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LOCKOUT PARTY LINE TELEPHONE SYSTEM

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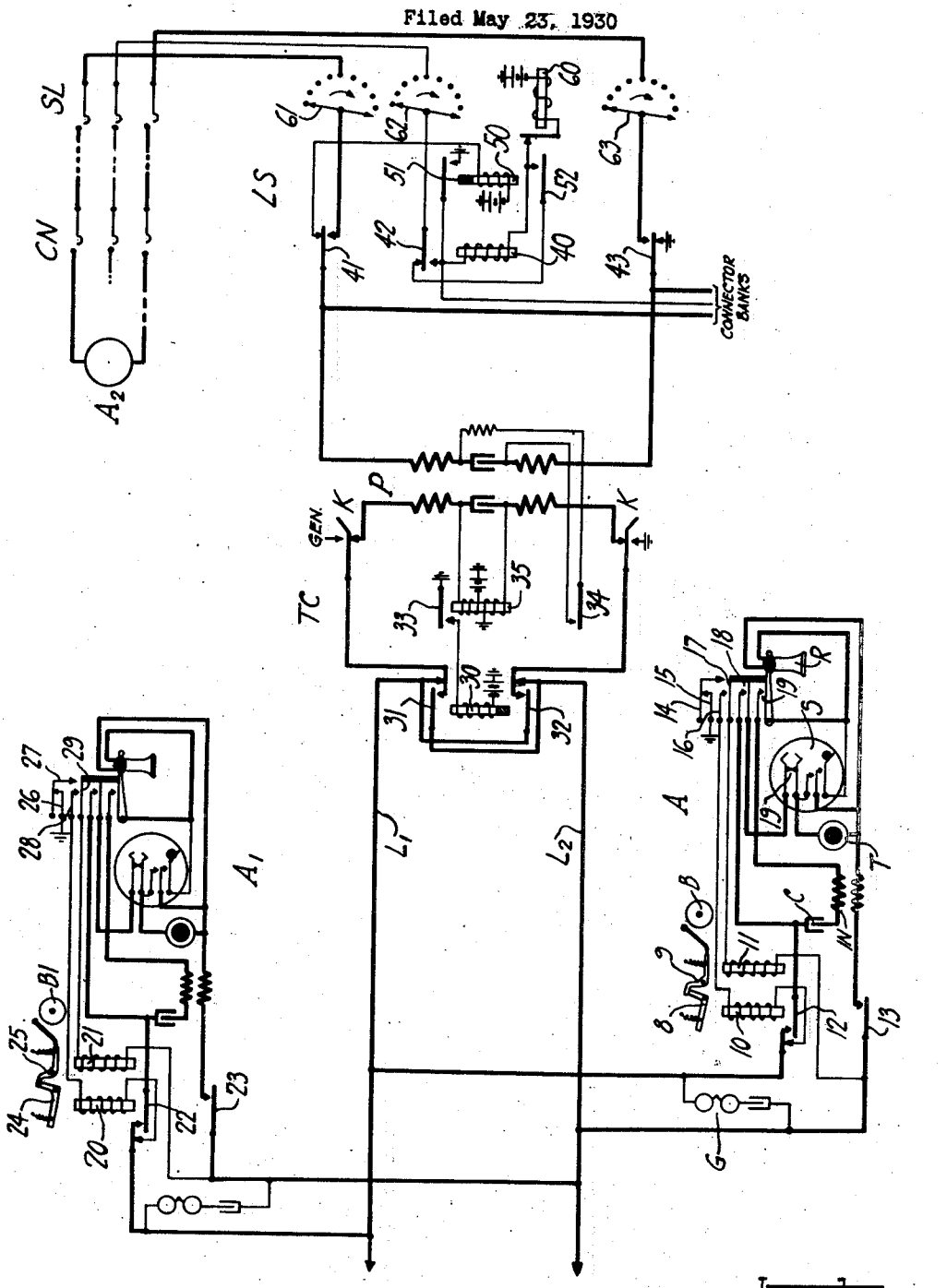

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LOCKOUT PARTY-LINE TELEPHONE SYSTEM

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This invention relates in general to party-line telephone systems and more particularly to an improved lock-out device for preventing a second subscriber from gaining access to a line when another subscriber on the same line is using it, and the principal object of the invention resides in new and improved means for doing this.

A further object of the invention is to provide means for signalling a subscriber when he attempts to call out on a line that is already in use by a second subscriber.

A feature of the invention resides in the means whereby a subscriber upon taking the party line into use, automatically reverses battery back over the line so that another subscriber, desiring access to the line, will be prevented from doing so due to the reversal of battery on the line.

A further feature of the invention resides in a pair of interlocking relays at each subscriber's station, one of which operates when a party initiates a call on the line, while the other relay is only operated at another subscriber's station, when he attempts to gain access to the line and operates to audibly inform him of the busy condition of the line.

These and other features not specifically referred to, will be apparent from the following description, which, together with the drawings, constitutes the preferred embodiment of the invention.

The drawings illustrate, by means of the usual circuit diagram, sufficient details of the invention so it can be easily understood by those versed in the art.

In the drawings, the reference characters L1 and L2 indicate a party line upon which any number of telephone subscribers may be connected. For example, the subscribers A′ and A are connected to this line. The line L1 and L2 extends to the exchange and terminates in a trunk circuit TC, which is connected to the line-switch LS, by means of which the subscribers A and A′ on the party line may have access to any telephone line connected to the exchange. The lineswitch LS is of the usual rotary step-by-step type, as is well known, the bank contacts of which have access to a selector switch SL, and this in turn has access to a connector switch CN whose bank contacts are directly connected to subscribers' lines such as A2.

From the foregoing it will be seen that either subscribers at substations A or A′ upon gaining access to the party line will seize the trunk circuit TC and this in turn will initiate the operation of the lineswitch LS immediately upon the removing of the receiver from either of these stations. In response to impulses transmitted from the subscriber's station, the selector SL has its wipers raised vertically and then rotated automatically to seize a connector switch such as CN. In response to two additional impulses transmitted from the subscriber's station, connector CN is operated both vertically and rotary to connect with the desired line. The selector SL and connector CN are of well-known construction and need not further be described in detail.

At the subscriber's station A and similarly on other subscribers' stations on the line L1 and L2, the relay 10 and the electromagnet 11 are provided, and the arrangement is such that upon the energization of relay 10, due to the removal of the receiver R, this relay will become energized over one side L1 of the line and attract its armature 8. This armature 8 likewise is connected to the armature springs 12 and 13 of the relay and moves them at the same time onto their front contacts. Immediately upon the armature 8 becoming attracted to the core of the relay, the armature 9 of magnet 11 will engage the side of the armature 8 instead of the top of it, so that when relay 10 is subsequently deenergized, it will be prevented from having its armature 8 restored by the fact that armature 9 will bear against the right side of the armature 8 and prevent the retraction and consequent opening of armatures 12 and 13 from their front contacts. If the subscriber A attempts to gain access to the line L1 and L2 when it is already in use by another subscriber, magnet 11 will be energized and attract its armature 9 and move the clapper attached to the end of the armature against the bell B, thereby audibly informing the subscriber of the existence of another call

on the line. When the subscriber A has initiated a call and subsequently releases the connection by restoring the receiver R upon the switchhook, magnet 11 will become energized momentarily thereby permitting the armature 8 to assume its normal position immediately below the projecting end of the armature 9.

The substations A and A', except for the relay 10 and magnet 11, are the usual type of automatic telephone substations, of well-known construction. The substation, such as A, comprises the receiver R, transmitter T, impulse sender S, induction coil IN, condenser C, and the ringer G. In addition, the usual hook springs are provided which, in this instance, have been slightly altered. The contacts 18 and 19 control the circuits to the transmitter T and receiver R, respectively, while the contact springs 14, 15, 16, and 17 control the circuits of the relay 10 and the magnet 11. Referring to these contact springs, it will be noted that upon the removal of the receiver R from the switchhook, the contact springs will be operated, and the ground connected to contact spring 15 will be for an instant extended from spring 15 to spring 14 and then in parallel to springs 16 and 17 which are connected to relay 10 and magnet 11, so as to energize the relay and magnet depending upon whether telephone line L1 and L2 is in use at this time or not.

In order to give a complete understanding of the invention, it will be explained in detail how a complete connection is established between a calling subscriber's substation A and the called subscriber's station A2. The subscriber at substation A, upon initiating a call, will remove his receiver R from the switchhook, thereby causing the contact springs 18 and 19 to make contact, and contact spring 17 to close onto the contact springs 14 and 16. Before contact spring 15 is separated from spring 14, a momentary ground connection is extended from ground on contact spring 15, through contact spring 14, and then over separate conductors connected to contact springs 16 and 17. A circuit is thereby established from ground on contact spring 15 over spring 16, through the winding of relay 10, normally-closed alternate contacts of armature 12, the negative line L1 extending to the exchange, normally closed alternate contacts of armature 31 of relay 30, normally-closed contacts of the ringing key K, upper left-hand winding of the repeating coil P, through the upper winding of line relay 35 to battery. Relay 35 and relay 10 energize over this circuit. The ground connection from spring 15 through spring 17 and the winding of magnet 11 is not effective to energize the magnet because its circuit extends over the positive line conductor L2, alternate closed contacts of armature 32, normally-closed contacts of ringing key K, lower left-hand winding of the repeating coil P, through the lower winding of line relay 35 to ground. Consequently, no circuit is completed for the magnet 11, and it is not effective in this instance.

Relay 10, upon energizing, operates its armature 8 to move its projection out of engagement from the bottom side of the projection of armature 9, and locks in this position until armature 9 is operated. Armature 8 moves armature springs 12 and 13 so they will be closed onto their front contacts and remain in this position even though the circuit of relay 10 is opened. At the front contacts of armatures 12 and 13, relay 10 completes the loop operating circuit extending over the negative line L1 to closed front contact of armature 12, closed contact springs 18 of the switchhook, closed impulse springs 19, transmitter T, primary winding of the induction coil IN, front contact of armature 13, and out over the positive line L2. At the normally alternate closed contacts of armature spring 12, the original energizing circuit of relay 10 is interrupted, and the relay becomes deenergized, although its armatures remain attracted due to the interlocking arrangement between armatures 8 and 9. Line relay 35 likewise is energized through its upper and lower winding, over both sides of the line L1 and L2 and the subscriber's loop circuit just traced. Line relay 35, upon having become completely energized, attracts its armature 33 to its front contact and thereby completes a circuit from ground over the contacts through the winding of slow-to-release relay 30 to battery. Relay 30, upon energizing, attracts its armatures 31 and 32, and thereby reverses the ground and battery connection of the line L1 and L2 extending to both windings of line relay 35.

From the foregoing, it will be seen that in the normal condition of the line circuit L1 and L2, battery is connected to negative line L1, while ground is connected to the positive side of the line L2, and upon the initiation of a call by any subscriber, the battery and ground connection to the line is reversed from normal. This is to prevent any additional subscriber from gaining access to the line, should he desire to do so when it is already in use, as will be pointed out in more detail later on.

As a further result of the line relay 35 having become energized, it closed its front contact and armature springs 34, thereby completing a circuit over the right-hand winding of the repeating coil P, from battery through the winding of line relay 50, back contact and armature 41, to armature 43 and its back contact to ground. Line relay 50, upon energizing over this circuit, closes its armature 51 upon its grounded front contact and extends this ground to the bank contacts in

the connector in the well-known manner to render this line busy to any incoming calls at this time. At the front contact and armature 52, the automatic rotary hunting circuit is established for the stepping magnet 60 which extends from battery through the winding of stepping magnet 60, its armature and back contact, front contact and armature 52, back contact and armature 42, the wiper 62, and the associated bank contact upon which the wiper is resting. In case the selector switch, such as SL, connected to the banks of wipers 61, 62, and 63, should be busy, ground is connected from this bank contact and extends over wiper 62 to the stepping magnet 60, so that upon energizing it attracts its armature to open its own circuit, and upon falling away, rotates the wipers in a forward direction onto the next set of bank contacts. The switching relay 40 is prevented from operating at this time by being short circuited from the grounded front contact and armature 51. When an idle selector switch, such as SL, is reached, the wiper 62 will no longer encounter ground on the bank contacts, and consequently the switching relay 40 will not be short circuited. In this event, it will become energized over a circuit extending from grounded front contact and armature 51 through the winding of the relay, back contact and armature of the rotary stepping magnet 60, through the winding of the magnet to battery. Relay 40 will energize, but due to the high resistance of this relay, stepping magnet 60 will not energize in series with it. Switching relay 40 upon operating, at its back contacts and armatures 41 and 43, opens the circuit to line relay 50 which thereupon deenergizes. At armature 42 and the front contact of relay 40, ground is extended from the selector switch SL, which has been seized, through wiper 62 and out to the private bank contact of the connector bank to maintain a busy condition on this line. At the front contacts of armatures 41 and 43, the subscriber's line L1 and L2 is connected directly to the wipers 61, 62, and 63, and to the line relay of the selector switch SL, which is now in a position to receive the impulses from the subscriber's calling device S as will now be pointed out.

The subscriber at substation A will now operate his calling device S in accordance with the first digit of the telephone number of the subscriber A2. The impulse springs 19 are thereby rapidly opened and closed to transmit impulses over the party line, and energize and deenergize line relay 35 a corresponding number of times. At its front contact and armature 34, relay 35 repeats the impulses to the secondary winding of the repeating coil P and over the wipers 61 and 63, to the line relay of the selector SL. The wipers of the selector SL are thereby elevated vertically opposite a level of bank contacts extending to the connector CN as is well known.

It will be noted that each time the line relay 35 becomes energized, it closes a circuit through the winding of slow-release relay 30 to battery and each time the line relay 35 deenergizes, it opens the circuit of this relay. However, due to the copper slug on the heel end of relay 30, it will remain in an energized condition for the duration of the series of impulses to maintain the reverse-battery condition on the line L1 and L2 by maintaining its armature springs 31 and 32 attracted. After the first series of impulses corresponding to the first digit of the calling subscriber's telephone number, the selector SL automatically rotates its wipers to an idle connector switch CN, whose bank contacts have direct access to the subscriber's line A2. In response to the transmission of the second digit of the called number, and the operation of line relay 35 a corresponding number of times in accordance with the impulses, the connector switch CN steps its wipers vertically opposite a level of bank contacts associated with the subscriber's line LA2. In response to the third digit from the subscriber's calling device S, the connector CN rotates its wipers to connect with the line of subscriber's station A2. Ringing current is then automatically projected out on the subscriber's line A2 to signal him, and upon his response the subscribers may engage in conversation.

As the foregoing operation of the selector switch SL and connector switch CN is well known, it is not thought necessary to further describe their operation except generally.

Upon the termination of the conversation, the subscriber A replaces his receiver R upon the switchhook, thereby opening the loop circuit extending over the line L1 and L2 at the switchhook springs 19 and 18. Line relay 35 thereupon restores its armatures, and at armature 34 opens the loop circuit extending through the lineswitch LS, selector SL, and connector CN, and as is well known, these switches are returned to normal. At its front contact and armature 33, the circuit of slow-release relay 30 is interrupted, and this relay starts to restore its armatures 31 and 32, so that the normal battery flow over the line L1 and L2 will be again restored, it having previously been in reversed condition to battery and ground through the winding of relay 35.

As a further result of the replacement of the receiver R upon the switchhook, the ground from contact spring 15 is momentarily extended through contact spring 14, contact springs 17, through the winding of the magnet 11, over the positive side of the line L2, and before relay 30 has fully retracted its armatures, due to the copper slug on the heel end, the circuit extends over armature 31

and its front contact, the upper contact springs of the key K, upper left-hand winding of the repeating coil P, through the winding of line relay 35 to battery. The magnet 11 energizes momentary and attracts its interlocking armature 9 so as to permit the extended portion of the armature 8 of relay 10 to ride over the end of armature 9 and assume its normal position as indicated. The gong B is actuated by the armature of the magnet 11 but has no effect at this time. Armature springs 12 and 13 of relay 10 are thereby restored to normal so as to open the line circuit from the telephone to line L1 and L2. At the time the magnet 11 was energized, a branch of the circuit from ground at contact spring 15 extended to spring 16 and through relay 10, armature 12, to the negative line L′, and as relay 30 is still operated, no circuit for relay 10 is completed because it extends to ground at relay 35 over operated armature 31.

After the switchhook contact springs 14, 15, 16, and 17 have been fully restored to normal, the circuit through the magnet 11 is interrupted at contact springs 17, and the magnet 11 restores its armature 9 in the position shown. After the above interval, slow-release relay 30 restores to normal and opens its armature springs 31 and 32 to restore the normal battery flow over the line conductors L1 and L2 from the windings of line relay 35. The circuits are now all in normal position.

It will now be assumed that a condition is encountered in which the subscriber A is in connection with the subscriber at substation A2, and is engaged in conversation over the lines L1 and L2, as has been pointed out before. In this event, it will be remembered the relay 10 has been operated, and its armature 8 assumes a locked position due to the projection on armature 9 of magnet 11 and the armature springs 12 and 13 are operated. Likewise, the line relay 35 is energized to maintain slow-release relay 30 in an energized condition, so that its armature springs 31 and 32 are operated to reverse the normal battery flow of current from line relay 35 over the line conductors L1 and L2. If with the above condition existing on the line should another subscriber, such as A′, on the line L1 and L2 desire to establish a connection with another subscriber, he will be prevented from doing so, and likewise be informed of the busy condition of the line. Upon the removal of the receiver from the substation A′ in the above event, the ground from contact spring 26 momentarily extends over contact spring 27 and in parallel over contact springs 28 and 29, as the switchhook is passing into its operated position. Ground thereby extends through relay 20, negative line conductor L1, and as relay 30 is in operated condition, the ground extends through armature 32 and its operated front contact, closed contact of ringing key K, lower left-hand winding of repeating coil P, through the lower winding of relay 35 to ground. Relay 20, therefore, cannot energize over this circuit to close the subscriber's line circuit at armatures 22 and 23. However, the other branch of the circuit from ground at contact spring 27 extends through contact spring 29, through the winding of magnet 21, the positive line conductor L2, armature spring 31 of relay 30 and its operated front contact, closed contacts of the ringing key K, upper left-hand winding of repeating coil P, through the upper winding of line relay 35 to battery. The magnet 21 is thereby energized over this circuit and attracts its armature 25. The clapper attached to the end of this armature strikes the gong B and audibly informs the subscriber at substation A′ of the busy condition of the line. As armature 24 of relay 20 is maintained in its normal position due to the spring attached to the end of the armature, it will not disengage itself from under the end of armature 25 at the time armature 25 is operated. After the switchhook springs have moved to their fully-operated position, the ground extending over contact springs 26 and 27 is interrupted and the magnet 21 is again deenergized.

The subscriber at substation A′ cannot listen in to the conversation upon the line L1 and L2, because relay 20 is not operated and therefore does not complete the talking circuit to the subscriber's receiver at armature springs 22 and 23. He therefore replaces his receiver upon the switchhook and again momentarily closes the ground circuit over contact springs 26 and 27 and in parallel over contact springs 28 and 29. Relay 20 again does not energize, but the magnet 21 receives another impulse of current from the ground on contact spring 26, over the previously-traced line circuit, and attracts its armature 25 to again strike the gong B′. This is further indication to the subscriber at substation A′ that the line is in a busy condition.

From the foregoing it will be seen that upon the establishment of a connection from a subscriber on a party line to a subscriber on another line, all other telephones connected to the same line will be prevented from gaining access to the line and at the same time be informed of the busy condition of it. In addition, they will be prevented from listening in to the conversation.

When it is desired to signal any of the subscribers on the party line L1 and L2, the ringing key K is operated to connect ringing generator current to each side of the line and the desired subscriber may either be signalled according to a code, or the ringers, such as G, may be of the harmonic type so that they respond to a particular frequency which may be connected to the line by means of the

ringing key K. In place of the key K, contacts may be provided in the circuit which are controlled by the ringing relay of the connector switch such as CN to automatically control the ringing as is well known.

What is claimed is:

1. In a telephone system, a party line having a plurality of substations thereon, electrically-operated means at each of said substations, means responsive to the taking into use of said line by any of said substations for operating said electrically-operated means, means responsive to the engagement of said line by said substation for reversing the normal battery flow over the line, and means responsive to the operation of said electrically-operated means at any other substation for preventing the engagement of said line by said other substation due to the said reversal of battery.

2. In a telephone system, a party line having a plurality of substations thereon, means on said line for reversing the normal battery current flow thereover, electrically-operated means at each of said substations, means responsive to the taking into use of said line by any one of said substations for operating said electrically-operated means to reverse the normal current flow over said line, and means responsive to the reversing of said current flow over said line for preventing the operation of said electrically-operated means at any other of said substations to prevent gaining access to said line.

3. In a telephone system, a party line having a plurality of substations thereon, means on said line for reversing the normal battery flow thereover, means responsive to the taking into use of said line by any substation for operating said battery-reversing means, and means at any other substation for preventing its connection with said line due to the operation of said battery-reversing means.

4. In a telephone system, a party line having a plurality of substations thereon extending to the exchange, battery-reversing means on said line at the exchange, means at each of said substations responsive to the taking into use of said line for operating said battery-reversing means, and means at any other of said substations for preventing the taking into use of said line by any other station responsive to said battery-reversing means.

5. In a telephone system, a party line, a plurality of subscribers on said line, battery-reversing means on said line at said exchange, means at each of said subscribers' stations responsive to the taking into use of said line by any one of said stations for operating said battery reversing means, and means at any other station responsive to the reversal of said battery for preventing said other station from gaining access to said line.

6. In a telephone system, a party line having a plurality of subscribers' stations thereon, said line terminating in the exchange in a line relay having a normal battery and ground connection with said line, a relay controlled by said line relay for reversing the line connection with said line relay, means at any of said subscribers' stations responsive to the taking into use of said line for operating said line relay to control said reversing relay to reverse the normal flow of battery and ground connections with said line, and means at any other station responsive to the attempt to gain access to said line for preventing such connection due to the reversing of said battery and ground connections on said line.

7. In a telephone system, a party line terminating in a line relay at the exchange, a plurality of subscribers' lines on said party line, a line-reversing relay in said line controlled by said line relay, a relay and a magnet at each of said subscribers' stations, means responsive to the taking into use of said line by any of said subscribers' stations for operating its associated relay and for operating said line relay to operate said reversing relay to reverse said line connections, and means at any other substation responsive to an attempt to gain access to said line for operating its associated magnet and inform said subscriber of the busy condition of said line.

8. In a telephone system, a subscriber's line having a plurality of substations thereon, battery reversing means on said line operative responsive to the taking into use of the line by any one of said substations for preventing any other substations from gaining access to the line, and means at any other of said substations operated by said battery reversal when attempting to gain access to said line for audibly informing the subscriber thereat of the busy condition of the line.

9. In a telephone system, a party line having line reversing means thereon, a plurality of subscribers' stations on said line, a relay and an electro-magnet at each of said stations, means responsive to the taking into use of said line by one of said substations for energizing its associated relay over one side of said line and operating said line reversing means, means responsive to the energization of said relay for locking its armature under control of said electromagnet, the operation of said reversing means on said line after it has been taken into use preventing any other substation from gaining access to it and for energizing the associated electromagnet at the substation to audibly inform the subscriber thereat of the busy condition of said line.

10. In a telephone system, a party line, a plurality of subscribers' stations on said line, a relay and an electromagnet at each of said substations, means responsive to the removal

of the receiver at one of said substations for energizing its associated relay, means on said line responsive to the removal of said receiver for reversing the normal connection to said line, means responsive to the removal of the receiver at another of said stations for preventing the operation of its associated relay due to the reversal of said line conductors and for energizing its associated electromagnet, and means controlled by said electromagnet for audibly informing said subscriber of the busy condition of said line and for releasing the armatures of the associated relay should this line be the calling one.

11. In a telephone system a party line having a plurality of subscribers' stations thereon, means on the line for reversing its connections with the exchange end, a relay and an electromagnet associated with each of said substations, means responsive to the removal of the receiver at one of said substations for energizing its associated relay over said line and for reversing the battery connection thereon, means controlled by the associated electromagnet for locking the armatures of said relay in operated position, means responsive to the removal of the receiver at another of said substations while said line is taken into use by said first substation for energizing its associated electromagnet while preventing its relay from becoming energized, means controlled by said last electromagnet for audibly informing the subscriber at said other substation of the busy condition of said line, and means responsive to the replacement of the receiver at said first substation for energizing its associated electromagnet to release said armatures of said relay and thereby disconnect said substation from the line.

12. In a telephone system, a party line having a plurality of substations thereon, said line extending to the exchange and terminating in battery and ground connections to a line relay, a reversing relay controlled by said line relay, a relay and an electromagnet at each of said substations, means responsive to the removal of the receiver from one of said substations for energizing its associated relay over one side of said line to energize said line relay and operate said reversing relay to reverse the battery and ground connection over said line, means responsive to the removal of the receiver at another of said substations for preventing the energization of its associated relay due to the reversed condition of the line, and for operating its associated electromagnet, and means controlled by said electromagnet for releasing its associated relay in case it is operated and for audibly informing the subscriber of the busy condition of the line in case it is already in use by another substation.

13. In a telephone system, a party line having a plurality of substations thereon, said line terminating in the exchange, a line relay terminating said line in battery and ground connections, a line-reversing relay controlled by said line relay, a relay and an electromagnet at each of said substations, a locking arrangement on said electromagnet for maintaining the armatures of said relay in operated condition after having been operated and released upon the energization of said electromagnet and the operation of its locking arrangement, means responsive to the removal of the receiver at one of said substations for energizing its associated relay to attract its armature and for energizing said line relay to operate said line-reversing relay, means responsive to the removal of the receiver at another of said substations in attempting to gain access to said line for preventing the energization of the associated relay and at the same time energizing its associated electromagnet, means controlled by the armature of the electromagnet for operating a busy signal, and means responsive to the restoration of the receiver at said first substation for energizing its associated electromagnet to release the armature of its associated relay and for releasing said line relay and said reversing relay to restore said party line again to normal.

14. In a telephone system, a party line having a plurality of substations thereon, battery reversing means on said line, means responsive to the connection of any substation with said line for operating said battery reversing means, and means controlled by said battery reversing means for preventing any other substation from connecting with the line.

15. In a telephone system, a party line having a plurality of substations thereon, battery reversing means on said line, means responsive to the connection of any substation with said line for operating said battery reversing means, and means controlled by said battery reversing means for rendering said line busy to any other substation.

16. In a telephone system, a party line having a plurality of substations thereon, battery reversing means on said line, means responsive to the connection of any substation with said line for operating said reversing means, and means controlled by said reversing means for rendering said line busy to any other substation and for giving an indication thereat of said busy condition.

In witness whereof, I hereunto subscribe my name this twenty-first day of May A. D. 1930.

BERNARD D. WILLIS.