June 24, 1930. W. T. POWELL 1,766,402

REMOTE CONTROL TELEPHONE SYSTEM

Filed Oct. 16, 1929 2 Sheets-Sheet 1

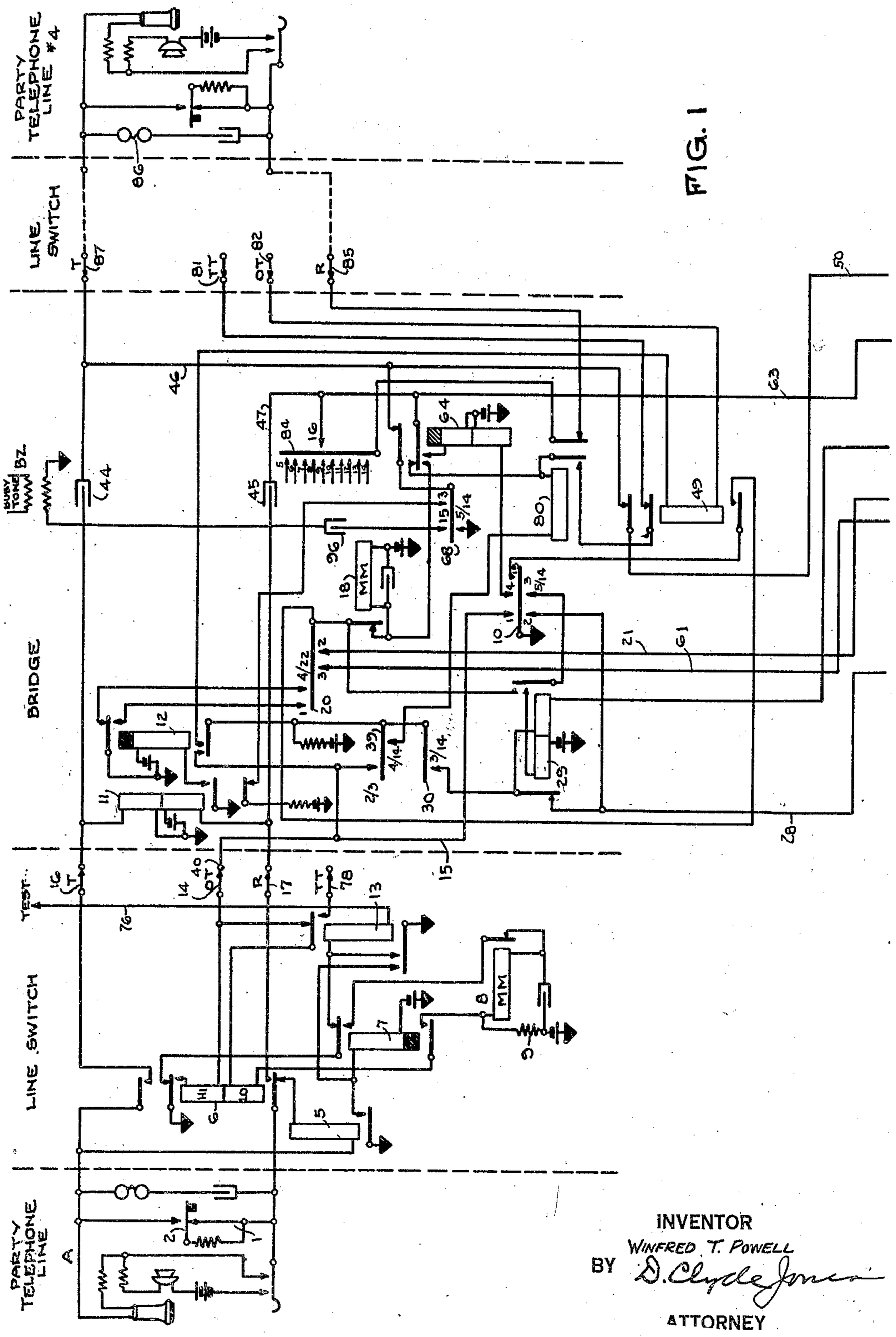

FIG. 1

INVENTOR
WINFRED T. POWELL
BY D. Clyde Jones
ATTORNEY

June 24, 1930. W. T. POWELL 1,766,402

REMOTE CONTROL TELEPHONE SYSTEM

Filed Oct. 16, 1929 2 Sheets-Sheet 2

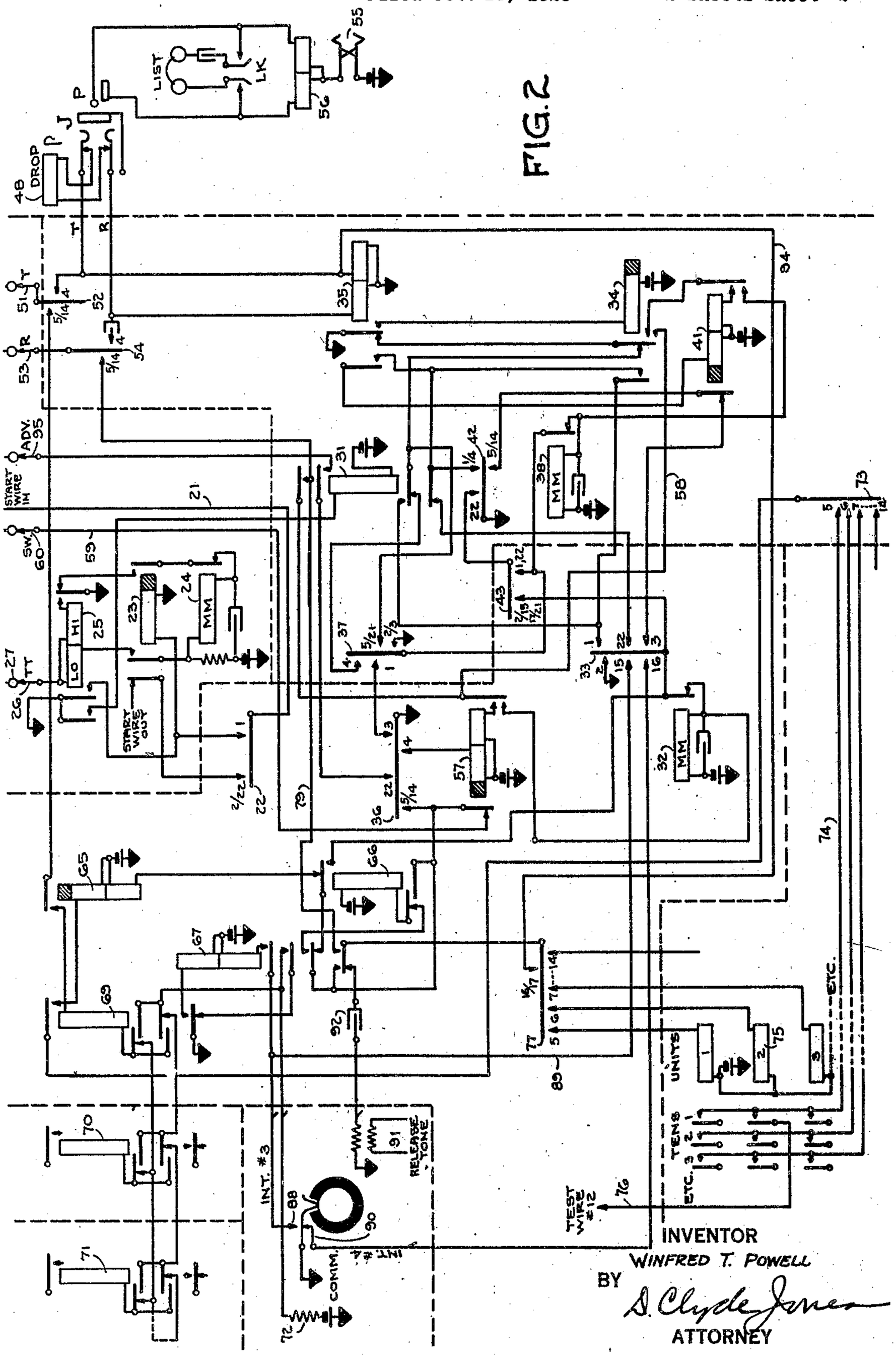

FIG. 2

INVENTOR
WINFRED T. POWELL
BY
S. Clyde Jones
ATTORNEY

Patented June 24, 1930 1,766,402

UNITED STATES PATENT OFFICE

WINFRED T. POWELL, OF ROCHESTER, NEW YORK, ASSIGNOR TO THE STROMBERG-CARLSON TELEPHONE MANUFACTURING COMPANY, OF ROCHESTER, NEW YORK, A CORPORATION OF NEW YORK

REMOTE-CONTROL TELEPHONE SYSTEM

Application filed October 16, 1929. Serial No. 399,968.

This invention relates to telephone systems and more particularly to telephone systems in which automatic switches under control of subscribers and operators are employed to complete telephone connections.

It frequently happens that a small group of rural telephone subscribers are localized in a community which is rather remote to the telephone exchange. In such communities the subscribers' outside telephone lines are so poorly constructed that it is impossible to directively control automatic switches thereover. In addition the subscriber's substation equipment is of the local battery type in which a hand-operated generator signals the initiation and termination of a call. The rates in such communities are so low that they do not justify the replacement of the substation equipment and the rebuilding of the outside telephone lines so that impulse senders or dials and directively operated automatic switches may be employed to establish telephone connections. Furthermore, such communities are frequently so small that they do not justify the services of a telephone operator so that these subscribers are usually served from a remote telephone exchange. The use of such a remote telephone exchange requires the use of long subscribers' lines which are expensive to maintain and are inefficient in service.

In my co-pending application 343,709, filed March 1, 1929 there is described a system in which telephone lines of a group of local battery subscribers in a small community may be connected to a remote exchange where an operator provided with an impulse sender may operate automatic switches of a simple type to extend a calling line to the line of a wanted subscriber. In this system it is also arranged so that a subscriber on a party line may signal another subscriber thereon by means of code ringing without the intervention of an operator.

The present invention relates to an improvement over the previously mentioned system which incorporates means for releasing the connection under the control of the calling subscriber by merely replacing his receiver on the switchhook without the need of transmitting a release signal from his magneto generator. In the previously mentioned application the system was also arranged to release the connection after a predetermined time period while in the present disclosure the release of the connection is effected by the calling subscriber independently of any time interval. In addition the present disclosure comprises a system which has been simplified over the previously mentioned system and which provides a more efficient method of operation.

In the drawings Fig. 1 diagrammatically represents a portion of a telephone system including a calling telephone line and its line switch circuit equipment, a common bridge or connecting circuit and a called telephone line, the line switch circuit of which has been omitted since it is identical with that shown in connection with the calling line; Fig. 2 represents common control equipment including a register sender and a finder switch for associating an idle register sender with a bridge circuit taken for use; at the right of the broken line of Fig. 2 there is indicated an operator's position and a portion of the telephone equipment associated therewith whereby an operator may receive the designation of a wanted subscriber over a calling line and may operate the selected register sender to effect a telephone connection between a calling telephone line and the line of a wanted subscriber.

When the subscriber at substation A desires to initiate a call, he operates the magneto generator 1 located thereat which transmits ringing current through the contact 2 of the generator over the upper side of the subscriber's line, winding of the alternating current relay 5, lower back contact and armature of relay 6, thence over the lower side of the subscriber's line to the other terminal of the magneto. The relay 5 is thus energized and at its armature and contact completes an operating circuit for the slow releasing relay 7. This last-named relay closes a break point in the driving circuit of the motor magnet 8 of the line switch, traceable from grounded battery, resistance 9, winding, back contact and armature of this magnet, upper front contact

and armature of relay 7, inner back contact and armature of relay 6 to ground. In the event that the brushes of the line switch have been standing in engagement with the terminals of a busy bridge, this circuit is effective to advance these brushes until the terminals of an idle bridge is found. During the time that the line switch is operating a circuit is extended from grounded battery, resistance 9, lower contact and armature of relay 7, low resistance winding of relay 6, armature and upper contact of relay 13, to the outgoing test brush 14. This circuit however is not completed until an idle bridge is found at which time the circuit is closed through the test terminal 40, and conductor 15 of the bridge, control switch brush 10 in position 1 to ground. On the completion of this circuit the relay 6 is energized to stop the operation of the line switch and also to close its armatures and front contacts which extend the calling line through the line switch brushes 16 and 17 and through both windings of the relay 11 in series to ground and grounded battery respectively. This operates the relay 11 which in turn effects the energization of the slow releasing relay 12. The relay 12 then closes a locking circuit for the switching relay 6 from ground, its upper armature and front contact and high resistance winding, outgoing test brush 14, front contact and armature of relay 12, resistance, to grounded battery. The operation of the relay 12 also advances the control switch into position 2 by the closure of a circuit from grounded battery, winding of its motor magnet 18, its back contact and armature, control switch brush 20 in position 1, upper front contact and armature of slow releasing relay 12 to ground.

As soon as the control switch reaches position 2 an idle finder switch is started to associate an idle register sender with the bridge circuit taken for use. This is effected over a circuit completed from grounded battery, winding of the motor magnet 18, its back contact and armature, brush 20 in position 2, conductor 21, brush 22 in position 1, winding of the slow releasing relay 23 to ground. The relay 23 is thus energized and completes an operating circuit for the motor magnet 24 of the finder from grounded battery, resistance unit, winding of the motor magnet 24, its back contact and armature, armature and front contact of relay 23, back contact and armature of relay 25 to ground. Under the control of this circuit the motor magnet 24 advances the brushes of its finder switch until its test brush 26 encounters the test terminal 27 leading to the bridge circuit taken for use which is assumed to be that shown in Fig. 1. As soon as this test brush engages the terminal 27, an energizing circuit for relay 25 is completed from grounded battery, resistance unit, left hand armature and contact of relay 23, left hand winding of relay 25, brush 26, terminal 27, conductor 28, control switch brush 10 in position 2 to ground. This circuit is also effective to shunt the motor magnet 24 and thereby stop the operation of the finder switch. As soon as the relay 25 operates, it closes a circuit from ground, its inner armature and contact, brush 22 in position 1, conductor 21, control switch brush 20 in position 2, back contact, armature and winding of magnet 18 to grounded battery, which circuit is effective to advance the control switch from position 2 to position 3. In this position a locking circuit for the switching relay 25 is closed from ground, its right hand armature, front contact and its high resistance winding, brush 26, terminal 27, conductor 28, back contact and armature of relay 29, control brush 30 in position 3 to grounded battery. Also, as soon as the switching relay 25 operated, it actuated the relay 31 from grounded battery, winding of this relay, outer front contact and armature of relay 25 to ground. The energization of this last named relay closes an operating circuit for the units register motor magnet 32 extending from battery, winding, back contact and armature of this magnet, units register brush 33 in position 1, inner, lower front contact and armature of relay 31, back contacts and armatures of slow releasing relay 34 and the impulse relay 35, to ground. Under the control of this circuit the motor magnet 32 advances the units register brushes into position 3 where its brush 36 closes a circuit from ground, tens register brush 37 in position 1, armature, back contact and winding of the motor magnet 38 of the tens register to grounded battery. This circuit causes the motor magnet to advance the brushes of the tens register into position 4.

In positions 2 and 3 of the control switch brush 39, battery potential is applied to the outgoing test terminal 40 of the calling line switch for maintaining the locking circuit of the line switch. Ringing current from the calling subscriber's generator may now be transmitted over the two sides of the subscriber's line in series through the condensers 44 and 45, conductors 46 and 47 to the winding of the drop 48, conductor 46 being extended through the upper, back contact and armature of relay 49, conductor 50, finder brush 51, tens register brush 52 in position 4, normally closed contacts of the jack J to one end of the winding of the drop 48, the conductor 47 being extended through finder brush 53, tens register brush 54 in position 4, normally closed contacts of the jack to the other end of the winding of the drop 48. The drop 48 is thus actuated and serves as a signal to the operator to insert the plug P of her listening equipment into the jack J leading to the bridge and calling line of Fig. 1. The operator also has a listening key LK to connect her listening equipment to the cord circuit

now in use and inquires the number of the wanted line.

As soon as the plug P is inserted in the jack J a circuit is completed from grounded battery, through the dial impulse springs 55, through both windings of the impedance coil 56 in multiple, over the two sides of the operator's cord circuit through the tip and ring contacts of plug P and jack J and thence through both windings of the impulse relay 35 in multiple to ground. This energizes the impulse relay 35 which in turn closes an operating circuit through the slow releasing relay 34.

If the call just initiated is a revertive call, the bridge control switch remains in position 3 until the operator whose equipment is shown at the right of Fig. 2 inserts the plug P of her telephone equipment into the jack J and then subsequently withdraws it, which operation is first effective to energize the impulse relay 35 and the slow releasing relay 34 to advance the tens register into position 5 in a circuit closed from ground at the armature and back contact of relay 35, armature and front contact of relay 34, armature and contact of relay 41, winding of the tens motor magnet 38 to grounded battery. When the relay 34 releases on the withdrawal of plug P from jack J, this tens register is advanced to position 22, from ground at the armatures and back contacts of relays 35 and 34, tens register brush 37 closed in positions from 5 to 21, armature, back contact and winding of the motor magnet 38 to grounded battery. The units register is advanced to position 22 through tens brush 42 in position 22, units register brush 43, armature, back contact and winding of the motor magnet 32 to grounded battery and in this position of the units register, the tens register is restored to normal.

Let it be assumed that the call is not revertive but for another line having as its designation 12—4 in which the numeral 4 corresponds to the subscriber's station on the called party line. It will be recalled that the control switch of the bridge is in position 3, the tens register is in position 4 and the units register is in position 3. The operator now actuates the dial impulse springs 55 to transmit one impulse corresponding to #1, the impulse relay 35 deenergizes once and then remains energized. The deenergization of this relay closes a circuit from ground, armature and back contact of relay 35, front contact and armature of relay 34, armature, front contact and right hand winding of change-over relay 41 to grounded battery. The motor magnet 38 of the tens register is operated in multiple of this last described circuit from grounded battery, winding of the motor magnet 38, front contact and armature of relay 41 and thence to ground at the armature and back contact of impulse relay 35 as previously described. Since the relay 41 is slow releasing, it is held operated during a series of impulses, but the motor magnet 38 responds to each deenergization of the impulse relay 35. Since but one tens impulse has been transmitted, the impulse relay 35 deenergizes once causing the tens register to advance to position 5 corresponding to the #1 tens digit. At the close of this series of impulses the relay 35 remains energized for a comparatively long interval which causes the change-over relay 41 to deenergize and advance the units register into position 4 over a circuit traceable from ground, tens register brush 42 in position 5, armature and back contact of change-over relay 41, units register brush 33 in position 3, armature, back contact and winding of the motor magnet 32 to grounded battery. In position 4 of the units register the units change-over relay 57 is energized from ground, units register brush 36, left hand winding of this slow releasing change-over relay, to grounded battery.

The units register is now in condition to receive the units series of impulses and the operator actuates the dial springs 55 to transmit two impulses corresponding to the second digit of the wanted number. On the transmission of each impulse the impulse relay 35 deenergizes and at its armature and back contact closes a circuit from ground, through the armature and front contact of slow releasing relay 34, conductor 58, armature, front contact and right hand winding of change-over relay 57 to grounded battery. The motor magnet 32 of the units register is also energized from grounded battery, its winding, front contact and armature of relay 57 and thence over the remainder of the circuit previously described to ground at the armature and back contact of the impulse relay.

Since the change-over relay 57 is slow releasing, it remains energized throughout this series of impulses. However, the motor magnet responds to each impulse and therefore advances the units register brushes into position 6 which corresponds to the #2 digit. At the close of the units series of impulses, change-over relay 57 deenergizes and thereby closes a circuit to advance the control switch of Fig. 1 from position 3 to position 4 over a circuit effective from ground, units brush 36 in position 6, armature and back contact of relay 57, conductor 59, finder brush 60, conductor 61, control switch brush 20 in position 3, armature, back contact and winding of motor magnet 18 of the control switch to grounded battery. At this time the slow releasing relay 64 is energized from grounded battery, its lower winding, control switch brush 10 in position 4, to ground.

The operator now dials the digit #4 which is effective to cause the impulse relay

35 to deenergize four times after which it holds its armature actuated for a relatively long interval. On each retraction of the armature of this relay, a circuit is closed from ground, its armature and back contact, armature and front contact of relay 34, conductor 58, uppermost armature and contact of relay 31, tens register brush 54 in position 5, finder brush 53, conductor 63, inner armature and front contact of relay 64, winding of the motor magnet 18 of the control switch, to grounded battery. The slow releasing relay 64 is held energized during this series of impulses from grounded battery, its upper winding, front contact and armature and thence to ground at the armature and back contact of the impulse relay 35 as previously described. In response to each of the four station code impulses the magnet 18 advances the control switch until at the close of this series of impulses this switch is standing in position 8.

Referring back to the point where the units register brush 36 is advanced to position 6, a circuit is closed for operating the slow releasing busy relay 65 from grounded battery, its lower winding, back contact and armature of relay 66, back contact and armature of relay 67, units register brush 36, to ground.

The system is now in readiness to start the line switch of the called line to search for the other end of the bridge to which the calling line is connected. This operation is started over a circuit traceable from ground, control switch brush 68 in position 8, armature and back contact of relays 64 and 49, conductor 50, finder brush 51, tens register brush 52 in position 5, armature and front contact of relay 65, winding of the test relay 69, its continuity spring and back contact and through similar springs and contacts of the series of test relays such as 70 and 71, thence through the back contacts and continuity springs of relay 70, 71 and 69 to the battery through the resistance coil 72. This circuit operates the relay 69 but it will be understood that the wiring and continuity contacts of relays 69, 70 and 71 is such that only one of these test relays is operated at any one time which is for the purpose of preventing the starting of more than one called line switch at any definite time. When the relay 69 is energized, it closes a circuit for operating the relay 67 and it also closes a circuit from grounded battery, upper winding of the busy relay 65, front contact and armature of relay 69, tens register brush 73 in position 5, conductor 74, innermost contact and armature of the common #2 units relay designated 75, conductor 76 which is the test wire individual to the line switch of line #12. This conductor then includes the winding of a relay, similar to 13 such as that shown in the line switch of Fig. 1 which is connected to ground through the back contacts and armature of relays similar to relays 7 and 6. The #2 test relay 75 was energized from grounded battery, winding of relay 75, units register brush 77 in position 6, lower armature and front contact of relay 67, units register brush 36, to ground. The test circuit previously referred to, includes the relay such as 13 of the called line switch which at its lower armature and front contact causes the line relay similar to 7, to operate and also at its armature and one of its contacts, closes a locking circuit for itself including the test conductor 76. The operation of the relay 13 renders the terminating test brush 78 effective instead of the outgoing test brush 14. The operation of the line switch of the called line is similar to the operation of the line switch of the calling line previously described except that the test brush similar to 78 is effective instead of the test brush similar to 14.

At this time a circuit is effective from the ground at the units register brush 36 at position 6, armature and front contact of relay 67, back contact and continuity spring of relay 66, winding of relay 66, to grounded battery. This last named relay is energized and closes a locking circuit for itself through its continuity spring and armature to ground at the register brush 36. A circuit is also completed from ground at the units register brush 36, front contact and armature of relay 67, conductor 79, tens register brush 54, finder brush 53, armature and back contact of relay 64, winding of the relay 80, control switch brush 39 in position 8 to grounded battery. This circuit energizes the relay 80 and applies a stopping potential on the terminating test terminal 81 of the called line switch over a circuit in multiple of that just described, thence through the inner armature and front contact of relay 80, inner armature and back contact of ringing relay 49 to the test terminal 81. Potential on this terminal is effective to stop the called line switch in engagement with the selected bridge circuit which is assumed to be that shown in Fig. 1 at which time the cut-off relay similar to 6 energizes to stop the operation of the motor magnet of this switch and to connect the called line conductors to the selected bridge circuit. The cut-off relay of the called line switch similar to relay 6 of Fig. 1, is locked from ground through its upper armature and front contact, its high resistance winding, outgoing test brush 82, winding of the relay 49, front contact and armature of relay 12, thence to grounded battery, through the resistance coil. Relay 49 when thus energized disconnects the terminating test terminal 81 so that there is no danger of another line switch seizing this bridge circuit at this point. The operation of the relay 49 also interrupts the circuit to ground at control switch brush 68 which was

holding the relay 69 energized so that this relay releases and closes a circuit from ground, its lower armature and back contact, armature and front contact of relay 67, resistance coil 72 to grounded battery. This is effective to prevent the operation of any other relay similar to 69 until the relay 67 is released.

Since the controller switch is now in position 8 the code ringing circuit corresponding to the #4 station on the called line is now connected by way of the brush 84, back contact of the relay 80, line switch brush 85 over the lower side of the called line to the condenser and ringer 86 of the wanted station on the called line, called line switch brush 87, conductor 46, armature and back contact of relay 64, brush 68, to ground. The relay 80 is maintained energized to prevent applying this code ringing to the called line at any time except the start of the code signal since relay 80 is maintained energized as long as relay 67 is held operated and this last named relay is locked operated through its lower winding, front contact and armature, contact 88 of the interrupter, to ground in all positions except at the beginning of the code ringing period at which time contact 88 is opened and relay 67 deenergized. At the close of the code ringing period contact 88 of this interrupter is opened which allows relay 67 to deenergize and thereby open the holding circuit of the relay 80. When relay 80 deenergizes, the ringing circuit above described is completed whereupon the called subscriber is signalled.

When the relay 67 deenergizes at the close of the ringing interval, it closes a circuit from ground at register brush 36, armature and back contact of relay 67, armature and front contact of relay 66, armature, contact and winding of the motor magnet 32 to grounded battery which magnet advances the units register brush to position 15. The controller brushes of Fig. 1 remain in position 8 until one complete cycle of the code machine is completed which cycle may include one complete code ring or if desired may include two or more complete code rings. At the beginning of the machine ringing cycle the contacts 88 of the interrupter are again closed to complete a circuit from ground, conductor 89, units register brush 33 in position 15, armature, back contact and winding of the magnet 32, to grounded battery which circuit causes the units register to advance its brushes into position 16. The units register then remains in position 16 during a complete cycle of the code ringing machine after which the contacts 90 of the interrupter are closed to cause the motor magnet 32 to advance the units register brushes into position 17 over a circuit completed over brush 33 in position 16.

The release tone is now applied from the tone device 91, the circuit extending from ground, condenser 92, back contact and armature of relay 67, brush 77 in position 17, conductor 94 to the tip side of the operating trunk and through the tip contacts of the jack J and plug P to the operator's listening equipment. The operator is instructed not to remove the plug P from the jack J until the release tone is heard. In this way the connection is maintained during a complete code cycle when it is once started. On hearing the release tone the operator removes the plug P from the jack J to effect the release of relays 34 and 35 which advances the tens register to position 22 in a circuit completed from ground, through the armatures and back contacts of relays 35 and 34, brush 37 in positions 5 to 21, armature, back contact and winding of motor magnet 38 to grounded battery. Following this operation the units register is moved to position 22 in a circuit extending from grounded battery, winding of its motor magnet, its back contact and armature, units brush 43, tens brush 42 to ground, and then the tens register is advanced to position 1, from grounded battery, winding of its motor magnet 38, its back contact and armature, units brush 43 in position 22, tens brush 42 in its position 22 to ground. In position 22 of the units register a circuit is closed from ground at brush 36, armature and front contact of relay 31, finder brush 95, right hand winding of relay 29, control switch brush 30 in position 8, winding of the resistance coil to grounded battery. Relay 29 is thus energized and locks itself operated through its armature and front contact to ground at control brush 10. When relay 29 is actuated, it operates the motor magnet 18 of the control switch to advance it into position 15 in a circuit from grounded battery, winding, back contact and armature of this motor magnet, front contact and armature of relay 29, control brush 10 to ground. The operation of the relay 29 also opens the circuit of relay 25 causing it to release and in turn to effect the release of relay 31. The release of the relay 31 advances the units register to position 1 over a circuit traceable from grounded battery, winding, back contact and armature of motor magnet 32, units brush 33 in position 22, back contact and armature of relay 31, tens brush 42 in position 1 to ground. The register finder together with the tens and units registers as well as the associated operating trunk circuits are now in normal condition.

In the foregoing description it was assumed that the called line was idle at the time that it was tested. Let it now be assumed that the called line is busy and when the relay 65 is now operated through its lower winding, its holding circuit completed through its upper winding and the test conductor 76 is

open so that it deenergizes in the case of a call to a busy line before relay 69 deenergizes. Relay 65 thus opens the circuit of relay 69 and the register sender completes its cycle of operations as above described in the case of a call to an idle line. In this case, however, relay 49 of the bridge circuit is not operated because the called line switch does not connect its finder to the selected bridge. When the control switch advances to position 15 it stops because there is no ground potential applied at its brush 10 in position 15 to move its brushes past this position. A busy tone is now applied to the calling line from the source BZ, condenser 96, brush 68 in position 15, armature and back contact of relay 64 and thence over the upper side of the bridge and the upper side of the calling line to the calling substation. On receiving this busy tone the calling party replaces his receiver on its switchhook to effect the deenergization of the relays 11 and 12 which results in the restoration of the control switch to normal condition.

If the calling line is idle, the control switch will be advanced to position 15 as above described and since relay 49 is energized a circuit is closed from ground at controller brush 10 in position 15, lower armature and front contact of relay 49, armature, back contact and winding of the motor magnet 18 to grounded battery to advance the control switch to position 16 which is the talking position.

At the termination of the conversation the calling party effects the release of the connection by restoring his receiver to its switchhook which effects the deenergization of the relays 11 and 12. This in turn restores the control switch to normal position from grounded battery, winding of the magnet 18, its back contact and armature, brush 20 in position 4 to 22, back contact and armature of slow releasing relay 12 to ground.

In the event that the tens register is moved from its normal position accidentally, that is, when it is not being used in a call, provision has been made to restore it to its normal condition. Under this assumption as soon as the tens register is moved from position 1, an operating circuit is closed for the motor magnet 38, from grounded battery, its winding, back contact and armature, tens brush 37 in positions 2 and 3 to ground. This circuit advances the tens register into position 4. From this position the tens register is advanced to position 5 from grounded battery, winding of the motor magnet 38, its back contact and armature, brush 37 in position 4, back contacts and armatures of relays 31, 34 and 35 to ground. This register is then advanced to position 22 over a circuit traceable from grounded battery, winding of the motor magnet 38, its back contact and armature, brush 37 in any of its positions 5 to 21 inclusive, back contacts and armatures of relays 34 and 35 to ground. This register is then restored to normal in a circuit completed from grounded battery, winding, back contact and armature of the motor magnet 38, units brush 43 in position 1, tens brush 42 in position 22 to ground. It will be understood of course that if the tens register has been accidentally moved to any other position besides position 2 it will be restored to normal over the circuits just described.

Let it now be assumed that the units register is accidently moved from its normal position, for example into position 2. From this position the units register is advanced to position 3 over a circuit extending from grounded battery, winding of the motor magnet 32, its back contact and armature, units brush 33 to ground. In position 3 of this register, there is completed an operating circuit for the tens register from grounded battery, winding of the motor magnet 38, its back contact and armature, tens brush 37 in position 1, units brush 36 in position 3. As soon as the tens register is moved from position 1 it advances into position 22 over the circuits previously described. The units register is now advanced to position 16 from grounded battery, winding, back contact and armature of the motor magnet 32, units brush 43 in positions 2 to 15 inclusive, tens brush 42 in position 22 to ground. When the contacts designated 90 of the interrupter are closed, they complete a circuit from ground, units brush 33 in position 16, armature, back contact and winding of the motor magnet 32 to grounded battery to advance the units register into position 17 where a circuit is completed for advancing this motor magnet into position 22 through units brush 43 over the circuit previously described as completed at tens brush 42 in position 22. With the units register in position 22 the tens register is advanced to position 1 over a circuit completed through units brush 43 in position 22 and tens brush 42 in position 22. The units register is now advanced to its normal position over a circuit from grounded battery, winding, back contact and armature of motor magnet 32, brush 33 in position 22, back contact and armature of relay 31, brush 42 in position 1 to ground.

Let it be assumed that the control switch of Fig. 1 is accidently advanced from position 1 in which case it will be restored to this position as follows. In position 2 of this switch a circuit is completed from grounded battery, winding, back contact and armature of the motor magnet 18, controller brush 20 in position 2, conductor 21, units brush 22 in position 1, winding of the slow releasing relay 23 to ground. This circuit energizes relay 23 to cause an idle sender to associate a register sender with the bridge related to the controller switch which is off-

normal whereupon the tens and units registers of this sender are advanced to positions 4 and 3 respectively. This circuit also advances the controller switch from position 2 to position 3. In this position it extends a circuit from grounded battery, resistance, lowermost contact and armature of relay 11, brush 68 in position 3, back contacts and armatures of relays 64, and 49, conductor 50, finder brush 51, tens brush 52, upper contacts of jack J, winding of drop 48 through the lower contacts of this jack, left hand winding of the impulse relay 35 to ground. This actuates the drop whereupon the operator inserts the plug P into the jack J which causes the tens and units registers of the selector finder to advance as in the case of a normal call. On discovering that there is no call to be answered the operator removes the plug P from the jack J whereupon the tens and units registers are restored to their normal positions as already described. While the units register brush 36 is in any of its positions from 5 to 14 inclusive a circuit is closed from ground, through this brush, armature and back contact of relay 57, conductor 59, finder brush 60, conductor 61, control brush 20 in position 3, armature, back contact and winding of the motor magnet 18 to grounded battery. In position 4 the controller is advanced to normal from grounded battery, winding of the motor magnet 18, its back contact and armature, brush 20 in any of its positions 4 to 22 inclusive, back contact and armature of relay 12 to ground.

What I claim is:

1. The method of extending telephone connections which comprises initiating the non-numerical automatic extension of a calling subscriber to an operator by the use of alternating current control, informing the operator of the wanted subscriber's designation, employing operator-transmitted code impulses corresponding to the wanted subscriber's designation to automatically connect the called subscriber with the calling subscriber, and utilizing direct current control effected by the interruption of a portion of the conversational circuit between the called subscriber and the calling subscriber for releasing the connection.

2. The method of interconnecting the stations of subscribers located on party lines which comprises using code magneto current to signal a wanted subscriber in the case of a revertive call, employing magneto current in a different code to extend a calling subscriber to an operator, informing the operator of the designation of the wanted subscriber, employing direct current code impulses corresponding to the wanted subscriber's designation to connect the wanted subscriber to the calling subscriber, and utilizing direct current control effected by the interruption of a portion of the conversational circuit between the called subscriber and the calling subscriber for releasing the connection.

3. The method of interconnecting the stations of subscribers located on party lines which comprises using code magneto current to signal a wanted subscriber in the case of a revertive call, employing magneto current in a different code to extend a calling subscriber to an operator, informing the operator of the designation of the wanted subscriber, employing direct current code impulses corresponding to the wanted subscriber's designation to connect the wanted subscriber to the calling subscriber, automatically disconnecting the operator from the calling subscriber when the connection between the calling and the called subscribers has been completed, and utilizing direct current control effected by the interruption of a portion of the conversational circuit between the called subscriber and the calling subscriber for releasing the connection.

4. The method of interconnecting subscribers which comprises automatically extending a calling subscriber to an operator in response to code impulses of magneto current, informing the operator of the wanted subscriber's designation, employing code impulses corresponding to the wanted subscriber's designation to set up a condition whereby the wanted subscriber is non-numerically, automatically connected to the calling subscriber, and utilizing direct current control effected by the interruption of a portion of the conversational circuit between the called subscriber and the calling subscriber for releasing the connection.

5. In an automatic telephone system, local battery telephone party lines, a magneto generator for each party on a line for signalling the other subscribers, a non-numerical switch for the use of each party line, bridge circuits multiply connected at each of their ends to said automatic switches, an operator's position provided with an impulse transmitter, a register sender associated therewith, means including a non-numerical switch for connecting an idle register sender and operator's position to a bridge circuit taken for use, said register sender being adjusted in accordance with impulses corresponding to the designation of the wanted subscriber's line transmitted from the operator's impulse transmitter, means controlled by said adjusted register sender for causing the non-numerical switch of the wanted telephone line to seize the bridge circuit which has been connected to the calling subscriber's line, and means including a direct current circuit extending over a portion of a subscriber's telephone line included in a telephone connection for releasing said connection.

6. In an automatic telephone system, a plu-

rality of local battery party telephone lines, a magneto for each party on a telephone line, an automatic non-numerical switch for each subscriber's line, a plurality of link circuits, each link circuit having an originating end and a terminating portion ending in said automatic switches, means controlled by the magneto of the calling subscriber on a line for causing its line switch to seize the originating end only of a link circuit, an operator's position, means for connecting said operator's position to a bridge circuit that has been selected by a calling telephone line, and means controlled by impulses corresponding to a wanted subscriber's line transmitted from said operator's position to cause the automatic switch of a wanted subscriber's line to seize the terminating portion of the selected bridge circuit, and means comprising a direct current circuit including a portion of the conversational circuit between the called subscriber and the calling subscriber for releasing the connection.

In witness whereof, I, hereunto subscribe my name this 10th day of October, A. D. 1929.

WINFRED T. POWELL.