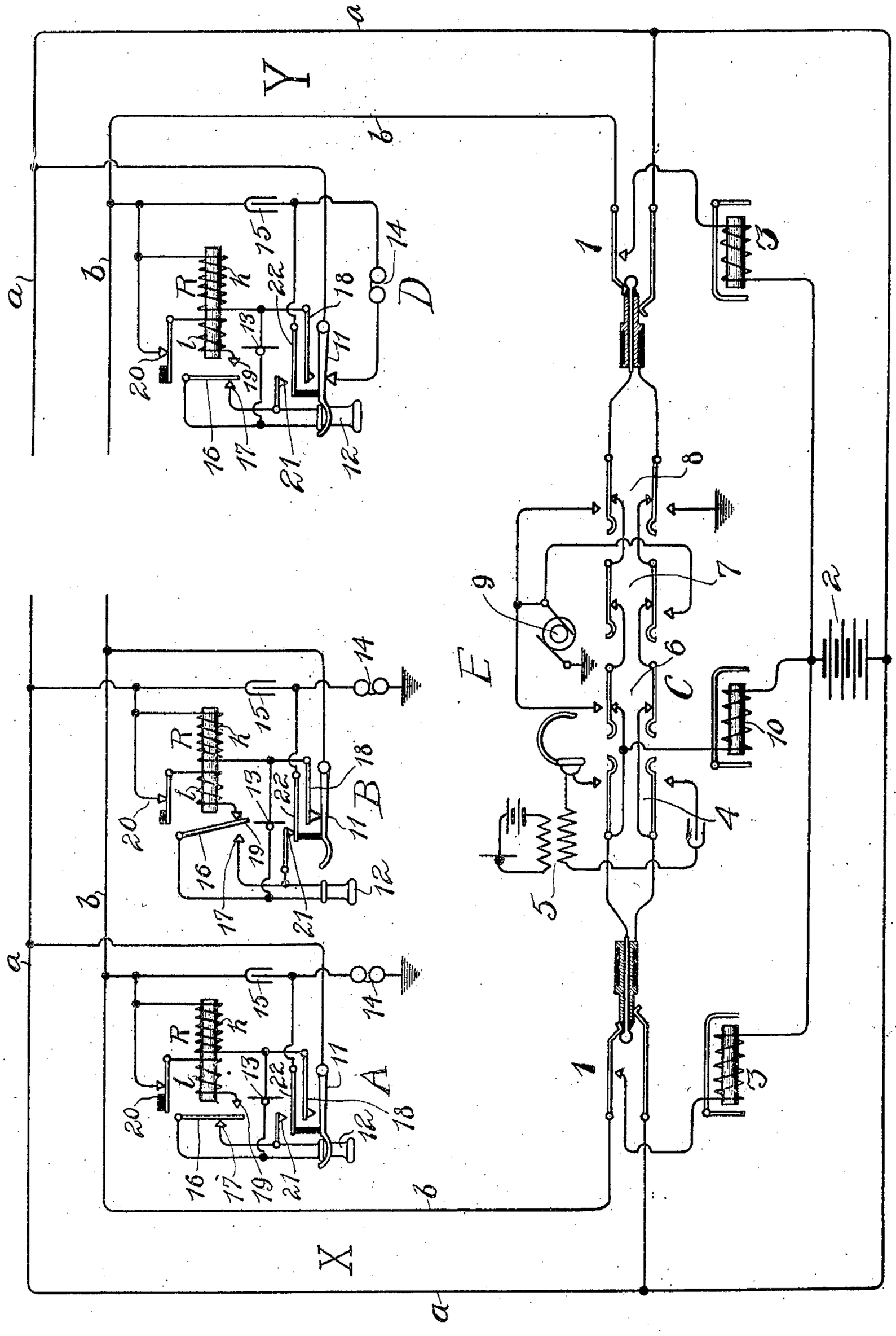
No. 878,018. PATENTED FEB. 4, 1908.

A. F. POOLE.

LOCK OUT TELEPHONE SYSTEM.

APPLICATION FILED DEC. 30, 1905. RENEWED SEPT. 27, 1907.



Witnesses:
Arthur H. Boettcher.
George C. Higham.

Inventor
Arthur F. Poole
By Charles A. Brown
Attorney.

UNITED STATES PATENT OFFICE.

ARTHUR F. POOLE, OF WHEELING, WEST VIRGINIA.

LOCK-OUT TELEPHONE SYSTEM.

Specification of Letters Patent. Patented Feb. 4, 1908.

No. 878,018.

Application filed December 30, 1905, Serial No. 294,028. Renewed September 27, 1907. Serial No. 394,810.

To all whom it may concern:

Be it known that I, ARTHUR F. POOLE, a citizen of the United States, residing at Wheeling, in the county of Ohio and State of West Virginia, have invented a certain new and useful Improvement in Lock-Out Telephone Systems, 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 relates to party line telephone systems, and particularly to an improved lock-out system for use in conjunction therewith.

My invention is applicable to central energy party lines, and any number of substations may be connected with each line. The system may be used in connection with any of the selective signaling systems of the art.

In accordance with my invention, the telephonic apparatus at each substation, that is, the transmitter and receiver, and any other apparatus which may be required for the transmission or translation of voice currents, is normally inoperative.

In accordance with my invention, electromagnetic controlling mechanism is provided at each substation, and a suitable actuation of this controlling mechanism is required in order to place the telephonic apparatus in operative condition. The operation of the electromagnetic controlling mechanism in turn is controlled by the amount of energy available in the line. When a single subscriber on a given line initiates or answers a call by removing his receiver from the hook, the available energy will be sufficient to actuate the electromagnetic controlling mechanism to render operative the telephonic apparatus at his substation, but upon such use of the line by the first substation the available energy in the line is so reduced that the electromagnetic controlling mechanism at another substation will not be operated upon the removal of the associated receiver from its hook, and consequently it is impossible for the second subscriber to render operative his telephonic apparatus. This lock-out condition will be maintained as long as the telephonic apparatus at the first substation is in use. In accordance with my invention, however, I provide means whereby a second substation on a given line may be signaled in answer to a call by another subscriber on that same line. Notwithstanding these results, which may be accomplished by the use of my invention, the apparatus is so arranged that there will be no impedance to voice currents resulting from the introduction of the electromagnetic controlling mechanism into the circuits. Furthermore the disposition of the electromagnets employed in carrying out my invention is such that there is normally no impedance in a substation circuit due to the presence of any part of the telephonic or lock-out mechanism. For this reason my invention is of peculiar advantage in that it may be used with any of the commercial selective signaling systems, in some of which any additional impedance connected into a substation circuit would interfere with the operation of the selective signaling apparatus. As will more fully appear, the circuits and apparatus employed in carrying out my invention are extremely simple, and many of the pieces of apparatus which are necessary for telephonic transmission are also utilized as parts of the signaling system *per se*.

My invention will be better understood by reference to the accompanying drawing, which shows two telephone lines connected together at a central exchange, the current for talking and signaling purposes being supplied from a common source located at the central office. I have shown the telephone lines X and Y connected together through the cord circuit C at the central office E. The line limbs *a* and *b* of each line terminate in a springjack 1. The line limbs *a* of each line are connected also with one pole of the common battery 2, the other pole of which is connected through the indicators 3, 3 and the springjack contacts with the line limbs *b*, *b*. The cord circuit is equipped with the operator's listening key 4 for connecting the operator's telephone set 5 in bridge of the circuit and the ringing keys 6, 7 and 8 serve to connect the ringing current generator 9 with the calling cord strands. A supervisory relay 10 is suitably connected with the cord and line circuits in any of the ways well known to the art.

Each of the telephone lines may lead to any desired number of substations, but for the sake of illustration I have shown the line X connected with two party line substations A and B, while the line Y is connected with substation D. At each of the party line substations is provided suitable telephonic ap-

paratus comprising a receiver 12, a transmitter 13, and a condenser 15. The switch hook 11 is equipped with contact springs, which serve to alter the electrical connections due to the movement of the switch hook. It is to be noted that the telephonic apparatus at the substation does not include an induction coil nor an impedance coil which is specially provided for the telephonic circuit alone.

At each substation there is a relay R, and in the preferred embodiment of my invention the relay has two windings, a high resistance winding *h* and a low resistance winding *l*. The armature 16 of the relay is permanently connected with one terminal of the receiver 12. The normally closed back contact 17 of the relay is connected with the other terminal of the receiver, thereby short-circuiting the receiver and rendering it inoperative at all times when the armature of the relay is in its normal position against the back contact 17. One terminal of the high resistance winding *h* is connected with the contact spring 18 associated with the switch hook. The other terminal of the high resistance winding is connected with one or the other of the line limbs. At the substation A it is connected with the limb *b*, while at substation B it is connected with the line limb *a*. This, as will be readily understood by those skilled in the art, is on account of the fact that the ringing currents for actuating the signal bell at the substation A traverses the line limb *b* to ground, while at substation B they traverse the line limb *a* to ground. At each substation is provided a signal bell 14 and a condenser 15, both being connected as shown in the drawing. One terminal of the low resistance winding *l* of the relay is connected with the front contact 19 associated with the armature 16, and the other terminal of this winding is connected through the manually operated switch or key 20 with the same line limb as that to which one terminal of the high resistance winding *h* is connected. The telephone transmitter 13 is preferably connected with the armature 16 and with the spring contact 18, while that terminal of the receiver which is connected with the contact 17 is also connected with a contact 21 associated with the contact spring 22, but normally disengaged therefrom. The contact spring 22 is mechanically connected with the switchhook but insulated therefrom and electrically connected with the line limb to which the high resistance winding of the relay is connected, this connection, however, being an inductive connection only on account of the interposition of the condenser 15. The switch hook at substation A is connected with the line limb *a*. At substation B the switch hook is connected with the line limb *b*.

The selective ringing keys 6 and 7 at the central station are arranged in a well known manner so that the generator 9 may send signaling current through the signal bell at one of the substations when the key 6 is actuated, and through the signal bell at the other substation when the key 7 is operated. In the drawing I have shown the answering side of the cord circuit connected with the line X by way of the associated springjack and the calling side of the cord circuit as connected with the line Y, the substation illustrated as connected with the line Y being arranged so that the signal bell will be actuated by an alternating current over both limbs of the metallic line. As will be readily understood by those skilled in the art, the ringing key 8 at the central station is connected with the generator 9 in such a way that an actuation of this key will send a current over the two limbs of the metallic line in a manner suitable for actuation of a signal bell connected as shown at substation D on the line Y. Any number of substations arranged like that shown at D may be connected with a metallic line, and the application of currents of suitable polarity or frequency may be relied upon to select and ring the desired substation.

A description of the operation of the system here shown will illustrate its novelty and usefulness. The receiver at substation B is shown removed from the switch hook and it may be assumed that the subscriber at this substation has initiated a call to be answered at the central station. The cord-connecting apparatus is normally disassociated with the telephone lines and current will therefore flow from the common battery 2 through the indicator 3, the springjack contacts, the line limb *b*, the switch hook at the substation B, the associated contact spring 18 now in engagement with the raised switch hook, thence through the high resistance winding *h* of the relay R to line limb *a* and back to the other pole of the battery 2. The current flowing over this circuit causes an actuation of the indicator 3, thus calling the attention of the operator. At the same time the current flowing through the high resistance winding *h* of the relay R causes the immediate energization of this relay to attract its armature 16, thus opening at once the short-circuit about the receiver 12. Furthermore, the attraction of the armature 16 causes an engagement of the armature with the front contact 19, thereby affording a new path at substation B through which current may flow from one line limb to the other. This additional circuit may be traced as follows: from the line limb *b* through the switch hook 11 at substation B, through the spring contact 18, the transmitter 13, the armature 16, the front contact 19 of the relay R, the low resistance winding *l* of this relay and the key 20 to line limb *a*. It will be apparent that the closure of a circuit at substation B through the high resistance winding *h* of the relay immediately reduces the voltage

available for the actuation of apparatus at any other station on the same line, but the closure of an additional low resistance circuit through the other winding of the relay immediately upon the attraction of the relay armature 16 causes a very much increased current to flow through the circuits at substation B, thereby reducing still further the line voltage available for actuation of apparatus at other substations on the same line. In this way all of the other substations on this line are locked out so that no other subscriber can put his telephonic apparatus into operative condition for listening upon the line. The attraction of the armature 16 at the substation B is maintained not only by the flow of current through the high resistance winding of the relay R but also by the flow of current through the cumulatively connected low resistance winding *l*. After the closure of this low resistance circuit at the substation B there is insufficient pressure across the line limbs to cause a flow of current through the high resistance winding *h* of a relay at any other substation on the line sufficient to cause the associated armature 16 to start or to move far enough to engage its front contact 19, it requiring more energy to start the armature than to hold it in its actuated position. Therefore the receiver at another station will remain short-circuited and transmitter circuit will be open by virtue of the inaction of the armature of the associated relay; even though the receiver at this substation be removed from its switch hook to close circuit the associated high resistance winding *h*.

Referring now to the apparatus at substation B, it will be seen that with the switch hook in its upper position there are three parallel circuits through the substation apparatus. In addition to the circuits already traced through the two windings of the relay R there is a circuit through the telephone receiver through which telephonic voice currents may flow. This circuit may be traced from the line limb *a* through the condenser 15, the spring contact 22, contact 21, the receiver 12, the transmitter 13, the spring contact 18, the switch hook 11, and thence to the line limb *b*. On account of the condenser included in this circuit it will not, of course, convey the direct current necessary for the operation of the transmitter 13. The direct current for the operation of the transmitter is conveyed through the circuit previously traced and includes the low resistance winding *l* of the relay R. This electromagnet winding *l* serves, therefore, not only to provide a low resistance path between the line limbs to deprive other substations of a current sufficient for the actuation of their relays and to assist in maintaining the energization of its own electromagnet core for the retention of the associated armature, but also to provide the impedance coil necessary in a telephonic substation set where a condenser is included in circuit with the receiver. The impedance coil formed by the low resistance winding *l* serves to kick the voice currents through the receiver and serially connected condenser. On account of the impedance of the relay windings incoming voice currents will be forced to follow almost exclusively the path through the condenser and serially connected receiver. Although the high resistance winding of the relay is connected in a branch of the low resistance winding and transmitter, its resistance is so high that practically all of the direct current will flow through the transmitter and low resistance winding. The impedance of the high resistance winding *h* is so great also that it does not serve to short-circuit the voice currents set up at the same substation. The condenser 15 prevents the flow of direct current through the associated receiver, thus preventing the demagnetization of the receiver. A single condenser at each substation when connected in accordance with my invention serves two purposes. Normally it prevents the flow of battery current from the line through the associated signal bell to ground and serves to convey the alternating or pulsating ringing current. When the switch hook is raised the condenser is connected in series with the receiver to transmit voice currents and to prevent the passage of direct current. I find it preferable to make the signal bells of comparatively high impedance to prevent the leakage of voice currents. The connection of the signal bells to opposite limbs of the line serves to maintain the inductive balance thereof.

The operator at the central office responding to the signal of the indicator 3, inserts her answering plug in a springjack associated with the line X, and upon learning from the calling subscriber that a connection is desired with substation D, she inserts her calling plug into the jack associated with the line Y and signals the subscriber at substation D by actuating the ringing key 8. The subscriber at substation D in answering the call removes his receiver from the switch hook 11, thereby causing the flow of current through the high resistance winding *h* of his relay R, and it being assumed that none of the other substation sets connected with this line are already in use, the pressure in the line Y will be sufficient to energize the relay R to cause the attraction of the armature, thus removing the short-circuit from the receiver and closing circuit through the low resistance winding *l* of the relay and thus completing the telephonic circuit at the substation D. The removal of the receiver from

the switch hook at substation D serves to lock out all of the other subscribers connected on line Y.

It is sometimes desirable that substations connected with the same line may be connected with each other for conversation, and this, under the conditions thus far described, would be impossible, owing to the lock-out feature of my invention. At each substation, however, there is provided the key 20, which normally closes the circuit through the low resistance winding of the relay and the transmitter. If we assume that the subscriber at substation B had wished for a connection with the substation A on the same line, he notifies the central operator of the connection desired and immediately depresses key 20 to open the low resistance branch at his substation. Under these conditions the high resistance winding only of the relay will remain in circuit. The line pressure, therefore, will not be as greatly reduced as when the low resistance path is closed between the line limbs at the substation B and the line pressure will then be sufficient to cause a current to flow through the high resistance winding of the relay at substation A, this current being sufficient to move the armature 16 at substation A to open the short-circuit about the receiver upon the removal of the receiver from the switch hook at substation A in response to the signaling current which the operator sends over the line to actuate the signal bell at the substation A. The opening of the low resistance circuit at substation B by depressing the key 20 will not affect the receiver circuit at substation B and the calling subscriber therefore can hear when the subscriber at the substation A answers. When he hears the answer he immediately releases his key 20, whereupon the low resistance circuit at substation B provides current for transmission purposes and the conversation between the connected subscribers may proceed in the usual way. Although the low resistance circuits at the substations A and B are both closed, the available energy will be sufficient to hold the armatures thereat but will not be sufficient to start the armature at any other substation when the receiver at the other substation is lifted during conversation between A and B.

It will be apparent to those skilled in the art that the lock-out system herein described is simple and efficient, and that the required results are accomplished without the provision of expensive and complicated apparatus in addition to that usually required in a common battery substation set. The high resistance relay winding, as before stated, and the low resistance winding also both prevent short-circuiting of voice currents and deflect them through the receiver and serially connected condenser. At the same time both windings coöperate to maintain the energization of the relay and the attraction of its armature to maintain the necessary connections during conversation, and, furthermore, the electromagnet which acts to operate the armature 16 serves also for the impedance coil of the telephonic circuit, no other impedance coil or induction coil being required. The condenser also performs the various functions heretofore ascribed to it.

While I have herein shown and described a preferred embodiment of my invention, I do not wish to be limited to this precise arrangement, as changes may readily be made by those skilled in the art without departing from the spirit of my invention. Furthermore, I do not wish to limit myself to any particular selective signaling system nor to the precise central station arrangement herein shown, since my improved lock-out system may be employed in connection with any selective signaling system in the central station equipment necessarily associated therewith.

What I claim as new and desire to secure by Letters Patent is:—

1. In a telephone system, the combination with a party-line, of a plurality of substations connected therewith, telephonic apparatus at each substation, a source for supplying current to the line and substations, a relay at each substation for controlling the operativeness of the telephonic apparatus thereat, said relay having two windings, means upon actuation of substation apparatus for causing first current flow through one of said windings to energize the relay and then current flow also through the other winding to assist in maintaining energization of said relay, energization of said relay causing the telephonic apparatus to become effective.

2. In a telephone system, the combination with a line, of a plurality of substations connected therewith, a source for supplying current to the line and substations, telephonic and switching apparatus at each substation, a relay for controlling the operativeness of the telephonic apparatus, said relay having two windings, actuation of switching apparatus at the substation causing first the closure of a circuit including one of said windings, means adapted upon current flow through said winding to cause the closure of a circuit in parallel with said first circuit and including telephonic apparatus and the other relay winding, said circuits being in parallel and affording a path through the substation for current from said source, said first winding being of high resistance whereby the greater part of said current will flow through the circuit containing the telephonic apparatus and the other winding, said telephonic apparatus being rendered effective upon actuation of said relay.

3. In a telephone system, the combination

with a line, of a substation connected therewith, a source for supplying current to the line and substation, telephonic and switching apparatus at the substation, a relay at the substation controlling the operativeness of the telephonic apparatus, two windings for said relay, actuation of switching apparatus at the substation causing first closure of a circuit including one of said windings whereby the relay is energized to render the telephonic apparatus operative, a second circuit closed upon actuation of the relay and including telephonic apparatus, said windings acting cumulatively to maintain energization of the relay, said first winding being of high resistance whereby the current flow through the substation is all confined practically to the circuit containing the telephonic apparatus.

4. In a telephone system, the combination with a line, of a substation connected therewith, a source for supplying current to the line and substation, telephonic apparatus at the substation normally ineffective, a relay at the substation having two windings, actuation of switching apparatus at the substation causing current flow through one of said windings to energize the relay to render the telephonic apparatus operative, the second winding of the relay being included in circuit upon energization of the relay by the first winding to assist said first winding in maintaining actuation of the relay.

5. In a telephone system, the combination with a line, of a substation connected therewith, a source for supplying current to the line and substation, telephonic apparatus at the substation normally ineffective, a relay at the substation having two windings, actuation of switching apparatus at the substation causing current flow through one of said windings to energize the relay to render the telephonic apparatus operative, the second winding of the relay being included in circuit upon energization of the relay by the first winding to assist said first winding in maintaining actuation of the relay, said windings upon action of the relay being included in parallel circuits.

6. In a telephone system, the combination with a telephone line, of a substation connected therewith, a source for supplying current to the line and substation, main switching apparatus at the substation, auxiliary switching apparatus at the substation normally disposed to render the telephonic apparatus inoperative, a relay controlling said auxiliary switching mechanism, two windings for said relay, actuation of the main switching mechanism causing closure of a circuit through the substation containing one of said windings whereby said relay becomes actuated and said auxiliary switching mechanism moved to allow the telephonic apparatus to become operative, actuation of said relay by said first winding causing also closure of a circuit through the second winding of the relay whereafter both windings are effective in maintaining actuation of the relay.

7. In a telephone system, the combination with a line, of a substation connected therewith, a source for supplying current to the system, main switching mechanism at the substation, telephonic apparatus at the substation normally disconnected from the line independently of the main switching mechanism, a relay controlling the connection of said telephonic apparatus with the line, two windings for said relay, means upon actuation of the main switching mechanism for allowing current flow through one of said windings to cause actuation of the relay, means upon actuation of the relay by said first winding for causing closure of a circuit through the second winding and connection of the telephonic apparatus with the line, said two windings then acting cumulatively to maintain actuation of the relay.

8. In a telephone system, the combination with a line, of a substation connected therewith, a source of current for connection with the substation, main switching mechanism and telephonic apparatus at the substation, said telephonic apparatus being normally disconnected from the line independently of the main switching mechanism, a relay for controlling the connection of the telephonic apparatus with the line and having two windings, actuation of the main switching mechanism causing the closure of a circuit through one winding of the relay whereby said relay is actuated, actuation of the relay causing closure of a second circuit through the substation, said second circuit including the other winding of the relay and telephonic apparatus, said telephonic apparatus being thereby connected with the line and said windings both active in maintaining actuation of the relay.

9. In a telephone system, the combination with a line, of a substation connected therewith, a source for supplying current to the substation, switching mechanism at the substation, telephonic apparatus at the substation normally ineffective, a relay at the substation controlling the telephonic apparatus, means upon actuation of the switching mechanism for causing closure of a path for current flow through the substation including one winding of the relay whereby said relay is actuated to render the telephonic apparatus effective, and a second winding for the relay connected in circuit upon actuation thereof to assist said first winding in maintaining actuation of the relay.

10. In a telephone system, the combination with a telephone line, of a substation connected therewith, a source of current for supplying the line and substation, telephonic

apparatus at the substation normally disconnected from the line, two normally open parallel paths at the substation for current flow, main switching mechanism at the substation for controlling one path, a relay for controlling the second path, two windings for said relay, one of said windings being included in said first path and adapted upon actuation of the switching mechanism to cause actuation of said relay whereby said second path is closed, said second path containing said telephonic apparatus, and means upon actuation of said relay by the first winding for causing said second winding to be included in circuit to assist said first winding in maintaining actuation of the relay.

11. In a telephone system, the combination with a telephone line, of a substation connected therewith, a source of current for supplying the line and substation, telephonic apparatus at the substation normally disconnected from the line, two normally open parallel paths at the substation for current flow, main switching mechanism at the substation for controlling one path, a relay for controlling the second path, two windings for said relay, one of said windings being included in said first path and adapted upon actuation of the switching mechanism to cause actuation of said relay whereby said second path is closed, said second path including the telephonic apparatus and the second winding for said relay, said second winding assisting said first winding in maintaining actuation of the relay.

12. In a telephone system, the combination with a line, of a substation connected therewith, a source for supplying current to the line and substation, telephonic apparatus at the substation, relay mechanism normally disposed to render the telephonic apparatus ineffective, a high resistance and a low resistance winding for said relay, switching mechanism at the substation adapted upon actuation to close first a circuit through said high resistance winding to cause actuation of the relay mechanism, whereby the telephonic apparatus is rendered effective, and a second circuit closed through said low resistance winding upon actuation of the relay for assisting the high resistance winding in maintaining actuation of the relay.

13. In a telephone system, the combination with a telephone line, of a substation connected therewith, a source of current for supplying the line and substation, telephonic apparatus at the substation normally disconnected from the line, two normally open parallel paths at the substation for current flow, main switching mechanism at the substation for controlling one path, a relay for controlling the second path, two windings for said relay, one of said windings being included in said first path and adapted upon actuation of the switching mechanism to cause actuation of said relay whereby said second path is closed, said second path including the telephonic apparatus and the second winding for said relay, said second winding assisting said first winding in maintaining actuation of the relay, the first path being of high resistance and the second path containing the telephone apparatus being of low resistance whereby practically all the current flow will be through said second path and telephonic apparatus.

14. In a telephone system, the combination with a telephone line, of a substation connected therewith, a source of current for supplying the line and substation, telephonic apparatus at the substation normally disconnected from the line, two normally open parallel paths at the substation for current flow, main switching mechanism at the substation for controlling one path, a relay for controlling the second path, two windings for said relay, one of said windings being included in said first path and adapted upon actuation of the switching mechanism to cause actuation of said relay whereby said second path is closed, said second path including the telephonic apparatus and the second winding for said relay, said second winding assisting said first winding in maintaining actuation of the relay, said first path being of high impedance whereby telephonic currents are deflected through the second path.

15. In a telephone system, the combination with a line, of a substation connected therewith, a source for supplying current for the line and substation, main switching mechanism at the substation, relay mechanism at the substation, telephonic apparatus normally short-circuited by the relay mechanism and disconnected from the line, two windings for said relay mechanism, means upon actuation of the switching mechanism for closing a circuit through one of said windings to cause actuation of the relay whereby the short-circuit is removed from the telephonic apparatus and other apparatus connected with the line, actuation of the relay mechanism causing also inclusion in a circuit the second winding of the relay, both windings then acting cumulatively.

16. In a telephone system, the combination with a telephone line, of a substation connected therewith, a source of current for supplying the line and substation, switching mechanism at the substation, relay mechanism normally causing the telephonic apparatus to be short-circuited and disconnected from the line, a high resistance and a low resistance winding for said relay, actuation of the switching mechanism causing current flow through the high resistance winding whereby the relay mechanism becomes actuated to open the short-circuit and to connect the telephonic apparatus with the line,

actuation of the relay mechanism causing also closure of a circuit in parallel of the high resistance winding and through the low resistance winding whereby a low resistance path is afforded through the substation and said high resistance winding assisted in maintaining actuation of the relay mechanism.

17. In a telephone system, the combination with a line, of a plurality of substations connected therewith, a source of current for supplying the line and substations, telephonic apparatus at each substation, relay mechanism at each substation normaliy causing telephonic apparatus thereat to be ineffective, switching mechanism at each substation, actuation of the switching mechanism at one substation causing closure of a high resistance path through the relay mechanism whereby said mechanism is actuated to render the telephonic apparatus operative, actuation of the relay mechanism causing the closure of a low resistance path through the relay mechanism in parallel to the high resistance, the current flow from said source upon connection of the low resistance path at the one substation being insufficient to cause actuation of a relay at another through its high resistance path upon actuation of the switching mechanism at the other substation whereby the telephonic apparatus at other substations are maintained in inoperative condition.

18. In a telephone system, the combination with a line, of a plurality of substations connected therewith, a source of current for supplying the line and substations, telephonic apparatus at each substation, relay mechanism at each substation normally causing telephonic apparatus thereat to be ineffective, switching mechanism at each substation, actuation of the switching mechanism at one substation causing closure of a high resistance path through the relay mechanism whereby said mechanism is actuated to render the telephonic apparatus operative, actuation of the relay mechanism causing the closure of a low resistance path through the relay mechanism in parallel to the high resistance, connection of the low resistance path at the one substation preventing sufficient current flow through any other substation to cause actuation of the relay at said other substation through its high resistance path upon actuation of the switching mechanism at said other substation whereby the telephonic apparatus at other substations are maintained in inoperative condition, and means at each substation for opening the low resistance path whereby upon actuation of said means at the one substation there will be sufficient current flow to cause actuation of the relay mechanism at any other substation upon actuation of the switching mechanism at the other substation.

19. In a telephone system, the combination with a telephone line, of substations connected therewith, a source of current for supplying the line and substations, telephonic apparatus at each substation, relay mechanism at each substation normally causing the telephonic apparatus to be disconnected from the line, switching mechanism at each substation, means upon actuation of the switching mechanism at one substation for causing current flow through a high resistance path through said relay mechanism whereby said relay mechanism is actuated, a low resistance path closed through said relay mechanism in parallel with the high resistance path upon actuation of the relay mechanism, said low resistance path including the telephonic apparatus whereby said apparatus is connected with the line, the energy from said source upon current flow through both paths at the one substation being insufficient to cause actuation of the relay mechanism at another substation through the high resistance path thereof whereby said other substations are locked from telephonic service.

20. In a telephone system, the combination with a telephone line, of substations connected therewith, a source of current for supplying the line and substations, telephonic apparatus at each substation, relay mechanism at each substation normally causing the telephonic apparatus to be disconnected from the line, switching mechanism at each substation, means upon actuation of the switching mechanism at one substation for causing current flow through a high resistance path through said relay mechanism whereby said relay mechanism is actuated, a low resistance path closed through said relay mechanism in parallel with the high resistance path upon actuation of the relay mechanism, said low resistance path including the telephonic apparatus whereby said apparatus is connected with the line, the energy from said source upon current flow through both paths at the one substation being insufficient to cause actuation of the relay mechanism at another substation through the high resistance path thereof whereby said other substations are locked from telephonic service, and additional switching means at each substation, actuation of said additional switching means at the one substation causing the low resistance path to be rendered ineffective whereby said source may supply sufficient energy through the high resistance path of the relay mechanism at another substation to allow actuation of the relay mechanism at the other substation.

21. In a telephone system, the combination with a telephone line, of substations connected therewith, a source for supplying current to the line and substations, trans-

mitting and receiving mechanism at each substation, relay mechanism at each substation normally causing the transmitting mechanism to be disconnected from the line, switching mechanism at each substation, means upon actuation of the switching mechanism at one substation for causing current flow through a high resistance path of the relay mechanism whereby said relay mechanism is actuated to cause the transmitting mechanism to be connected with the line, a low resistance path for the relay mechanism connected in circuit upon actuation of the relay mechanism, said low resistance path causing sufficient diminution of the energy from said source to prevent actuation of the relay mechanism at another substation through the high resistance path thereof whereby other substations are locked from service, and a non-impedance path closed through the receiving mechanism at the substation about the relay mechanism upon actuation of the relay mechanism.

22. In a telephone system, the combination with a telephone line, of substations connected therewith, a source for supplying current to the line and substations, telephonic apparatus at each substation, relay mechanism controlling the connection of telephonic apparatus with the line, switching mechanism at each substation, actuation of the switching mechanism at one substation causing closure of one path through the relay mechanism whereby the relay mechanism is actuated, actuation of said relay mechanism causing closure of a second path through the relay mechanism in parallel with the first path, said second path including the telephonic apparatus, said first path being of high resistance and the second path of low resistance whereby the greater part of current flow through the substation will pass through the telephonic apparatus, the energy from said source upon closure of the low resistance path at the one substation being insufficient to cause actuation of the relay mechanism at any other substation through the high resistance path thereof whereby other substations are locked from service.

23. In a telephone system, the combination with a telephone line, of substations connected therewith, a source for supplying current to the line and substations, telephonic apparatus at each substation, relay mechanism controlling the connection of telephonic apparatus with the line, switching mechanism at each substation, actuation of the switching mechanism at one substation causing closure of one path through the relay mechanism whereby the relay mechanism is actuated, actuation of said relay mechanism causing closure of a second path through the relay mechanism in parallel with the first path, said second path including the telephonic apparatus, said first path being of high resistance and the second path of low resistance whereby the greater part of current flow through the substation will pass through the telephonic apparatus, the energy from said source upon closure of the low resistance path at the one substation being insufficient to cause actuation of the relay mechanism at any other substation through the high resistance path thereof whereby other substations are locked from service, and auxiliary switching means at each substation, actuation of these auxiliary switching means at the one substation causing opening of the low resistance path to allow sufficient energy to flow through the high resistance path at any other substation upon actuation of the switching mechanism thereat whereby the relay mechanism at said other substation may be actuated to render the telephonic mechanism thereat effective.

24. In a telephone system, the combination with a telephone line, of substations connected therewith, a source for supplying current to the line and substations, receiving and transmitting telephonic apparatus at each substation, relay mechanism at each substation normally causing short-circuiting of the receiving mechanism and disconnection from the line of the transmitting mechanism, main switching mechanism at each substation, actuation of the main switching mechanism at one substation causing closure of a high resistance path through the relay mechanism to cause actuation of the relay mechanism to remove the short-circuit about the receiving mechanism and to connect the transmitting mechanism with the circuit, actuation of the relay mechanism causing closure of a low resistance parallel path through the relay mechanism, the energy from said source being insufficient upon connection of the low resistance path at the one substation to cause actuation of the relay mechanism at any other substation through the high resistance path thereof whereby the receiving mechanism at any other substation is maintained in short-circuiting condition and the transmitting mechanism thereat kept disconnected from the line.

25. In a telephone system, the combination with a telephone line, of substations connected therewith, a source for supplying current to the line and substations, receiving and transmitting telephonic apparatus at each substation, relay mechanism at each substation normally causing short-circuiting of the receiving mechanism and disconnection from the line of the transmitting mechanism, main switching mechanism at each substation, actuation of the main switching mechanism at one substation causing closure of a high resistance path through the relay mechanism to cause actuation of the relay mechanism to remove the short-circuit about the receiving mechanism and to connect the

transmitting mechanism with the circuit, actuation of the relay mechanism causing closure of a low resistance parallel path through the relay mechanism, the energy from said source being insufficient upon connection of the low resistance path at the one substation to cause actuation of the relay mechanism at any other substation through the high resistance path thereof whereby the receiving mechanism at any other substation is maintained in short-circuiting condition and the transmitting mechanism thereat kept disconnected from the line, and means at each substation for destroying the effect of the low resistance path to allow energization of the relay mechanism at other substations.

26. In a telephone system, the combination with a telephone line, of substations connected therewith, a source for supplying current to the line and substations, receiving and transmitting telephonic apparatus at each substation, relay mechanism at each substation normally causing short-circuiting of the receiving mechanism and disconnection from the line of the transmitting mechanism, main switching mechanism at each substation, actuation of the main switching mechanism at one substation causing closure of a high resistance path through the relay mechanism to cause actuation of the relay mechanism to remove the short-circuit about the receiving mechanism and to connect the transmitting mechanism with the circuit, actuation of the relay mechanism causing closure of a low resistance parallel path through the relay mechanism, the energy from said source being insufficient upon connection of the low resistance path at the one substation to cause actuation of the relay mechanism at any other substation through the high resistance path thereof whereby the receiving mechanism at any other substation is maintained in short-circuiting condition and the transmitting mechanism thereat kept disconnected from the line, said relay mechanism being of high impedance, and a non-impedance by-path at each substation for the passing therethrough of voice currents.

27. In a telephone system, the combination with a telephone line, of a substation connected therewith, a source of current for connection with the substation, main switching mechanism, and telephonic apparatus at the substation, said telephonic apparatus being normally disconnected from the line independently of the main switching mechanism, a relay for controlling the connection of the telephonic apparatus with the line, said relay having two windings, actuation of the main switching mechanism causing the closure of a circuit through a winding of the relay whereby said relay is actuated, actuation of the relay causing closure of a second circuit through the substation, said second circuit including the other winding of the relay and telephonic apparatus, said telephonic apparatus being thereby connected with the line.

28. In a party line telephone system, a central source of electric energy, line wires extending therefrom to a plurality of substations, normally inoperative telephonic apparatus at each substation, a relay having two windings, means controlled by the relay for rendering the telephonic apparatus operative, and a receiver and condenser in shunt of the said windings.

29. In a party line telephone system, a central source of electric energy, line wires extending therefrom to a plurality of substations, normally inoperative telephonic apparatus at each substation, a relay at each substation, and a switch controlled by said relay to close a telephonic circuit including a winding of said relay.

30. In a party line telephone system, a central source of electric energy, line wires extending therefrom to a plurality of substations, telephonic apparatus at each of said substations, an electromagnet at each substation, and switching mechanism controlled by each electromagnet and serving normally to maintain the telephonic apparatus at the associated substation imperative, and serving when actuated by the energization of said electromagnet to close a circuit including a winding of said electromagnet and telephonic apparatus.

31. In a party line telephone system, a central source of electric energy, line wires extending therefrom to a plurality of substations, telephonic apparatus at each of said substations, an electromagnet at each substation, and switching mechanism controlled by each electromagnet and serving normally to maintain the telephonic apparatus at the associated substation inoperative, and serving when actuated by the energization of said electromagnet to close a circuit including a winding of said electromagnet and a telephone transmitter.

32. In a party line telephone system, a central source of electric energy, line wires extending therefrom to a plurality of substations, normally inoperative telephonic apparatus at each substation, a relay at each substation, a switch controlled by said relay to close a telephonic circuit including a winding of said relay, and a receiver and serially connected condenser in shunt about a winding of the relay.

33. In a party line telephone system, a central source of electric energy, line wires extending therefrom to a plurality of substations, telephonic apparatus at each of said substations, an electromagnet at each substation, switching mechanism controlled by each electromagnet and serving normally to maintain the telephonic apparatus at the associated substation inoperative and serving

when actuated by the energization of said electromagnet to close a circuit including a winding of said electromagnet and telephonic apparatus, and a receiver and serially connected condenser in shunt about a winding of the relay.

34. In a party line telephone system, a central source of electric energy, line wires extending therefrom to a plurality of substations, telephonic apparatus at each of said substations, an electromagnet at each substation, switching mechanism controlled by each electromagnet and serving normally to maintain the telephonic apparatus at the associated substation inoperative, and serving when actuated by the energization of said electromagnet to close a circuit including a winding of said electromagnet and a telephone transmitter, and a receiver and serially connected condenser in shunt about a winding of the relay.

35. In combination, a telephone line leading from a plurality of substations to a central office, sources of talking and signaling current at the central office, an electromagnet at each of the substations, a signal bell at each substation, a condenser normally in circuit with each bell, switching means associated with each electromagnet and adapted upon actuation of the associated electromagnet to close a telephonic circuit including the condenser at the associated substation, and a receiver connected with each condenser in shunt of the winding of the associated electromagnet.

36. In combination, a telephone line leading from a plurality of substations to a central office, sources of talking and signaling current at the central office, a relay at each substation normally inoperative, telephonic apparatus at each substation, a signal bell at each substation, a condenser normally in circuit with each bell, means for connecting said telephonic apparatus in circuit with said condenser, and means controlled by said relay to render the telephonic apparatus operative.

37. In combination, a telephone line leading from a plurality of substations to a central office, sources of talking and signaling current at the central office, a relay at each substation normally inoperative, telephonic apparatus at each substation, switch apparatus at each substation, a signal bell at each substation, a condenser normally in circuit with each bell, actuation of the switch apparatus causing closure of a circuit including the condenser and telephonic apparatus, and means controlled by each relay to render operative said telephonic apparatus.

38. In combination, a telephone line leading from a plurality of substations to a central office, sources of talking and signaling current at the central office, a relay at each substation, telephonic apparatus at each substation comprising a receiver and transmitter, switch apparatus at each substation, a signal bell at each substation, a condenser normally in circuit with each signal bell, actuation of the switch apparatus causing connection of said receiver in circuit with the condenser and with the telephone line, and means controlled by the relay for closing a circuit through the transmitter and through one winding of said relay.

39. In combination, a telephone line leading from a plurality of substations to a central office, sources of talking and signaling current at the central office, a relay at each substation, telephonic apparatus at each substation comprising a receiver and a transmitter, switch mechanism at each substation, a signal bell at each substation, a condenser normally in circuit with each bell, actuation of the switch mechanism causing connection of the receiver with the line through a circuit including the condenser, actuation of said switch mechanism also causing connection of the relay with the line, and means adapted upon energization of the relay to connect the transmitter with the line through a circuit including a winding of the relay, said condenser serving to provide a non-inductive path about the relay winding.

40. In combination, a telephone line leading from a plurality of substations to a central office, sources of talking and signaling current at the central office, an electromagnet at each substation normally inoperative, telephonic apparatus at each substation comprising a transmitter and a receiver, switch mechanism at each substation, a signal bell at each substation, a condenser normally in circuit with each bell, actuation of the switch mechanism closing a circuit through the relay, and a switch at each substation controlled by the electromagnet when energized to render the telephonic apparatus operative, said switch when actuated closing also a circuit including a winding of the electromagnet and the transmitter, actuation of the switch mechanism closing also a circuit including the receiver and the condenser.

41. In combination, a telephone line leading from a plurality of substations to a central office, a central source of electric energy connected with the line at the central office, a source of ringing current at the central office, normally inoperative telephonic apparatus at each substation, comprising a transmitter and a receiver, a relay at each substation, each relay being adapted upon actuation to render operative the associated telephonic apparatus, a path at each substation for ringing currents, a signal bell in each of said paths, a path at each substation in shunt around the relay winding for voice currents,

and a condenser common to both paths, the condenser and receiver being connected in shunt about said relay winding.

42. In combination, a telephone line leading from a plurality of substations to a central office, a central source of electric energy connected with the line at the central office, a source of ringing current at the central office, normally inoperative telephonic apparatus at each substation comprising a transmitter and a receiver, a relay having two windings at each substation, each relay adapted upon actuation to render operative the associated telephonic apparatus, a path at each substation for ringing currents, a signal bell in each of said paths, a path at each substation in shunt around the relay windings for voice currents, a condenser common to both paths, the condenser and receiver being connected in shunt about said relay windings, a manual switch at each substation for closing the circuit through one of the associated relay windings, and a switch controlled by each relay to close the circuit through the other relay winding at each substation.

43. In combination, a telephone line extending from a plurality of substations to a central office, sources of talking and signaling current at the central office, normally inoperative telephonic apparatus comprising a receiver and transmitter at each substation, a relay having two windings at each substation, means at each substation adapted upon actuation of the associated relay to render operative the associated telephonic apparatus and to close a circuit including a winding of said relay and the transmitter, a path at each substation in shunt around the relay windings for the passage of voice currents, and a condenser common to both paths.

44. In combination, a telephone line extending from a plurality of substations to a central office, sources of talking and signaling current at the central office, normally inoperative telephonic apparatus comprising a receiver and transmitter at each substation, a relay at each substation, means at each substation adapted upon actuation of the associated relay to render operative the associated telephonic apparatus and to close a circuit including a winding of said relay and the transmitter, a path at each substation for ringing currents, a path at each substation in shunt around a relay winding for the passage of voice currents, and a condenser common to both paths.

45. In combination, a telephone line extending from a plurality of substations to a central office, sources of talking and signaling current at the central office, normally inoperative telephonic apparatus comprising a receiver and transmitter at each substation, a relay having two windings at each substation, means at each substation adapted upon actuation of the associated relay to render operative the associated telephonic apparatus and to close a circuit including a winding of said relay and the transmitter, a path at each substation for ringing currents, a path at each substation in shunt around the relay windings for the passage of voice currents, a condenser common to both paths, a manual switch at each substation for closing circuit through one winding of the associated relay, and a switch controlled by each relay and adapted upon the strong energization of the relay to close circuit through the other relay winding.

46. In combination, a telephone line leading from a plurality of substations to a central office, sources of talking and signaling current at the central office, a relay at each of said substations having two windings, a manual switch at each substation for closing through a winding of the associated relay a circuit in bridge of the telephone line, and a switch controlled by said relay to close a circuit including the other winding of said relay and telephonic apparatus.

47. In combination, a telephone line leading from a plurality of substations to a central office, sources of talking and signaling current at the central office connected with said line, a transmitter at each substation, an electromagnet at each of said substations having two windings, a manual switch at each substation for closing through a winding of the associated electromagnet a circuit in bridge of the telephone line, and a switch automatically controlled by each electromagnet and adapted upon the energization of the magnet to close a circuit including the other winding of the electromagnet and the associated telephone transmitter.

48. In combination, a telephone line leading from a plurality of substations to a central office, sources of talking and signaling current at the central office connected with said line, a transmitter at each substation, an electromagnet at each of said substations having two windings, a manual switch at each substation for closing through a winding of the associated electromagnet a circuit in bridge of the telephone line, a switch automatically controlled by each electromagnet and adapted upon energization of the magnet to close a circuit including the other winding of the electromagnet and the associated telephone transmitter, and a receiver and serially connected condenser connected in shunt of the other winding of said electromagnet.

49. In combination, a telephone line leading from a plurality of substations to a central office, sources of talking and signaling current at the central office, a transmitter at each substation, an electromagnet at each substation having a high resistance winding and a low resistance winding, a manual switch at each substation for closing through

the high resistance winding of the associated relay a circuit in bridge of the telephone line, and a switch controlled by each electromagnet and adapted upon the closure of the high resistance circuit through one only of the electromagnets on a line to close a circuit through the low resistance winding of the associated relay and the telephone transmitter.

50. In combination, a telephone line leading from a plurality of substations to a central office, sources of talking and signaling current at the central office, a transmitter at each substation, an electromagnet at each substation having a high resistance winding and a low resistance winding, a manual switch at each substation for closing through the high resistance winding of the associated relay a circuit in bridge of the telephone line, a switch controlled by each electromagnet and adapted upon the closure of the high resistance circuit through one only of the electromagnets on a line to close a circuit through the low resistance winding of the associated relay and the telephone transmitter, and a receiver and serially connected condenser connected in shunt of a winding of said electromagnet.

51. In combination, a telephone line leading from a plurality of substations to a central office, sources of talking and signaling current at the central office connected with said line, a transmitter at each substation, an electromagnet at each of said substations having two windings, a manual switch at each substation for closing through a winding of the associated electromagnet a circuit in bridge of the telephone line, a switch automatically controlled by each electromagnet and adapted upon the energization of the magnet to close a circuit including the other winding of the electromagnet and the associated telephone transmitter, and a receiver connected in shunt of the other winding of said electromagnet.

52. In combination, a telephone line leading from a plurality of substations to a central office, sources of talking and signaling current at the central office, a transmitter at each substation, an electromagnet at each substation having a high resistance winding and a low resistance winding, a manual switch at each substation for closing through the high resistance winding of the associated relay a circuit in bridge of the telephone line, a switch controlled by each electromagnet and adapted upon the closure of the high resistance circuit through one only of the electromagnets on a line to close a circuit through the low resistance winding of the associated relay and the telephone transmitter, and a receiver connected in shunt of a winding of said electromagnet.

53. In a party line telephone system, a central source of electric energy, line wires extending therefrom to a plurality of substations, normally inoperative telephonic apparatus at each substation, a relay at each substation, a switch actuated by said relay to render the telephonic apparatus operative, when said switch is in its alternative position, a hook switch, magnetic means for maintaining said relay controlled switch in its alternative position during the time that said switch hook is in its alternative position.

In witness whereof, I hereunto subscribe my name this eighteenth day of December A. D., 1905.

ARTHUR F. POOLE.

Witnesses:
FRANK B. HALL,
JNO. F. FRASHER.