(No Model.) 4 Sheets—Sheet 1.

A. L. CREELMAN.

ELECTRIC CIRCUIT PROTECTOR.

No. 584,462. Patented June 15, 1897.

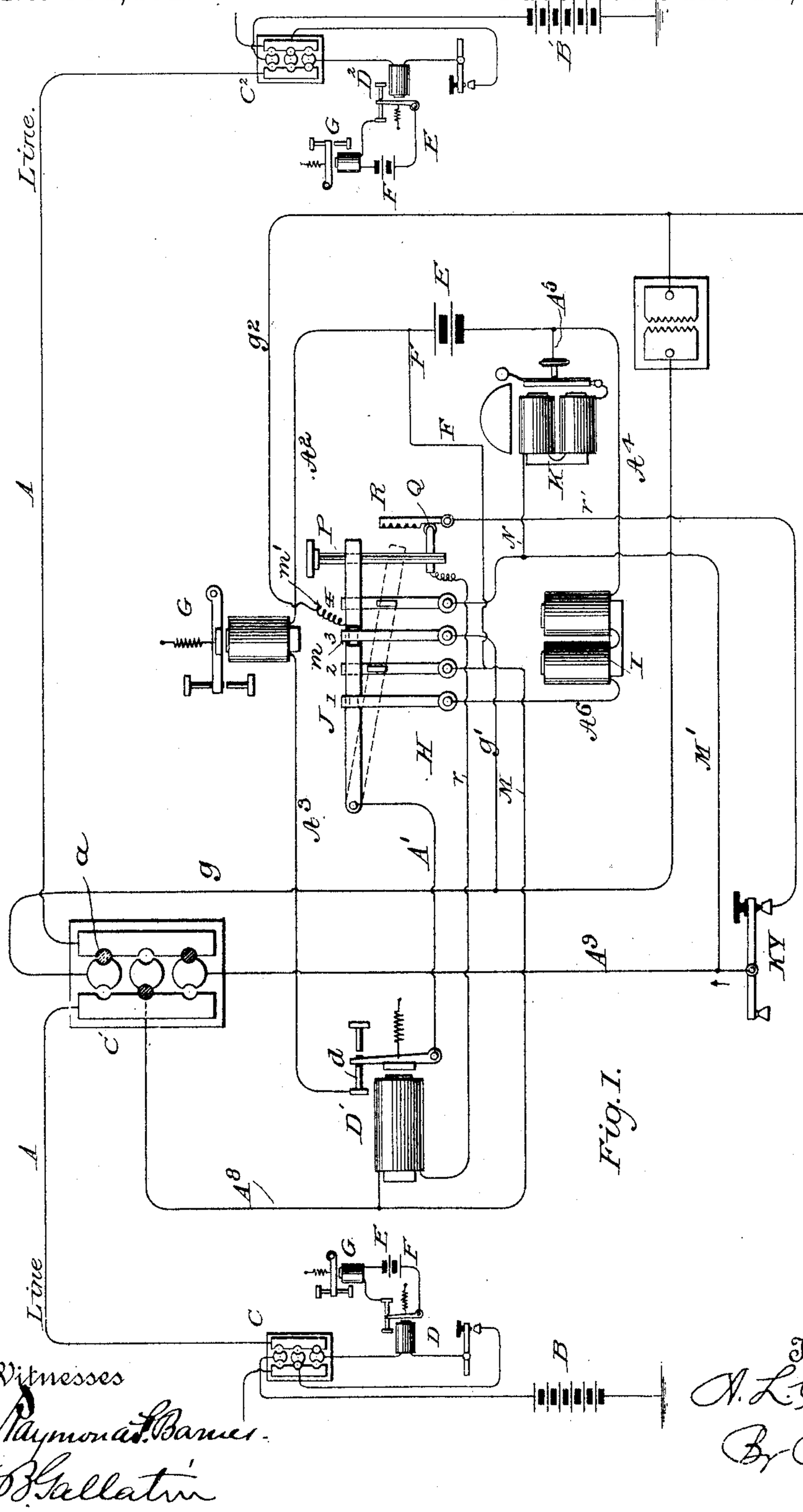

Fig. 1.

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(No Model.) 4 Sheets—Sheet 2.

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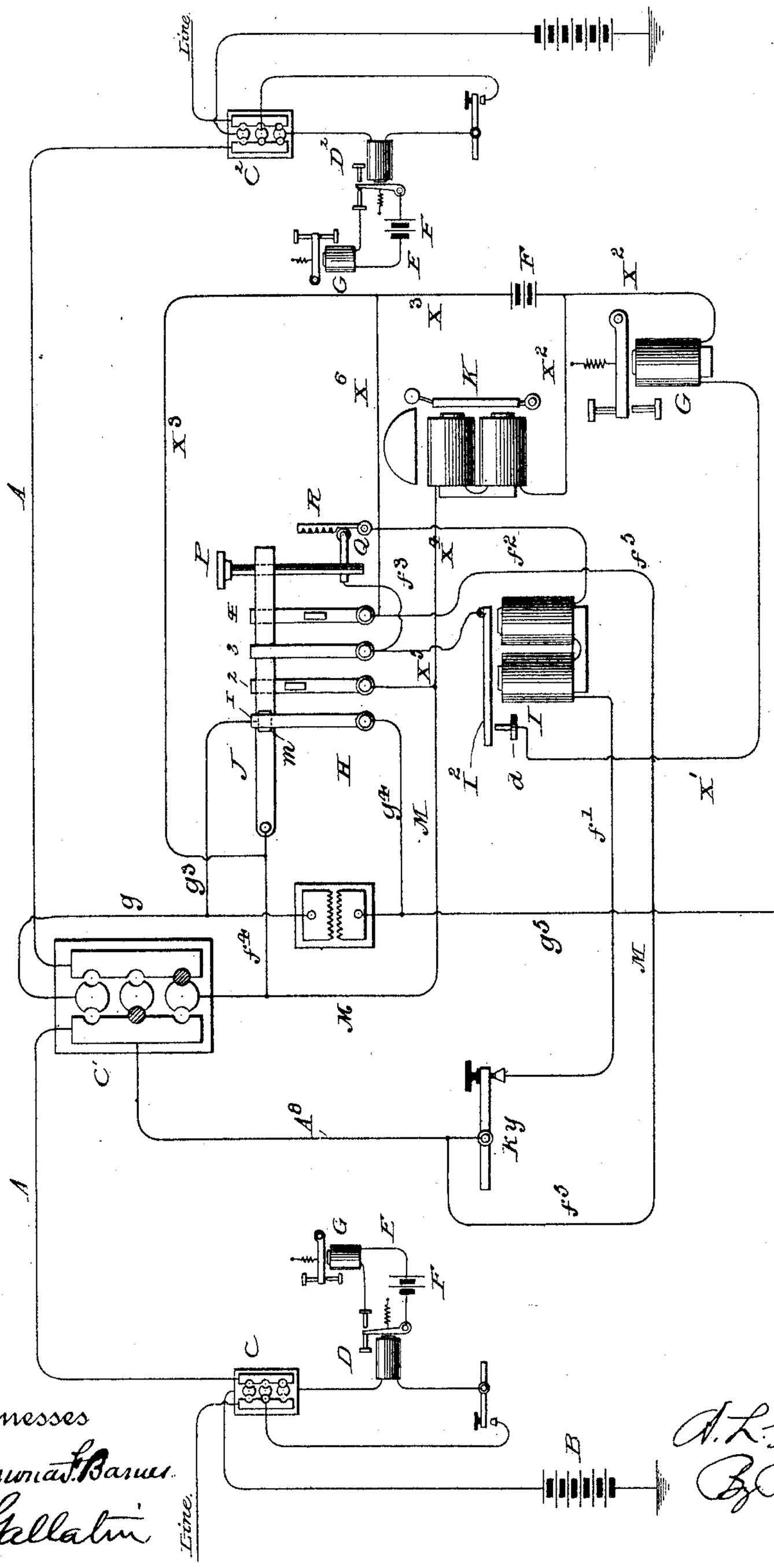
ELECTRIC CIRCUIT PROTECTOR.

No. 584,462. Patented June 15, 1897.

Fig. 2.



(No Model.) 4 Sheets—Sheet 3.

A. L. CREELMAN.

ELECTRIC CIRCUIT PROTECTOR.

No. 584,462. Patented June 15, 1897.

Fig. 3.

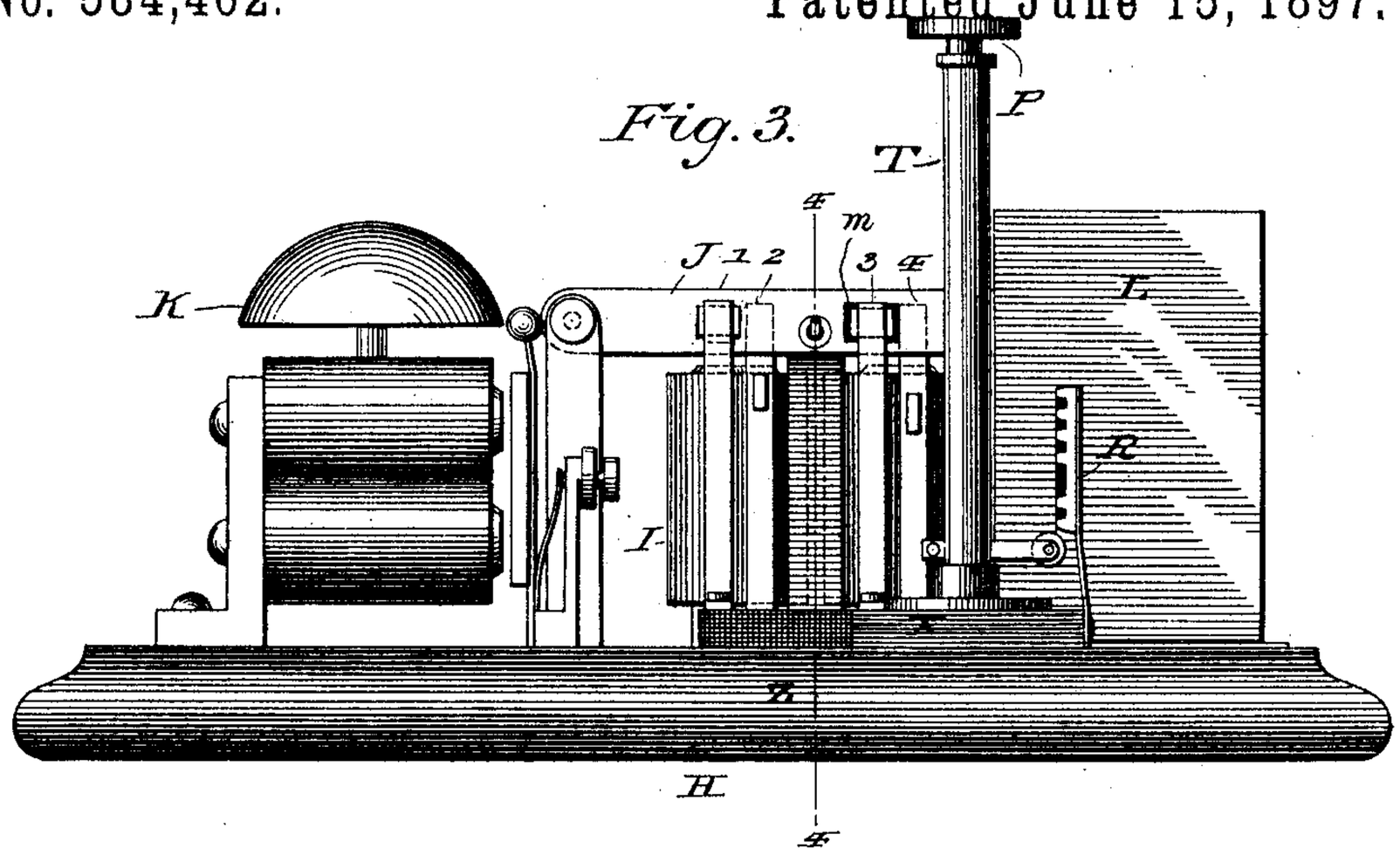


Fig. 4.
on line 4–4.

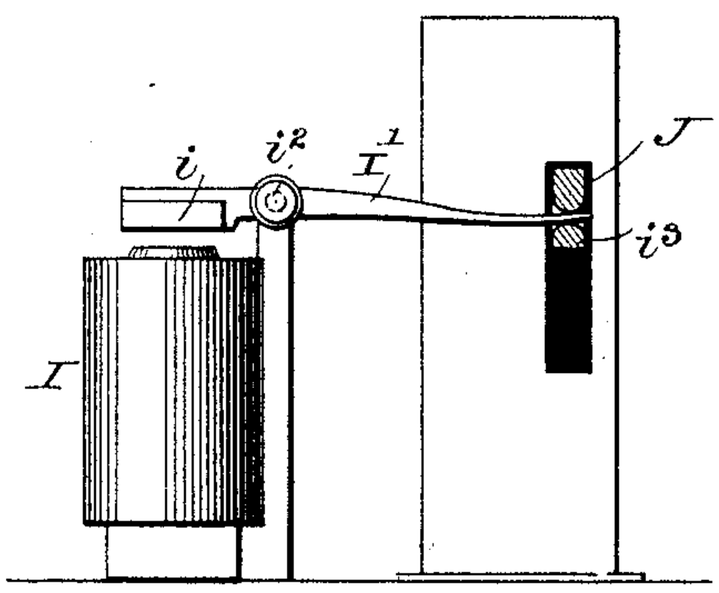


Fig. 5.

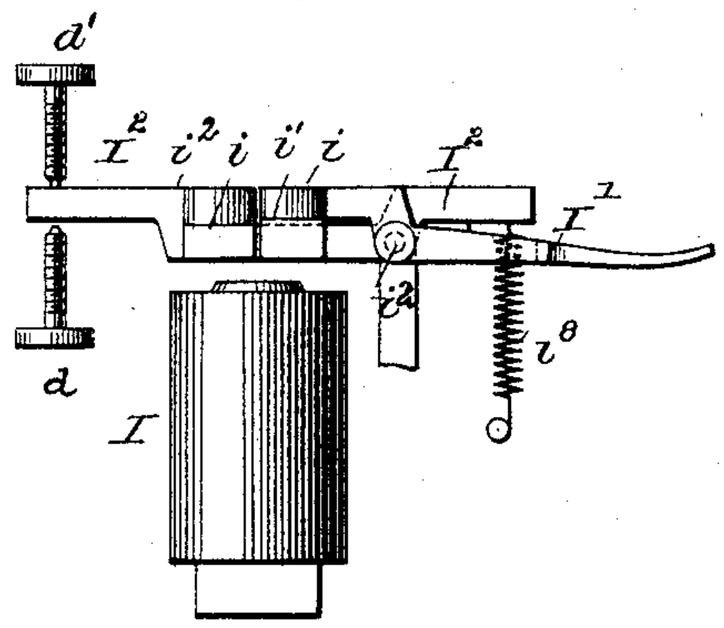
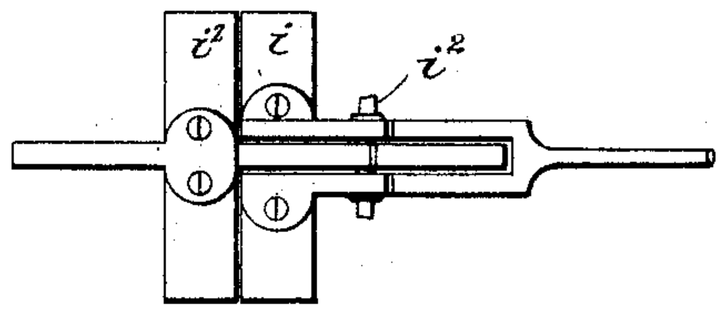


Fig. 6.



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(No Model.) 4 Sheets—Sheet 4.

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ELECTRIC CIRCUIT PROTECTOR.

No. 584,462. Patented June 15, 1897.

Fig. 7.

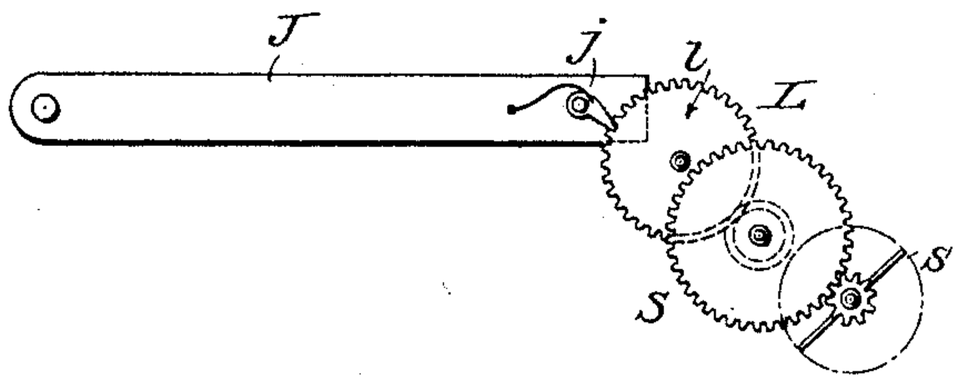


Fig. 8.

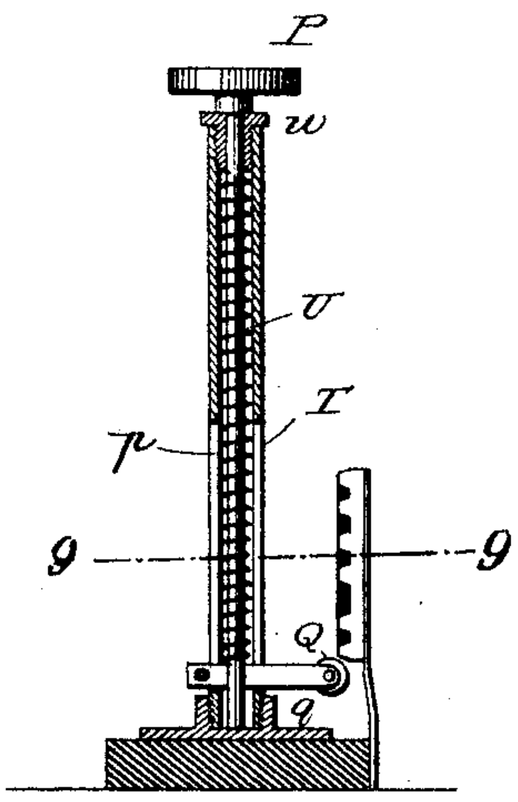


Fig. 9.

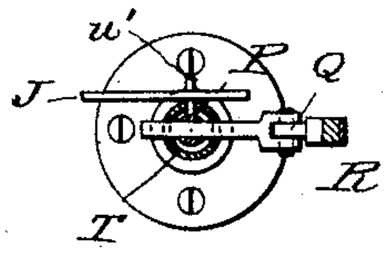
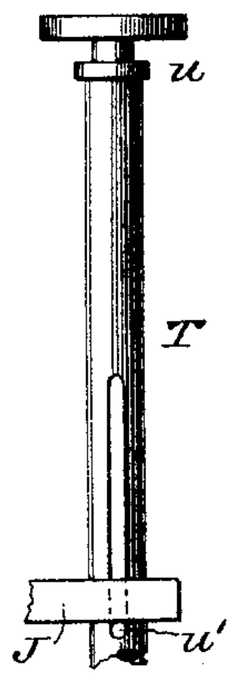


Fig. 10.



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Inventor
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By P. J. Lodge
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UNITED STATES PATENT OFFICE.

ALVAH LEWIS CREELMAN, OF MEMPHIS, TENNESSEE, ASSIGNOR TO THE CIRCUIT PROTECTING SOUNDER COMPANY, OF SAME PLACE.

ELECTRIC-CIRCUIT PROTECTOR.

SPECIFICATION forming part of Letters Patent No. 584,462, dated June 15, 1897.

Application filed August 11, 1892. Renewed February 26, 1897. Serial No. 625,175. (No model.)

To all whom it may concern:

Be it known that I, ALVAH LEWIS CREELMAN, a resident of Memphis, county of Shelby, and State of Tennessee, have invented a new and useful Improvement in Electric-Circuit Protectors, of which the following is a specification.

It is a well-known fact in the present practice of electric telegraphy that an operator working on a line with instruments connected in the usual manner is liable to be cut out of circuit by another operator who through neglect may fail to close his key or may leave his ground connection on; also, that an operator of an instrument between the station transmitting and the station receiving will receive any message in course of transmission and may cut out any operator on either side of him at any time by opening the circuit at his key, thereby breaking the main circuit, or by grounding the circuit through his switchboard, thus cutting off any station beyond him, without notifying either office so cut out of his action.

The object of my invention is to remedy these defects; and to this end it consists in combining with the usual instruments in a Morse circuit—that is to say, a relay and key in the main circuit controlling a local battery and sounder—an apparatus controlled by a magnet and train of gear for making and breaking both the ground-circuit and a shunt-circuit around all the instruments in the station and also operating to give an alarm on a bell, and in controlling the operation of resetting such apparatus by an annunciator adapted to give an alarm through the main circuit to the other offices in circuit on the line, said annunciator carrying its own number or character and thereby indicating to every other office the particular office cut into circuit.

It further consists in the details of construction and combinations of parts hereinafter described.

In the accompanying drawings, Figure 1 shows a circuit including an intermediate station showing the complete apparatus in diagram and two terminal stations showing the transmitting and receiving instruments only. Fig. 2 shows the same with the exception that the magnet actuating the protecting and shunt device acts as a relay. Fig. 3 is a side view of the cut-out instrument and bell. Fig. 4 represents a vertical section on the line 4 4 in Fig. 3. Fig. 5 is a side view, and Fig. 6 a plan view, of the controlling-magnet provided with a double armature. Fig. 7 is a side view showing the application of a train of retarding-gear to the lever of the cut-out instrument. Fig. 8 is a sectional elevation of the resetting-plunger and its signal-transmitting devices. Fig. 9 is a horizontal section on the line 9 9 in Fig. 8, and Fig. 10 is a side view of the signal-transmitter.

Referring to the drawings, A is the main line, including in circuit batteries B B′ and passing through the usual switchboards C C′ C^2 to relays D D′ D^2, such relays controlling by their action the local circuits E, including local batteries F and sounders G, this being the usual arrangement of a Morse circuit.

In the local circuit E of each station is a controlling apparatus H. (Shown in detail in Figs. 3, 4, 7, 8, and 9, wherein I represents an electromagnet secured to a suitable base Z.) In the field of the magnet I, which I call the "controlling-magnet," is an armature *i*, attached to one end of an approximately horizontal lever I′, pivoted at i^2 to a post or other support secured to the base Z. The other end of the lever I′ extends beyond the pivotal point and has its upper side formed into a knife-edge to support a second or cut-out lever J, which lies in the same horizontal plane as the armature-lever I′, but at a right angle thereto. The cut-out lever J, pivoted at one end to a support extending upwardly from the base Z, has a hole i^3 formed therein near its center, into which the knife-edge of the armature-lever J enters. The cut-out lever J being pivoted at one end the natural tendency of the opposite end is to fall, but this tendency is prevented by the armature-lever I′. When the controlling-magnet I is energized, the armature i' is attracted. This causes the outer end of the armature-lever to rise, carrying with it the cut-out lever J, which as soon as the current through the magnet I is broken returns slowly to its lower position, the downward movement being retarded by mechanism to be described hereinafter.

Extending up from an insulating-block X, secured to the base Z, are four contact-fingers 1, 2, 3, and 4, insulated from each other and from the base and so arranged that 1 and 3 are on one side and 2 and 4 on the opposite side of the cut-out lever J, which arrangement, however, is only for convenience and may be varied, if desired. When the lever J is in its raised position, contact-finger 1 is in electrical contact therewith, while finger 3 is in electrical contact with a plate *m*, insulated from the lever J. When the cut-out lever J falls, it is in electrical contact with the fingers 2 and 4 and away from fingers 1 and 3.

To retain the cut-out lever J in its elevated position and prevent it from falling immediately after the current through the magnet I is interrupted, a retarding mechanism, such as is shown in Fig. 7, is used. It consists of a train of gearing L, the main spur-wheel *l* of which meshes with a pinion on the shaft of a second spur-wheel S, that in turn meshes with a pinion on the shaft of a fly *s*. This train is arranged in such relation to the cut-out lever J that a pawl *j* on its outer end engages the teeth of the gear *l* or with a ratchet-wheel mounted on the same shaft as the gear-wheel.

When the magnet I is energized, the cut-out lever J will be raised through the medium of the lever I', carrying with it the pawl *j*, which will engage with one of the teeth of the spur-wheel *l* when the lever begins to fall, thereby moving the train and rotating the fly, the size of which will regulate the time required for the lever J to attain its lower position. Secured to the insulating-block X on the base Z is an upright tubular standard T, through the center of which passes a rod U, having a bearing in a cap *u*, screwed into the upper end of the standard T and provided with a finger-button by means of which it can be raised. A transverse arm *q*, in one end of which is pivoted a roller Q, is secured to the lower end of the rod U and projects through slots cut in the lower part of the standard T. Surrounding the rod U is a spiral spring V, bearing against the cap *u* and the arm *q*, which keeps the said rod and arm *q* normally down. A pin *u'*, secured to the rod U, projects through a slot in the standard T and under the cut-out lever J, as shown in Figs. 9 and 10.

A spring contact-plate R, provided with insulated points, as shown, is secured to an insulating-block attached to the base Z, and which extends above the roller Q when the latter is in its normal position, being at all times, however, in contact therewith.

An apparatus such as above described will be placed in all the telegraph-stations on a line, the electrical connections being such as shown in Fig. 1, which figure represents diagrammatically three offices or stations on a main line, the central one only being provided with my apparatus. The main circuit enters the office by the main wire A, which is connected with the switchboard C', passing from thence to the relay instrument D' and by the wire *r* to the roller Q, which, as before stated, is in contact with the plate R, thence by the wire *r'* to the normally-closed key *ky* and by wire A^9 back to the switchboard and on to the next office. The local circuit starting from the local battery E is carried by the wire A^2 to the sounder G, through which it passes thence by the wire A^3 to front stop *d* of the relay D', through the relay-armature and by wire A' to the cut-out lever J, through it, contact-finger 1, and wire A^6 to the magnet I, and finally back to the battery by wire A^4. A wire M, branching from the wire A^8, passes around the relay to connect with the finger 2. The contact-finger 4 is connected by a wire M' to the main-circuit wire A^9 between the key *ky* and the switchboard. From the switchboard C' extends a ground-wire *g*, in the circuit of which is placed a lightning-arrester, as shown. A wire *g'*, connected to the ground-wire, extends to the contact-finger 3, which, as before stated, rests on a plate *m*, secured to the cut-out lever J, but insulated therefrom. From the plate *m* extends a wire g^2 to the ground. A coil *m'* in the wire g^2 forms a yielding connection between the wire and the plate *m*, which allows the lever J to vibrate easily. From the local battery E a wire z^2 runs to the contact-finger 2. From the contact-finger 4 a wire N extends to the bell K, which is connected by a wire A^5 to the wire A^4, leading back to the battery.

The operation of my apparatus is as follows: The parts being in the position shown in Fig. 1, a message coming over the main-line wire A enters the station through the switchboard C, passing thence by way of the wire A^8, relay D', wire *r*, roller Q, spring-plate R, wire *r'*, key *ky*, and wire A^9 back to the switchboard, whence it passes out over the main line to its destination. The vibration of the armature of the relay D' causes the sounder G to be operated in the usual manner and the magnet I to become energized and deënergized as the circuit is made and broken, both the sounder G and magnet I being in the local circuit, as heretofore described. As soon as the circuit through the magnet I is broken the cut-out lever is released, the tendency of which is to drop, which action would, if permitted, cut out the station by shunting the main-line circuit around the relay, as hereinafter described. To prevent the sudden falling of the cut-out lever J, the retarding device heretofore described is used, which device, operated by the weight of the lever J, moves so slowly that the circuit can be completed before the cut-out lever has left the finger 2, it being well known to all that the make and break when telegraphing follow each other very quickly.

If an operator at any station through carelessness or other cause fails to close his key, the main-line circuit through the relay and key would be broken. This would open the local circuit passing through the sounder G and magnet I at the relay, releasing the armature *i*

and permitting the cut-out lever J to fall slowly, being controlled by the retarding device L until it had reached the lower position. Contact would then be made between the cut-out lever J and fingers 2 and 4 and broken with fingers 1 and 3. The main-line circuit would then pass around the relay D′ by wire M to finger 2, thence through lever J, finger 4, wires M′ and A^9, to the switchboard C′ and onward. By the same operation of the lever J the shunt-circuit from the local battery E, through wire F, finger 2, lever J, finger 4, wire N, bell K, wires A^4 and A^5, will energize the magnet of the bell and cause the bell to ring as long as the lever J remains in its lower position, thus calling the operator's attention to the condition of his instrument or circuit.

When a secret message is to be sent from one office to another without disclosing the same to operators at the intervening stations, the desired office is called up in the usual manner. Upon receiving a reply the sender opens his key, which breaks the main circuit and of course all the local circuits on the line. The main line will then remain broken for a predetermined period, being sufficiently long to permit all the cut-out levers J to fall, after which the sender closes his key and the receiver sets his cut-out lever by raising the plunger P, which thus puts his instruments in circuit with the sender. The line is now ready for use. The cut-out levers J of all the other offices being down and the main line shunted, as above described, around the relays, all the local circuits will be broken and of necessity all the sounders between the sender and receiver will remain silent. The cut-out lever J is reset by lifting the rod U of the plunger P, which through the medium of the pin u' raises the cut-out lever to its higher position, breaks the main circuit, passing through itself and the fingers 2 and 4, and restores it through the relay, roller Q, and contact-plate R. The local circuit is thereby closed again at the relay, and finger 1, energizing the magnet I, holds the lever J in its raised position. The rod U is then released and is returned to its normal position by the spring V. As the rod returns to its normal position the roller Q passes over the plate R, which has its insulated spaces so arranged that the letter or number designating the office is announced to the operators at both ends, it being understood that each office has a character different from all the other offices on the line. The sender as soon as he receives the announcement of the desired office delivers the secret message.

If any operator attempts to cut in while a secret despatch is being sent, which can only be done by raising the plunger P to cut in his instrument, that fact will be announced as the roller Q passes over plate R, which will give the distinctive character of the office so doing. To cut him out again, the sender need only leave his key open for the predetermined time, thus causing the lever J of the offending office to drop again.

An operator may at some time leave the ground-plug a in his switchboard C, the result of which would be that all stations to the right, when the connections are arranged as in Fig. 1, would be grounded through the wires $g\ g'$, finger 3, insulated plate m, and wire g^2. A call coming from some station to the left for a station to the right of the grounded station would of course fail to reach its destination, because the main circuit, after passing through the relay D′ and controlling apparatus, as heretofore described, would, as soon as it reached the switchboard, pass to the ground-wire g across the plug a. The sender failing to receive an answer from the desired office will then open his key, which action will cause the cut-out lever J of the controlling apparatus in the grounded office to fall, separating the insulated plate m from its contact with the finger 3, breaking the ground-circuit, and establishing the main circuit through the shunt around the relay.

I sometimes dispense with a separate relay instrument, using the magnet I, arranged as shown in Figs. 5 and 6, for this purpose. In Fig. 2 is shown the arrangement of the circuits, differing slightly from those shown in Fig. 1, which is necessitated by the change in the relay-magnets.

Referring to Figs. 5 and 6, I represents the magnet, above which are two armatures i and i', lying side by side, each occupying one-half of the field of the magnet. The armature i is secured to one end of a lever I′, which engages with the cut-out lever J, as heretofore described. The other armature i' is fastened to a lever I^2, which vibrates on a pivot i^2, common to the two levers I′ I^2, between two stops $d\ d'$. A spring i^8, secured to the rear end of the lever I^2, keeps the forward end against the stop d' and away from the stop d, except when the magnet is energized, at which time the lever I^2 strikes the stop d and closes the local circuit through the said stop and the lever I^2, as usual in relay instruments.

The electrical connections used with the instrument above described are shown in Fig. 2, which is similar to Fig. 1 except for the omission of the relay instrument D′ and the substitution of the modified form of cut-out magnet I. The main circuit, entering by wire A, passes through the switchboard C′, wire A^8, to the normally closed key ky, thence by wire f' to the magnet I, wire f^2, plate R, roller Q, wire f^3, finger 3, cut-out lever J, wire f^4, to switchboard, and thence onward to the next station. When the main circuit is broken and the cut-out lever J falls, as heretofore explained, the main circuit will be shunted around the key by way of wire f^5, finger 4, cut-out lever J, finger 2, and wire M to switchboard. The local circuit, when the cut-out lever J is raised, is from the battery F, through wire x^3, wire f^4, cut-out lever J,

finger 3, wire x^5, armature-lever I^2, stop d, wire x', sounder G, and wire x^2 to battery. When the lever J drops, the circuit will then pass from battery F to wires X^3 X^6, finger 4, cut-out lever J, finger 2, wire x^4, bell K, and wire x^7 to battery. The ground-circuit is from the switchboard by way of wires g g^3, insulated plate m, finger 1, wires g^4 g^5, to ground. The operation being the same as that described in Fig. 1 a detailed explanation will be unnecessary.

The apparatus shown and described is the best arrangement of which I am at present aware, but it is obvious that other arrangements for the same purpose may be used without departing from the spirit of my invention, which is to combine with a protector and cut-out for a telegraph-station a means by which a secret message can be sent over the line without passing through the Morse or other signaling instruments of any office between the transmitter and receiver without first indicating by a characteristic number or letter the office or station tampering with the line.

Having thus described my invention, what I claim is—

1. The combination of a main telegraphic or like circuit, a series of stations or offices thereon, each station or office being provided with a relay instrument and a key included in said circuit, a local circuit at each station or office containing a battery, sounder and controlling apparatus each controlling apparatus being adapted to shunt the main circuit around the relay and key in the same office therewith, when the main-line circuit remains open for a prolonged time, substantially as set forth.

2. The combination of a main circuit, a series of stations or offices thereon, each station being provided with a relay and key included in the said circuit, a local circuit at each station containing a battery and sounder, and a controlling or cut-out apparatus in the main and local circuits, said controlling apparatus adapted to be operated by each local circuit under the control of the main circuit after the said main circuit has been held open for a predetermined time, substantially as set forth.

3. The combination of a main circuit, a series of stations or offices thereon, each station being provided with a relay and key included in the said circuit, a local circuit at each station containing a battery and sounder and a controlling or cut-out apparatus, operated by the local circuit through the action of the main circuit, for shunting the main circuit when opened for a prolonged time, around all the relays and keys in said circuit, and each local circuit around its sounder through a signal mechanism, substantially as set forth.

4. A main and a local telegraph-circuit, in combination with a gravity-switch through which the circuits pass, a retarding device operated by the said switch for reducing the speed of its downward movement, a magnet for retaining the switch in its elevated position, and a manually-operated device for raising the switch and closing the circuit through the said magnet, substantially as set forth.

5. A main telegraphic circuit containing a relay and key, and a local circuit containing a sounder and battery, in combination with a gravity-switch, a retarding mechanism operated by the said switch, a device for resetting the switch a magnet for retaining the switch after being set, and an alarm mechanism substantially as shown and described.

6. A main telegraphic circuit containing a relay and key and a local circuit containing a battery and sounder, in combination with a downwardly-tending switch-lever for shunting the main and local circuits around the instruments contained therein after the main circuit has remained open for a prolonged time, a device for resetting the switch, a device for indicating the characteristic letter or number of the office containing the apparatus, a magnet for retaining the switch after being set, and an alarm mechanism in the shunt of the local circuit substantially as set forth.

7. In a telegraphic circuit the combination of a main line, a relay and key included therein, a local circuit containing a battery and sounder controlled by the relay and key, a cut-out or controlling apparatus for controlling the main and local circuits, a ground-circuit adapted to be broken by the cut-out apparatus, a normally open shunt around the relay and key, a second normally open shunt, containing a signal around the sounder, the said shunts adapted to be closed by the cut-out apparatus, and a device for resetting the cut-out and sending a characteristic or distinctive number or letter to the line.

8. A circuit-controlling device consisting of a downwardly-tending switch-lever a retarding device to regulate its downward movement, a magnet for retaining the switch-lever when raised, contact-fingers in the path of the switch-lever, a device for resetting the lever and a signal device operated by the resetting device for sending over the line its characteristic signal.

9. In a cut-out for a main and local telegraphic circuit, said circuits containing a relay, key and sounder, the combination of a lever adapted to open and close a ground-circuit, a shunt-circuit around the relay and key, a shunt-circuit around the sounder, a magnet for controlling the action of the lever, a train of gear for retarding the motion of the lever and a resetting device which by its operation sends a signal to the line, substantially as set forth.

10. In a circuit-controlling apparatus the combination of a magnet controlled by the main circuit, an armature-lever adapted to be attracted by the magnet, a cut-out lever in engagement with the armature-lever, contact-fingers to engage the cut-out lever when

raised, other contact-fingers to engage the said lever when lowered, a retarding device for limiting the speed of the cut-out lever in one direction, a resetting device and a signal device operated by the resetting device, substantially as set forth.

11. A cut-out instrument for telegraphic circuits consisting of a lever, a series of contact-points, a magnet to control the operation of the lever, a train of gear for retarding the fall of the same, and a plunger for resetting the lever, said plunger provided with a roller operating to automatically send through a series of contacts a distinctive signal to the line.

12. In a telegraphic cut-out instrument, the combination of a vertically-moving lever, a series of contact-points between which said lever moves and acting to control a normally closed ground and a normally open shunt, a magnet controlling the action of the lever, a train of gear for retarding the fall of the lever, a resetting device to automatically send a signal to line and an alarm-bell in a local circuit opened by the fall of the lever.

In testimony whereof I hereunto set my hand, this 12th day of April, 1892, in the presence of two attesting witnesses.

ALVAH LEWIS CREELMAN.

Witnesses:
G. V. RAMBOUT,
DABNEY M. SCALES.