(No Model.)

C. E. SCRIBNEB.

SELECTIVE SIGNAL AND LOCK-OUT SYSTEM.

No. 559,869. Patented May 12, 1896.

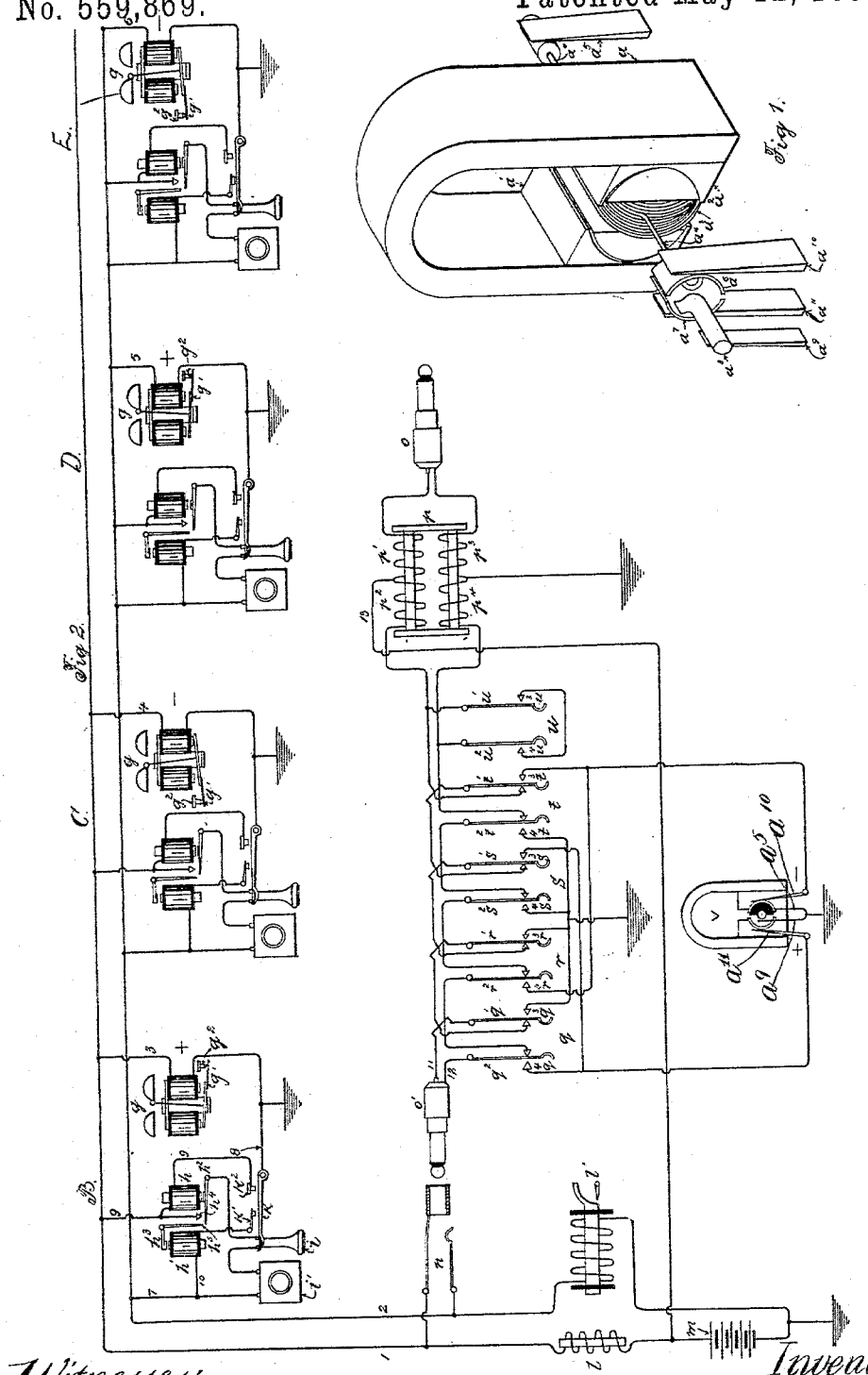

Fig. 1.

Fig. 2.

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UNITED STATES PATENT OFFICE.

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SELECTIVE-SIGNAL AND LOCK-OUT SYSTEM.

SPECIFICATION forming part of Letters Patent No. 559,869, dated May 12, 1896.

Application filed May 13, 1895. Serial No. 549,763. (No model.)

To all whom it may concern:

Be it known that I, CHARLES E. SCRIBNER, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a certain new and useful Improvement in Selective-Signal and Lock-Out Systems, (Case No. 386,) of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawings, forming a part of this specification.

My invention applies to selective-signal systems in which several polarized signal-bells are arranged in different branches from a line-circuit and are combined with mechanism at each substation for preventing the connection of more than one telephone with the "party" line at one time under normal conditions. It comprises a number of different features contributing to the efficient and reliable operation of the system, the principal among which are a device to prevent the transmission of false signals or the accidental operation of one of the polarized bells in the event of a cross connection or bridge between the line conductors, a device to permit the suspension of the operation of the locking mechanisms for the purpose of bringing the telephonic instruments at two stations on the same party line into connection with the line-circuit, and a mode of connecting an annunciator or signal-controlling relay with the line-circuit at the central station to prevent its operation by currents finding circuit through the lock-out mechanism or through the bells.

The objects of the two devices last mentioned are obvious. A statement of the object of the first-mentioned apparatus necessitates an explanation of the defective operation which it is designed to obviate.

I have described the lock-out system to which I refer in this specification and to which my invention applies in an earlier application, Serial No. 556,719, filed July 22, 1895, (Case No. 379,) for a lock-out system for telephone-lines, patent issued April 7, 1896, No. 557,898. In that application I have shown a signal-controlling relay and impedance-coil or other annunciator, together with a source of current in a permanently-closed bridge of the line-circuit at the central station, the relay or annunciator being operated by the closing of the telephone-circuit at the substation by the lock-out mechanism controlling it. I have associated with this system a series of polarized bells, two bells adapted to respond to currents of different polarity being placed in connection with each of the two normally-insulated or separate line conductors of the metallic telephone-circuit. In such a system I find that when a pulsatory or intermittent current of proper polarity for operating a particular bell is thrown upon either line conductor the "extra" or "self-induction" current from the impedance-coil and relay or other annunciator tends to produce in the line-circuit a current in the proper direction to operate that bell which is not desired to respond. Any electromagnet bridged across the circuit, even the magnet of a bell, may have a similar effect, so that while the current from the signaling-generator may be of proper direction and may operate the desired bell there will be produced in the line-circuit an extra current of reverse direction through the bells tending to operate the other bell also of the pair. In my present invention I avoid this detrimental action by grounding the conductor of the line over which the signaling-current is being transmitted during the intermissions of the signaling-current. The commutator of the signaling-generator is preferably provided with two segments, one of which constitutes a terminal of the generator-armature and the other of which is permanently grounded, which segments pass alternately under that collecting-brush of the generator which is applied to the signaling-circuit. The commutator thus delivers to the signaling-circuit a pulsating or intermittent current and short-circuits the signaling-circuit during the intermissions of current, so that the extra currents from the magnets in the circuit are diverted from the responsive instruments.

For the purpose of bringing two telephones on the party line simultaneously into connection with the line-circuit—that is, of temporarily suspending the operation of the lock-out devices—I provide means for short-cir-

cuiting or otherwise diverting from the line-circuit the current which excites the lock-out magnets.

In order to prevent the false or accidental operation of the line signaling instrument at the central station, I maintain the independence or separation of the line conductors, connecting one of them with the source of current supply and placing the annunciator or signal-controlling relay in a ground branch from the other line conductor, whereby current is prevented from reaching and exciting the annunciator excepting in the event of a bridge connection being purposely closed between the line conductors.

The apparatus and arrangements of circuits which constitute my invention are shown in the accompanying drawings.

Figure 1 of the drawings represents diagrammatically a magneto signaling-generator provided with a commutator and circuit connections which adapt it for use in my invention. Fig. 2 is a diagram of a party line equipped at each of four substations with signal-bells and with lock-out mechanism such as I have described and connected with a signal-controlling relay and with other usual apparatus in a telephone-switchboard at a central station.

The generator represented in Fig. 1 may be a bipolar magneto-generator of ordinary type, having a permanent magnet a, terminating in pole-pieces a' a^2, inclosing a Siemens shuttle-armature a^3. One extremity of the armature-coil is connected permanently with the shaft a^4 of the generator and through it with a resilient contact-piece a^5, maintained in permanent connection with it. The other extremity of the armature-coil is connected with one semicylindrical contact-segment a^6 of the commutator. The other segment, a^7, is connected through a cylindrical stud or pin a^8, integral with it, to a spring contact-piece a^9. Two brushes a^{10} a^{11} bear on diametrically-opposite points of the commutator. The brushes should be in such position with reference to the armature that they or either of them may be in contact with a segment during that portion of a revolution in which the armature is delivering a current of one polarity—that is, for example, the brush a^{10} should bear upon the segment a^6 while it is delivering a pulsation of positively-directed current, while the same segment should come under brush a^{11} during the generation of oppositely-directed current in the armature.

In Fig. 2 four stations B, C, D, and E are represented connected with a single party line 1 2, terminating in a switchboard at a central station F. At each of the four stations is placed a bell g. Each bell g is of the ordinary polarized type, but is equipped with a light spring g', secured to its armature and bearing against a stop g^2, which may be adjustable. This spring gives a "bias" to the armature of the bell, maintaining it normally in a particular position. The bells at stations B and C are connected in ground branches 3 and 4 from one of the line conductors 1, while the bells at stations D and E are arranged in other ground branches 5 and 6 from line conductor 2. The springs on the bells at stations B and C are placed to throw their respective armatures in opposite directions. Those on the bells at stations D and E are similarly arranged with relation to each other. Hence the bell at station B will ring only when current traverses it in a particular direction—say positively—while the bell at station C will ring only with current in the opposite direction. Thus by closing to either line conductor at the central station either a positively or negatively directed current, as may be required, any particular one of the bells at the different stations may be operated and a "selective" signal transmitted to that station. The bells should have a resistance of about two thousand five hundred ohms each.

Each station is also equipped with a lock-out device such as I have described at length in my prior application referred to. This instrument comprises two electromagnets h and h' and their armatures and supporting-levers h^2 h^3 for the same. The extremities of levers h^2 h^3 are so placed that when the lever h^3 is moved by the attraction of its armature it will be brought into the path of the other lever h^2 and will prevent the approach of the latter to its magnet. I have designated the lever h^3 the "stop-lever" and its magnet the "stop-controlling" magnet and the lever h^2 the "relay-lever" and the magnet the "relay-magnet." The relay-contacts h^4 h^5 control the continuity of a bridge or cross-conductor 7 of the line-circuit in which the substation receiving-telephone i and the transmitter i' are contained. The usual switch-hook k is provided for supporting the telephone and adapted to be operated by the weight of the telephone. It is furnished with two contact-points. One of these, contact k', is a yielding contact adjusted to make connection with the lever during its first movement. The other contact, k^2, may be a rigid anvil and may serve as a stop for the lever k. The lever k is grounded by a conductor 8. The relay-magnet h is included in a conductor 9, connected with line conductor 1 and terminating in contact-anvil k^2, while the stop-controlling magnet h' is in another conductor 10 from line conductor 2, terminating in the yielding contact k'.

At the central station the line conductor 1 is connected through an impedance-coil l with one pole of a battery m or other source of current whose other pole is grounded. Conductor 2 is connected through a signaling instrument l', preferably a "visible" signal, to earth. Branches are led from the line conductors 1 and 2 to the sleeve and spring, respectively, of a spring-jack n in the telephone-switchboard.

The operator at the switchboard is furnished with the usual pairs of connecting-plugs for

electrically uniting different lines at the switchboard. A single pair of plugs o and o', together with their associated circuits and appliances, are shown at the switchboard. The tip-contacts of the plugs are united through a conductor 11 and the sleeves through a conductor 12. In each of these conductors are included two helices p', p^2, p^3, and p^4, respectively, of an induction-coil or transformer p. The point of junction of helices p' and p^2 is connected by a wire 13 with the free pole of battery m. That of helices p^3 p^4 is grounded.

In the portions of the conductors 11 and 12 between the induction-coil p and the plug o' are included the switch-springs of a series of keys q, r, s, t, and u. The springs q' r' s' t' and their normal resting contacts or anvils are included in series in conductor 11 of the plug-circuit. The corresponding springs q^2 r^2 s^2 t^2 of the other sides of the keys with their contacts are likewise included in conductor 12. The anvils q^1 and s^3 are connected with the positive pole of a generator v of signaling-current, such as is shown in Fig. 1. The anvils r^1 and t^3 are connected with the negative pole of the same generator. The contact-anvils q^3, r^3, s^4, and t^4 are connected to ground. The springs a^5 and a^9 of the generator are permanently grounded.

If a subscriber at any station of a party line should wish to signal to the central station, he would simply remove his telephone i from its switch-hook k in readiness to address the operator. By this act the circuit of battery m is closed from line conductor 1 through branch 9 and contact k^2 and lever k of the switch to ground. The magnet h is excited and attracts its armature, closing the conductor 7, which includes the telephone i, and thus completing the circuit from the battery to conductor 2, and thence through the signaling instrument l' at the central station. The latter instrument is caused to display its signal, and the call is thus indicated to the operator. The latter makes connection with the line by means of her answering-plug o and receives the order from the subscriber through her telephone set in the usual way, the circuits and mechanism involved in this act being so well known that they have been omitted from the drawings.

It will be observed that the conductor 1 is grounded through two bells, which have a resistance of about twelve hundred and fifty ohms. Hence the signaling instrument l' cannot be included directly in conductor 1, together with the battery, in the way common in systems of this type, since its proper operation would be more or less interfered with by the current in the line-circuit. Its inclusion in a ground branch from conductor 2, together with means for closing a cross connection between the lines in the act of calling, constitutes one feature of my present invention.

For the purpose of illustrating the other features of my invention let it be assumed that the call-signal has been transmitted from station B and that the subscriber at that station wishes to communicate with another party on the same line—say at station D. Having received the order for this connection, the operator withdraws the answering-plug o from the spring-jack n of the line and in place of it inserts the calling-plug o'. The operator is instructed that a positively-directed current must be closed to the conductor 2 of the line-circuit in order to operate the bell at station D, or, if desired, the stations may be numbered consecutively and the keys q, r, s, and t may be correspondingly numbered. The operator momentarily depresses the plunger of the key s, and thus closes the positive pole of the generator v to the conductor 2 of the line-circuit, at the same time grounding conductor 1 of the circuit. Here I may explain both the effect of the signaling-current in this circuit and the difficulty which a feature of my invention is designed to avoid. As the contact-segment a^6 of the generator v passes under spring a it delivers to this spring a pulsation of positively-directed current. This current finds circuit to the contact s^3 and thence to spring s', thence through conductor 11 to conductor 2, from which it has several paths. One of these is through the signal-indicator l' to ground, another is through the bridge 7 at station B, another is through conductor 5 at station D, including the bell at that station, to ground, and still another is through conductor 6 at station E to ground. The bell at station D is rung by the pulsating current, but that at station E is not thrown into vibration, since its armature is already inclined and held by the spring toward the side to which the magnet tends to throw it. Current finds circuit also through bridge 7 at station B to conductor 1 of the line-circuit; but from this conductor it does not follow any of the branches through the bells, but finds circuit to the exchange, thence to conductor 12 of the plug-circuit, and thence through spring s^3 and contact s^4 directly to ground, the bells and magnets connected with this conductor of the line being thus short-circuited. An instant later the pulsation of current is interrupted at the commutator of the generator. The different magnets in the circuit tend to continue, by virtue of their self-induction, the current in the same direction through each ground branch of the circuit. If all the magnets in the circuit were characterized by equal self-induction and had received equal currents during the continuance of the signaling-current, no detrimental effect would result from this tendency; but in practice the instrument l' not only has the greatest self induction or impedance, but also receives the greatest proportion of the signaling-current. Hence its electromotive force tending to continue the current is much greater than that of the bells at stations D and E, for example. Hence the tendency is for a momentary current to flow from earth through these branches 5 and 6 over conductor 2 and through the

signal-indicator l' at the central station. It will be noted that such current through branch 6 would be in proper direction to ring the bell at station E. It has been found in practice that this bell will in fact ring more or less loudly under the conditions which I have described. This detrimental effect is eliminated in the following manner: The instant after the segment a^6 has passed from under brush a^{11} the segment a^7 passes under the same brush and thus grounds it directly. The "discharge-current" from the instrument l' or from any other electromagnets in similar positions in the circuit is diverted from the line through this direct path to ground. Hence only the bell which it was designed to ring is operated. The operator has then depressed the plunger of key s and signaled the subscriber at station D. In order to bring the subscribers at stations B and D into communication, she must now suspend the operation of the lock-out system and permit both telephones to become connected with the line-circuit. It will be noted that when bridge 7 was closed at station B the central-station battery m became connected with the conductor 2. If subsequently to this a telephone at another station were removed from its switch-hook, the branch 10 at that station would be first closed as the switch-hook rose. Current would then pass from battery m through line conductor 1, through bridge 7 at station B to line conductor 2, thence to the other station, where it would find circuit through branch 10, including magnet h' and contact-points k' k^3 of the telephone-switch, through the ground-wire 8 to earth. The magnet h' would thus become excited and the stop-lever h^3 would be thrown into the path of lever h^2 and would prevent the latter from closing the branch 7 at the same station.

The operator depresses the plunger of the special key u, which I have designated the "short-circuiting" key. The line conductors 1 and 2 are now directly short-circuited, and current from battery m is diverted from the line-circuit. It must be assumed that previous to this the subscriber at the signaled station D has responded and has removed his telephone from its switch-hook. When the short circuit across the line-circuit is created, the magnets h and h' at both stations B and D become inert and release their armatures. When the short circuit is removed by the release of key u, the battery again finds circuit to the line, magnets h at both stations are first excited, and both magnets close the branches 7 at their stations, including the two telephones i. The subscribers are now in position to communicate with each other. The battery m finds circuit through the low-resistance helices p' p^3 of the induction-coil p, and thus supplies current of sufficient volume to properly excite the transmitters i' at the substations. The mode of production and transmission of telephonic currents under such conditions is well understood in the art. I may merely note that the impedance of helices p' p^3 should be sufficient to prevent the escape or shunting of telephonic current through them.

When both the subscribers have completed their conversation and have replaced the telephones on their switch-hooks, the current through the signal l' is interrupted and the latter returns to its normal inert position, and by this movement indicates to the operator the termination of the use of the line.

Obviously if the initial call-signal were received from another line that call would be answered by means of plug o, and the final connection with the party line would be made by means of plug o', as has been already described, the signal being sent to the particular station desired by means of the proper key.

My invention is defined in the following claims:

1. The combination with a telephone-line made up of two line conductors not directly connected together at any substation, of a ground branch from one line conductor including a source of current, a ground connection from the other line conductor including a signaling instrument adapted to be operated by said current, and a switch at a substation for connecting the line conductors together, substantially as described.

2. The combination with a telephone party line having its different line conductors normally separated, of several ground branches from the line including signal-bells or other appliances, ground branches from the different line conductors at a central station, a source of current in one of the ground branches, and a signaling instrument adapted to respond to said current in the other branch, substantially as described.

3. The combination with a telephone-line circuit having its line conductors normally separated, and having different responsive instruments or signal-bells in ground branches from the different line conductors, of a signaling-key adapted to connect a generator of signaling-current with one of the line conductors and simultaneously to ground the other line conductor directly, substantially as described.

4. The combination with a telephone-line having at two or more substations lock-out boxes adapted to be set by current from a battery connected with the line, of a key adapted to short-circuit the lock-out boxes to suspend their operation, substantially as described.

5. The combination with a telephone-line, of several lock-out boxes having lock-out magnets connected in bridges of the line-circuit at different stations, and a battery in a bridge of the line-circuit controlling the lock-out boxes, and a key adapted to interrupt the current of the battery in the line-circuit to temporarily suspend the operation of the lock-out boxes, substantially as described.

6. The combination with a telephone-line

having its line conductors normally separate, of a telephone at each of several substations, a lock-out magnet controlling the continuity of a bridge of the line-circuit including each telephone, the lock-out magnet being connected in a ground branch from one line conductor, a battery at a central station connected with the other line conductor, and a key at the central station adapted to interrupt the current from said battery to the line to deënergize the lock-out magnets, substantially as described.

7. In combination with a telephone-line comprising two line conductors, a relay-magnet at each of several stations on the line in a ground branch from one of the line conductors, a stop-controlling magnet in a ground branch from the other line conductor at each station, means for closing the circuit first of the stop-controlling magnet and later of the relay-magnet, a normally open bridge of the line-circuit including the subscriber's telephone controlled by the relay-magnet, a source of current in permanent connection with the line conductor connected with the relays, and a key at the central station adapted to ground said line conductor directly for the purpose of bringing two telephones simultaneously into connection with the line, substantially as described.

8. In combination, two electromagnetic responsive devices adapted to respond to pulsatory currents of opposite polarity in different parallel branches of a circuit, a generator of pulsatory current in the circuit, and means for short-circuiting the responsive devices during the intermissions of current, substantially as described.

9. The combination in an electric circuit, of two signal-bells adapted to respond to pulsatory current of opposite polarity and an electromagnet, in three different parallel branches of the circuit, a generator of pulsatory current in the circuit, and means for closing together the terminals of the generator during the intermissions of current, substantially as described.

10. The combination in a signaling-circuit, of two signal-bells adapted to respond to pulsatory currents of opposite direction, and an electromagnet, in different parallel bridges of the signaling-circuit, a generator of pulsatory currents in another bridge of the circuit, and a commutator carried on the armature of said generator adapted to short-circuit the terminals of the generator during the intermissions of current, substantially as described.

11. The combination with a revolving single-coil armature, of a ground connection to one terminal of the armature-coil, a commutator having two semicylindrical segments, one of which is connected with the other terminal of the armature, and the other of which is permanently grounded, two collecting-springs bearing upon diametrically-opposite points of the commutator, and means for connecting either spring with a grounded signaling-circuit, whereby a pulsatory current of either direction may be applied to the signaling-circuit and the circuit may be grounded during the intermissions of current, substantially as described.

In witness whereof I hereunto subscribe my name this 10th day of May, A. D. 1895.

CHARLES E. SCRIBNER.

Witnesses:
ELLA EDLER,
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