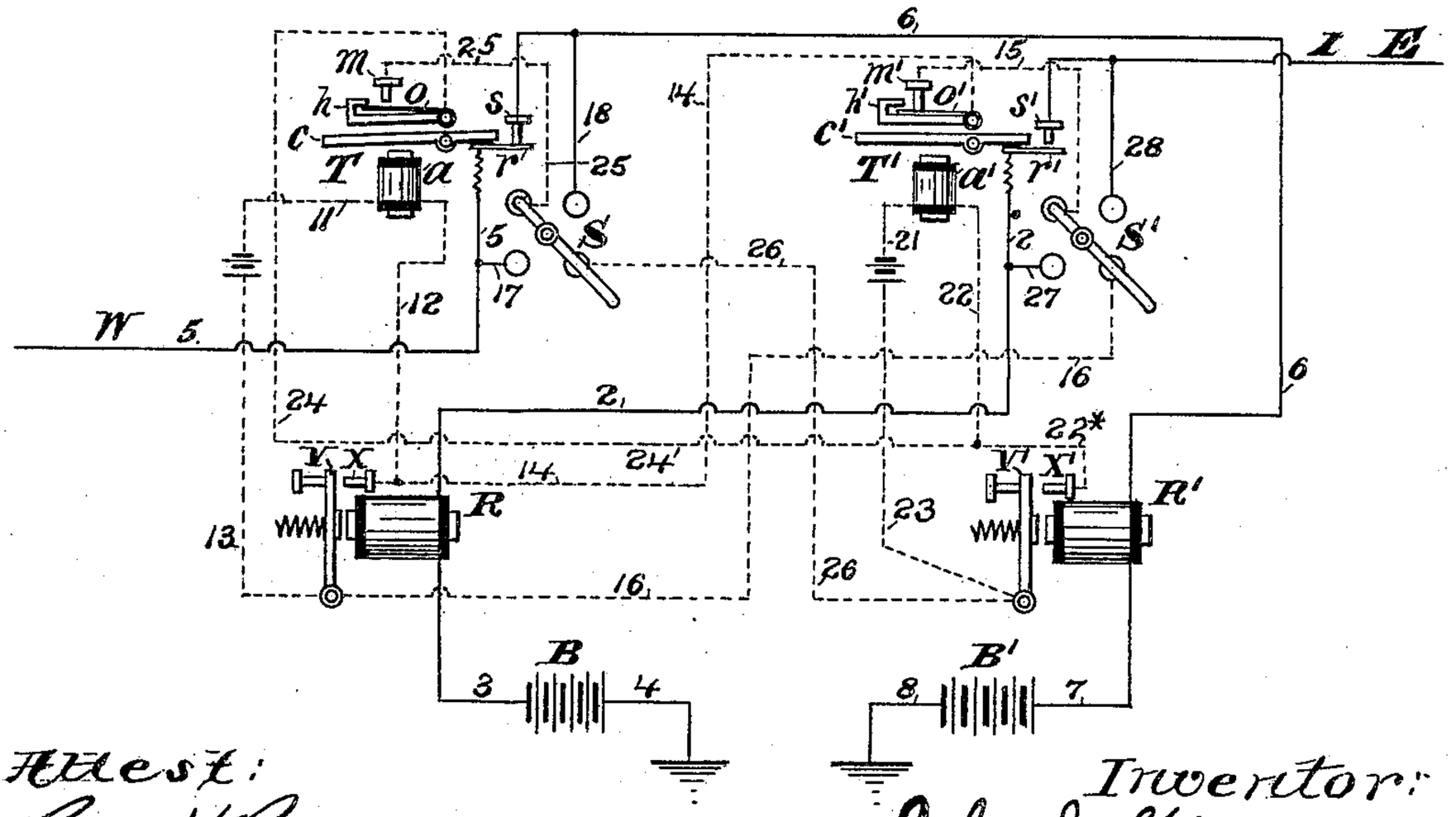


Fig. 5.



Attest:
Geo. H. Botts
Elijah MacRoberts

Inventor:
John J. Ghegan
By Edith J. Griswold
Atty.

UNITED STATES PATENT OFFICE.

JOHN J. GHEGAN, OF NEWARK, NEW JERSEY.

CIRCUIT-CONTROLLER.

SPECIFICATION forming part of Letters Patent No. 697,834, dated April 15, 1902.

Application filed August 20, 1901. Serial No. 72,662. (No model.)

To all whom it may concern:

Be it known that I, JOHN J. GHEGAN, a citizen of the United States, residing at Newark, Essex county, New Jersey, have invented a Circuit-Controller, of which the following is a specification.

My invention relates to an electromagnetic device in the form of a circuit-controller in which the magnetism induced by an electric current is utilized to act through a plurality or series of parts or pieces capable of having magnetism induced therein.

To illustrate the principle of my invention, I have shown it applied to a device in the form of an electromagnet having two armatures, the second armature being acted upon by the magnetism induced in the first armature and contact-points controlled by said armatures, and to illustrate a practical use of this device I have shown its application to an automatic telegraph-repeater, in which field it is of great utility.

In the accompanying drawings, Figures 1 and 2 represent elevations of one form of a spring-point repeating-sounder provided with a second armature according to my invention, Fig. 1 showing the movable parts in the position when the current is off, and Fig. 2 showing the position of these parts when the current is on. Figs. 3, 4, and 5 are diagrams representing a novel telegraph-repeater employing my improved device.

I will first describe the instrument embodying the principle of my invention and then describe the application of this instrument to my new telegraph-repeater system.

For convenience I will call the complete instrument shown in Figs. 1 and 2 a "compound circuit-controller."

Referring to Figs. 1 and 2, the instrument comprises an electromagnet *a*, an armature *b*, carried transversely on the top (or, as shown, countersunk in the top) of the armature-lever *c*, which lever is pivoted at *d* in the support or arch *e*, and a second armature *f*, just above the armature *b*, fixed to the lower side of a second armature-lever *h*, also pivoted in the support *e* at *i*. Suitable stops *j* and *k* limit the vertical motion of the lever *c*, due to the action of the magnet *a* and opposing compression-spring *l*, and an insulated contact-screw *m* forms an adjustable stop for the lever *h* when drawn up by the retractile spring *n*. Contact between the lever *h* and contact-screw *m* is preferably made through a spring *o*, as shown, normally tending to press upward against the hook *p* on the lever *h*. The prolonged end of the armature-lever *c* carries an insulated spring *r*, making contact with the adjustable screw *s* when the armature *b* is drawn down by the magnet *a*. When a suitable current is passed through the electromagnet *a*, its cores become magnetized and draw down the first or regular armature *b*, which on approaching the cores becomes magnetized by induction from them, forming a magnet with opposite poles, which in turn attracts the second armature *f*. Thus I utilize the magnetism induced in the cores of an electromagnet by the electric current to act through a plurality of armatures or other parts capable of having magnetism induced therein.

In automatic telegraph-repeaters various devices have been used for keeping the "opposite side closed," which generally include special relays with extra cores, extra relays, or other complicated arrangements requiring extra batteries.

In my system of telegraph-repeater two of my compound circuit-controllers and two ordinary Morse relays constitute a complete set of automatic repeaters.

Referring again to Figs. 1 and 2, the closer the armature *b* approaches the cores of the electromagnet *a* the more magnetic it becomes; but it does not instantly acquire its maximum magnetic point—that is, it takes an appreciable period to reach its greatest saturation. However, when made of proper material it demagnetizes instantly on the slightest interruption of the current through the electromagnet. Also experiment has shown that the second armature draws back faster than the first armature when the current is interrupted. I take advantage of these facts to cause the movements of the armatures to differ in time according to the adjustment of their respective tension-springs, so that, if necessary, the first armature-lever may be on its front stop for a short and limited time before the second armature-lever moves from its

back stop. Consequently by having the contact-points of the second armature in a shunt-circuit from the local contact-points of the opposite relay of a set of automatic repeaters the opposite transmitter can be kept closed until after the main circuit, which is operated by the regular contact-points of the transmitter, has energized the relay-magnets and closed the local contact-points in the regular way, as hereinafter explained. In all other forms of automatic repeaters the circuit controlling the device for holding the "opposite side" passive is released the instant the transmitter-lever reaches its front stop, whereas I gain the great advantage of maintaining the circuit closed for a short period after the transmitter has completed its downward movement, whereby the repeater is made operative on the most sluggish-working leaky circuits.

Referring to diagrams Figs. 3, 4, and 5, two regular Morse relays R and R′ and two of my instruments acting in the double capacity of transmitters and controllers (designated by T and T′) are shown connected up to form a set of automatic repeaters. Switches S S′ are inserted to separate the two main lines. The main line from the east E passes to the relay R by way of the contact-points s' r' of the controller T′, and the main line from the west W passes to the relay R′ by way of contact-points s r of the controller T. The local circuits of the transmitter-magnets a a' may be closed in two ways—that is, the circuit of magnet a may be closed through contact of the armature v and front stop x of relay R or through the shunt passing from armature-lever v through switch S′ to contact-point m' of the opposite controller T′ through spring o' of the second armature-lever of the controller T′ to contact-stop x. In like manner the shunt-circuit of the magnet a' may be traced.

The operation is as follows, it being understood that the main-line contact-points s and s' and the local contact-points m and m' are so adjusted that on opening the transmitter-circuit contact will be made at m o or m' o' before the main circuit is broken at s r or s' r': Fig. 4 represents the positions of all the parts when no messages are passing. The circuits are then as follows: The current coming in by the main eastern line E passes through wire 1, contacts s' r', wire 2, relay R, wire 3, battery B, and wire 4 to ground-return. The current coming in by the main western line W passes through wire 5, contacts r s, wire 6, relay R′, wire 7, battery B′, and wire 8 to ground-return. The relays R R′ being magnetized, the armatures v v' are on the front stops x x' and the local circuits of the magnets a a' are closed, as follows: The current from the local battery of the transmitter T passes through wire 11, magnet a, wire 12, front stop x, lever v, and wire 13 back to battery. The current from the local battery of transmitter T′ passes through wire 21, magnet a', wires 22 and 22*, front stop x', lever v', and wire 23 back to battery. Supposing a key is opened on the main line east, this opens the circuit of relay R, Fig. 3, its armature v falls back and opens the circuit of the transmitter-magnet a, the shunt through the opposite controller T′ being open, as shown, as the magnet a' is energized. By opening the circuit of the magnet a both armatures of the controller T are drawn up; but because of the adjustment above mentioned and the fact that the second armature draws back more rapidly than the first armature when the circuit is interrupted contact is made at m o before contact is broken at r s of the main western line, so that the shunt-circuit of controller T′ is closed at m o, and thus the controller T′ kept passive, notwithstanding the falling back of the armature-lever v' of the relay R′ when its circuit is broken at r s. The positions of the instruments when a key on the eastern line is open are shown in the diagram, Fig. 3. The circuits are then as follows: No current is passing through either main line, and in consequence the contacts v x and v' x' of the local circuits of the controller-magnets are open. The controller T′ being maintained passive, as explained, the shunt-circuit also of the controller T is broken at m' o'. The controller T being thus demagnetized, the shunt-circuit of the controller T′ is closed at m o and the current from the local battery of controller T′ passes through wire 21, magnet a', wires 22 and 24 to the closed contacts m o through wire 25, switch S, and wires 26 and 23 back to battery. On closing the key on the main eastern line the relay R draws its armature to the front stop and closes the circuit of the magnet a, and here comes in the great advantage of the retarded movement of the second armature-lever of the compound circuit-controller. If the second armature-lever were to move in unison with the regular armature-lever and break the shunt-circuit at m o of the opposite transmitter at or before the moment of closing the circuit of the main western line at r s, there would be a "kick" in the opposite transmitter, because the moment the circuit of the main western line is closed at r s the armature of relay R′ is on its back stop. In other words, the advantage of retarding the breaking of the shunt-circuit at m o until after the main circuit has been closed at r s is to give the armature of relay R′ time to close its local circuit, and thus keep the controller T′ passive. This retarding method is particularly advantageous on lines having heavy escapes which cause the relay-armatures to move very sluggishly. The spring-contacts o o' act as further retarders, as will readily be seen. The parts have again resumed their normal positions when no messages are passing or when there is no break in either main line, as shown in Fig. 4, the circuits being as already described in reference to that figure. Should an operator on the main western line desire to

"break" while one on the main eastern line is sending by opening his key, the relay R' will remain demagnetized even when the east closes his key, with the following result: Referring to Fig. 3, it will be seen that at the instant of closing the eastern line the current can pass through relay R, as already described; but as soon as the relay R is magnetized and draws its armature v to the front stop x the local circuit of magnet a is closed, (through wire 11, magnet a, wire 12, stop x, lever v, and wire 13,) and the magnet a then draws down its armatures, as shown in diagram Fig. 5, thus breaking the contact at $m\ o$ in the shunt-circuit of the controller T'. The relay R' remaining demagnetized, the local circuit of the controller T' is also broken at contacts $v'\ x'$, causing the magnet a' to become demagnetized. When the armatures of magnet a' are drawn up, first the contacts $m'\ o'$ close and then the contacts $r'\ s'$ open, the difference in time being due to the retarding action hereinbefore explained. Referring now to Fig. 5, which shows the parts in the position when west has broken in upon east, it will be seen that the contacts $m'\ o'$ having first been closed the shunt-circuit of magnet a has been closed (through wire 11 from battery, magnet a, wires 12 and 14, contacts $o'\ m'$, wire 15, switch S', wires 16 and 13 back to battery) before the break at $s'\ r'$ in the main eastern line. When this break occurs, relay R becomes demagnetized; but although this breaks the local circuit of magnet a at $v\ x$, its shunt-circuit being closed, as just explained, the controller T remains passive. West can then send to east so long as east leaves his key closed. By turning the switches S S' onto the other opposite contact-points shown the two lines east and west are separated and the instruments can be used as ordinary single Morse apparatus. The current from the east passes through wires 1 and 28 to switch S', thence by wires 27 and 2 through relay R, wire 3, battery B, and wire 4 to ground-return, and the current from the west passes through wires 5 and 17, switch S, wires 18 and 6, relay R', wire 7, battery B', and wire 8 to ground.

While I have shown the principle of my invention as applied to a telegraph-repeater, it will be evident that it may be put to various other uses, and I do not limit myself either to the particular use herein shown or to the particular construction of the instrument. It is also evident that more than two armatures could be magnetized and in turn impart magnetism, and the word "armature" in the claims is to be given its broadest signification—that is, the word covers any piece or mass of magnetizable material so placed in any way as to be acted upon by the magnetism of the adjacent part.

I claim as my invention—

1. A compound circuit-controller comprising an electromagnet and its armature, with a second armature actuated by the magnetism induced in the regular armature, and a plurality of "make-and-break" points controlled by said armatures.

2. A compound circuit-controller comprising an electromagnet and its armature, with a second armature actuated by the magnetism induced in the regular armature, the said armatures being provided with contact-points.

3. In a compound circuit-controller, the combination of a plurality of circuit-controlling contacts, with a series of three or more parts of magnetizable material adapted to control said contacts, and a source of electric current adapted to induce magnetism in one of said parts, the said series being so arranged that magnetism induced in one of said parts will, in turn, induce magnetism in the second, and so on throughout the series.

4. A compound circuit-controller comprising an electromagnet and its armature, a second armature actuated by the magnetism induced in the regular armature, and a plurality of "make-and-break" points controlled by the said armatures at different times for each make or break in the circuit of the electromagnet.

5. The combination of two compound circuit-controllers each comprising an electromagnet provided with two armatures actuated thereby, with two circuits each including the coils of one of said magnets, and a shunt-circuit for each of said magnets, the shunt-circuit of one magnet being controlled by one of the armatures of the other magnet.

6. The combination of two compound circuit-controllers each comprising an electromagnet provided with two armatures actuated thereby, with two circuits each including the coils of one of said magnets, two relays, each controlling one of said circuits, and a shunt-circuit for each of said magnets, the shunt-circuit of one magnet being controlled by one of the armatures of the other magnet.

7. The combination of two compound circuit-controllers each comprising an electromagnet provided with two armatures actuated thereby, with two circuits each including the coils of one of said magnets, two relays, each controlling one of said circuits, a shunt-circuit for each of said magnets, the shunt-circuit of one magnet being controlled by one of the armatures of the other magnet, and two more circuits each including one of the said relays and controlled by the other armature of one of the magnets.

8. The combination of two circuit-controllers each comprising an electromagnet provided with two armatures actuated thereby, with two circuits each including the coils of one of the said magnets, two relays each controlling one of said circuits, a shunt-circuit for each of said magnets, the shunt-circuit of one magnet being controlled by the second armature of the other magnet, two more circuits each including one of said relays and

controlled by the first armature of the magnet whose circuit is controlled by the other relay, and means for adjusting the said armatures of each controller to first close the shunt-circuit of the other controller and then open the circuit of the relay controlling the first-named circuit of said other controller at one actuation of the controller-magnet, and at the other actuation thereof to first close the last-named relay-circuit and then open said shunt-circuit of the other controller.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

JOHN J. GHEGAN.

Witnesses:
EDITH J. GRISWOLD,
EDITH SARLES.