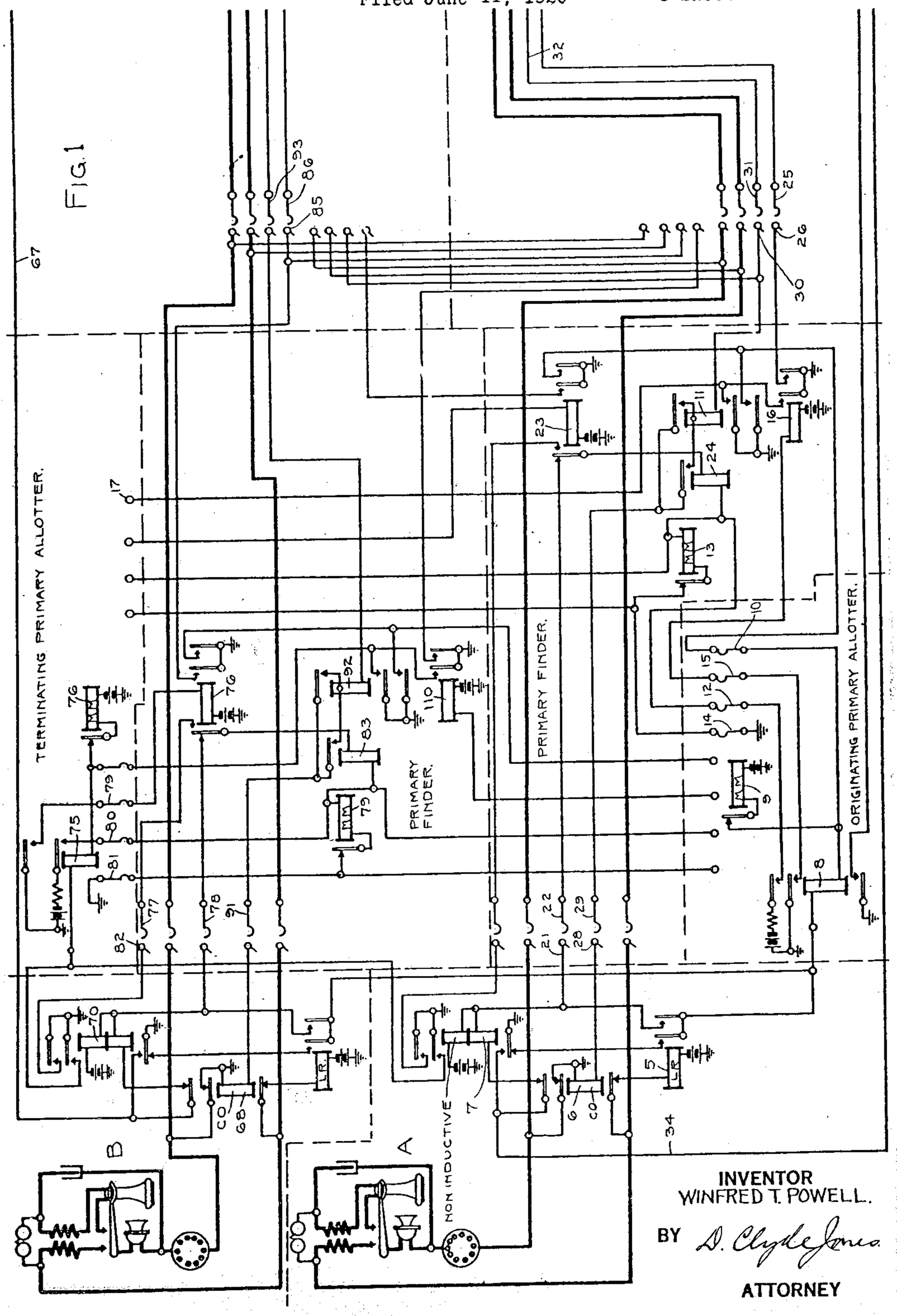
Oct. 27, 1925. 1,559,371

W. T. POWELL

AUTOMATIC TELEPHONE SYSTEM

Filed June 11, 1920 3 Sheets-Sheet 1

FIG. 1



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ATTORNEY

Oct. 27, 1925.

1,559,371

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AUTOMATIC TELEPHONE SYSTEM

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3 Sheets-Sheet. 2

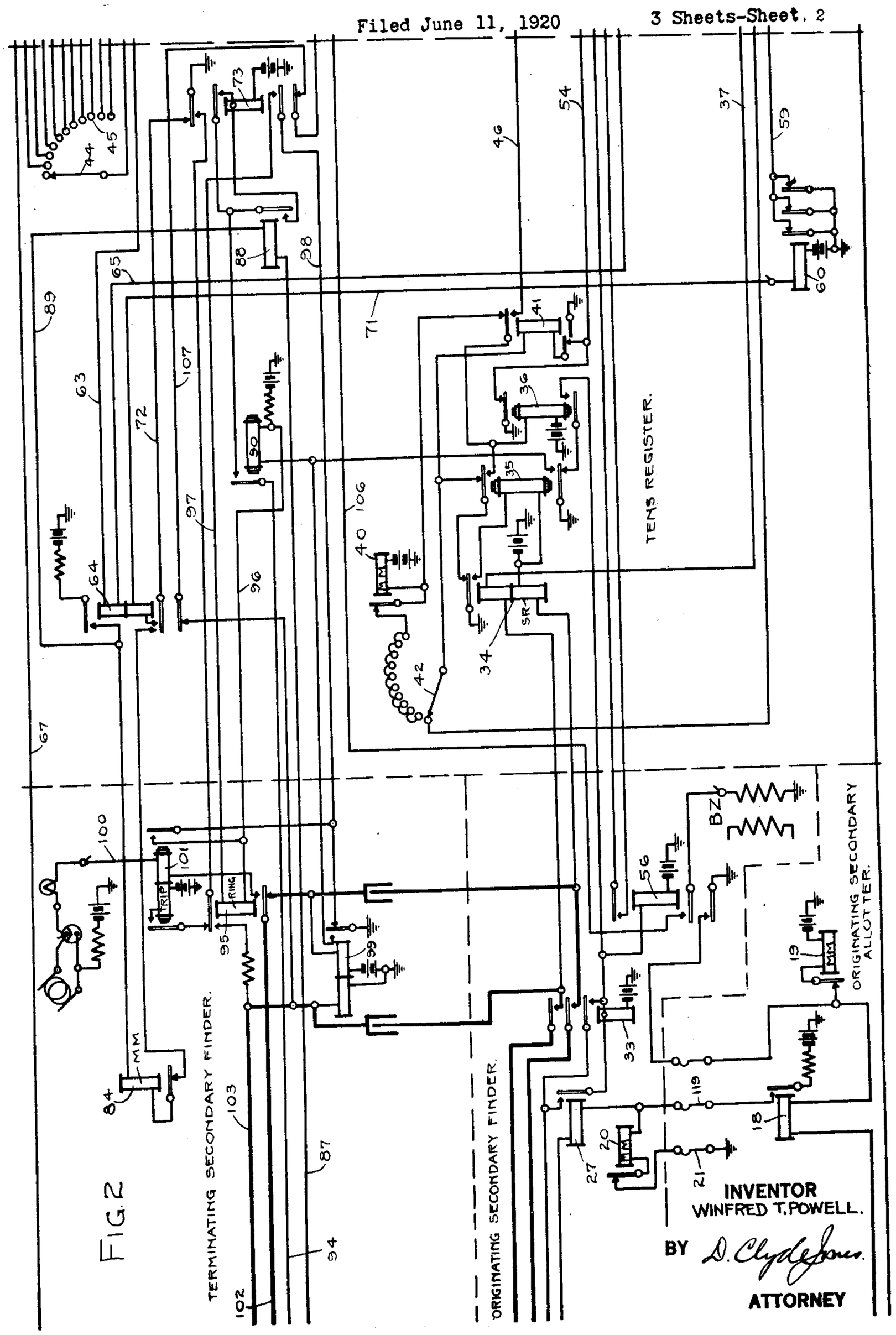

FIG. 2

Oct. 27, 1925.

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Filed June 11, 1920

3 Sheets-Sheet 3

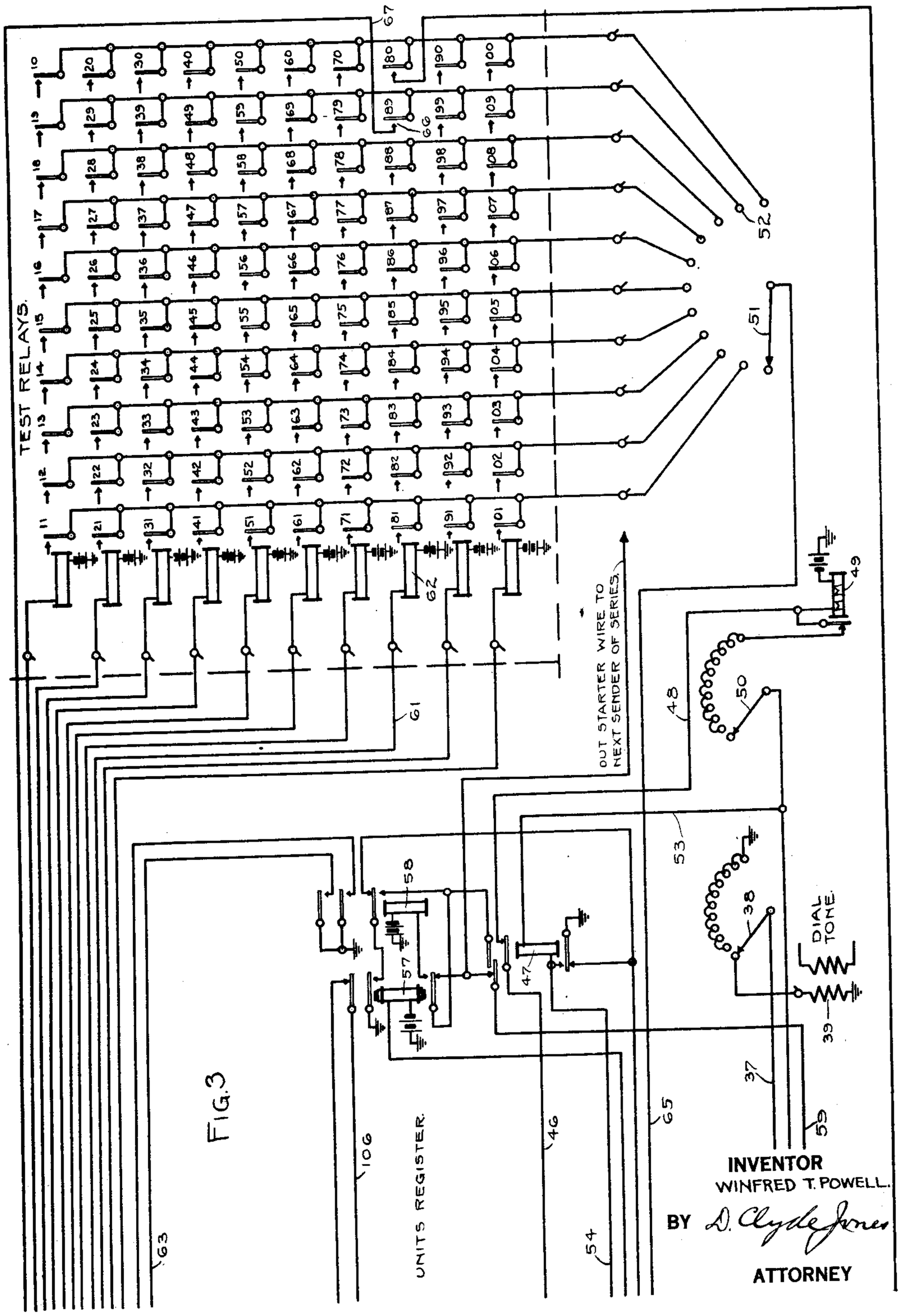

FIG. 3

Patented Oct. 27, 1925. 1,559,371

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.

AUTOMATIC TELEPHONE SYSTEM.

Application filed June 11, 1920. Serial No. 388,207.

To all whom it may concern:

Be it known that I, WINFRED T. POWELL, a citizen of the United States, residing at Rochester, in the county of Monroe and State of New York, have invented certain new and useful Improvements in Automatic Telephone Systems, of which the following is a full, clear, concise, and exact description.

This invention relates to telephone systems, and more particularly to telephone systems employing automatic switches in extending a telephone connection from the calling to a called subscriber's line.

The main feature of this invention consists in the provision of means for electrically distinguishing a wanted subscriber's line, and thereafter starting primary and secondary automatic switches to locate the line so distinguished.

Other features of the invention will appear from the detailed description and claims.

The drawings with Figs. 1, 2 and 3 arranged in the order named, diagrammatically represent a portion of the telephone system employing the present invention.

At the left of the dotted line of Fig. 1, there are represented the substations and line circuits of two subscribers' lines. For purposes of this description the line designated A, is referred to as the calling line and the line designated B, is referred to as the called line, although it will be understood that each line may function as a calling or called line. Within the dotted rectangles at the center portion of Fig. 1, there is represented two switches which are referred to as primary finder switches. These switches may be switches of the same or different groups depending on whether the calling and called lines are in the same or different groups. Within the rectangle at the bottom of Fig. 1, and within the rectangle at the top of this figure there are represented two switches, the first designated originating primary allotter, and the second terminating primary allotter. There is one of these pairs of switches for each group of primary finder switches. At the right of Fig. 1, and at the left of Fig. 2, there are shown two secondary finder switches; one of these switches co-operating in extending a call from a calling line which switch is referred to as an originating secondary finder, and the other which functions to extend a call to the called line, and this switch is referred to as a terminating secondary finder. At the lower left hand corner of Fig. 2 there is diagrammatically shown a switch which is called an originating secondary allotter. This switch functions to assign an idle originating secondary finder switch for each calling line. At the right of Fig. 2 and at the left of the dotted line of Fig. 3, there are shown a tens register and a units register. These two registers co-operate and are referred to as a register sender. At the upper right hand corner of Fig. 3 there is shown a group of ten relays provided with a plurality of contacts. These relays are common to all the lines of the system, and each line is represented by a contact in some one of these relays.

The present invention has been represented in a system having 100 lines. In such a system the lines are arbitrarily divided into four groups, each having 25 lines. For the individual use of each group of 25 lines there are provided 8 primary finder switches which may function to connect to a line irrespective of whether it is calling or being called. Each group of lines also has for its individual use an originating primary allotter for assigning any one of the 8 primary switches for use when idle in the case of an originating call, and the terminating allotter functions to assign any idle one of the same 8 switches to locate the called line in the case of a terminating call. Twenty secondary finder switches, each provided with 32 sets of terminals and having access to the 8 primary switches of each of the 4 groups are employed. Ten of these secondary finder switches are used only for extending a call from a calling line, and the remaining 10 secondary switches are only used to extend a call to the called line. A single allotter switch herein referred to as the originating secondary allotter functions to assign the 10 originating secondary finder switches for use in succession when they are idle.

The switches employed in this system may be of a structure substantially similar to that disclosed in the patent to Clement, No. 1,107,153, issued August 11, 1914, and may

all be of the same design except that the number of sets of terminals in the switch and the brushes co-operating with the same may vary in number. For example, the primary finder switches are provided with 25 sets of terminals and with 5 brushes for co-operating with the sets of terminals. The primary allotters are provided with 8 sets of terminals and with 4 sets of brushes for engaging these terminals. The secondary finder switches are provided with 32 sets of terminals and with 4 sets of brushes for co-operating therewith. The originating secondary allotter has 10 sets of terminals and 3 sets of brushes, while the tens and units registers have 11 sets of terminals provided with 2 sets of brushes and 3 sets respectively.

Briefly the operation of the system is as follows: When the calling subscriber removes his receiver from its switchhook, an allotted primary finder switch in the group associated with the calling line is started to find the calling line. Simultaneously a secondary finder switch is started to locate a primary finder switch that has begun to operate. The first of these switches to complete its operation will wait for the other to complete its function, and the calling line will then be extended to an idle register sender. The subscriber now operates his dial switch to set the tens register in accordance with the tens digit of the wanted number. Thereafter the dial switch is again operated to set the units register in accordance with the units digit of the wanted number. After the number is thus registered, the called line is tested and, if idle, is characterized by a condition which will cause a primary finder switch of the group in which it is located to seize the line terminals. Also a terminating secondary finder switch associated with the originating secondary finder that has been taken for use operates simultaneously with the primary finder switch that is locating the called line. When these last mentioned primary and secondary finder switches have located the called line, the called line is signaled and the talking and releasing functions then take place. It will be noted that the register sender taken for use in extending a call, is retained until this call is terminated, or abandoned.

It is believed that the invention will best be understood by describing the operation of establishing a telephone connection from a calling substation, such as A to a called substation, such as B. It will first be assumed that the called substation is idle, and it will thereafter be assumed that the called substation is busy.

When the subscriber at A removes his receiver from its switchhook, a circuit is closed for the line relay 5, from grounded battery, its winding, through the lower back contact and armature of the cut-off relay 6, through the substation circuits of the substation at A, inner upper armature and back contact of the cut-off relay 6 to ground. The line relay 5 attracts its armatures and closes a circuit from ground, at the lower back contact and armature of relay 7, inner contact and armature of relay 5, winding of relay 8, back contact, armature and winding of the motor magnet 9 of the originating primary allotter to grounded battery, unless this allotter is engaged in assigning an idle primary finder switch for use, under which condition the relay 8 will be short circuited by a circuit completed from grounded battery, winding, armature and contact of the motor magnet 9, allotter brush 10, to ground at lower front contact and armature of relay 11 or at the outer right hand front contact and armature of relay 23. As soon as the originating primary allotter is standing with its brushes associated with the allotted idle primary finder switch, the circuit described for the relay 8 will be effective to energize this relay and it will close a circuit for advancing the primary finder switch into engagement with the terminals of the calling line. This circuit extends from grounded battery, resistance, upper-most armature and front contact of relay 8, allotter brush 12, winding of the motor magnet 13, armature and back contact of this motor magnet, allotter brush 14 to ground. When the relay 8 operates, it also closes a circuit from ground, its inner-most armature and front contact, allotter brush 15, winding of relay 16 to grounded battery.

The relay 16 when energized closes two circuits, one of which places a busy potential on the test terminal 17 of the primary finder at the terminating primary allotter switch, and at its right hand armature and front contact closes a break point in the stopping circuit for the originating secondary finder switch as will be described. Also when relay 8 operated, it closed at its lower armature and front contact a circuit from ground, through the winding of relay 18, back contact, armature and winding of the motor magnet 19 of the originating secondary allotter to grounded battery. The magnet 19 does not operate in series with the relay 18, but the relay 18 is energized and closes an operating circuit for the originating secondary finder switch from grounded battery, resistance, armature and front contact of relay 18, originating secondary allotter brush, winding of the motor magnet 20, its armature, back contact and allotter brush 21 to ground. It will thus be seen that relay 8 simultaneously starts an allotted primary and an allotted secondary finder switch to extend a connection from the calling line to the register sender.

When the line relay 5 operated, it closed a circuit from ground at the lower armature and back contact of relay 7, through its armatures and contacts in series, to all the multiple terminals such as 21 at all of the primary finder switches in the group in which the calling line is located. As soon as the started primary finder switch engages the set of terminals individual to the calling line, the ground potential on test terminal 21 is extended over the finder brush 22, armature and back contact of relay 23, winding of relay 24, allotter brush 12, uppermost front contact and armature of relay 8, and resistance to grounded battery. It will be noted that this last traced circuit shunts the motor magnet 13 of the primary finder switch, causing this switch to stop with its brushes in engagement with the terminals of the calling line. The relay 24 is energized in the circuit just described and attracts its armature to extend the holding circuit of the primary finder switch to the secondary finder switch.

It will be remembered that the circuit for the originating secondary finder switch was completed through the brushes 119 and 21 of the originating secondary allotter. Under the control of this circuit, the allotted originating secondary finder switch advances its brushes until its test brush 25 engages the terminal 26 associated with the primary finder switch that has been engaged in locating the calling line.

As soon as the test terminal 26 is tested, the stopping circuit previously mentioned for the originating secondary finder switch is closed from ground, outer armature and front contact of relay 16, test terminal 26, test brush 25 of the originating secondary finder switch, winding of relay 27, allotter brush 119, front contact and armature of relay 18, and resistance to grounded battery. This circuit is effective to energize the relay 27 and also to shunt the motor magnet 20 to stop the originating secondary finder switch in engagement with the terminals of the primary finder switch engaged in locating the calling line. When the primary and secondary finder switches have been operated and stopped in the manner just described, the relays 24 and 27 will be operated and a circuit will be closed from ground, winding of the cut-off relay 6, terminal 28, finder brush 29, upper armature and front contact of relay 24, winding of relay 11, secondary finder terminal 30, secondary finder brush 31, conductor 32, front contact and armature of relay 27, winding of relay 27, winding of relay 33 to grounded battery. A circuit in multiple with that just described is closed through relay 56. The relay 56 at its upper armature and contact closes a circuit for energizing relay 57 (Fig. 3) to close other circuits as will be described, while the cut-off relay 6 in operating disconnects the line relay 5 from the calling line, and at its upper-most armature and back contact opens the test conductor 34, which prevents the calling line from being seized as a called line. The relay 11 closes a locking circuit for itself and thus maintains the holding circuit independent of the armature and contact of the relay 24. The relay 33 on attracting its armatures closes a break point in the talking conductors of the link circuit associated with the secondary finder switch, and also eliminates the control of the relay 27 over the holding circuit by extending this circuit through an armature and front contact of the relay 33. When the relay 33 closed the break points in the talking conductors extending through the link circuits to the calling subscriber's line, stepping relay 34 was energized. This circuit may be traced from grounded battery, lower winding of the stepping relay 34, over the connection just built up, through the upper winding of the relay 34, conductor 37, brush 38 of the units register in its normal position, winding of the induction coil 39 to ground. The stepping relay SR, is energized in this circuit and operates the slow releasing relay 35, which in turn operates the slow releasing relay 90. The apparatus and circuits are now in condition to receive the impulses corresponding to the tens digit of the wanted number. This condition will be indicated to the calling subscriber by the application of a dialing tone through windings of the induction coil. All the subscribers may be instructed not to operate their dial switches until this tone is heard.

Let it be assumed that the number of the wanted station is 89. The calling subscriber will therefore operate his dial switch to transmit 8 impulses in response to which the armature of the stepping relay 34 is vibrated. When the armature of the stepping relay 34 is retracted in response to the first impulse of the tens series, the slow releasing relay 36 is actuated in a circuit extending from grounded battery, winding of this relay, upper front contact and armature of relay 35, back contact and armature of relay 34 to ground. Relay 35 as is well known controls the restoration of the tens and units registers as will be described. Also in response to the tens series of impulses the motor magnet 40 of the tens register is operated once for each impulse transmitted. The circuit for controlling the motor magnet extends from grounded battery, winding of the motor magnet, upper back contact and armature of relay 41, upper front contact and armature of relay 35, back contact and armature of stepping relay 34 to ground. Under the control of this circuit the brushes 42 and 44 of the tens register

are advanced until brush 44 engages contact 45, which contact is allotted to all the lines of which the tens designation is the numeral 8. At the close of this tens series of impulses, the stepping relay 34 will hold its armature attracted for a relatively long interval, permitting the slow releasing relay 36 to retract its armatures. In response to this retraction, a circuit is closed from ground, upper armature and back contact of relay 36, continuity contact and spring of switching relay 41, units register brush 42, back contact, armature and winding of the motor magnet 40 to grounded battery. The motor magnet 40 does not energize in the circuit last described, but the relay 41 attracts its armatures and is locked operated through its lower armature to ground, so that the stepping relay 34 now repeats its impulses to the motor magnet of the units register instead of to the motor magnet of the tens register as last described.

The calling subscriber now operates his dial switch to send 9 impulses corresponding to the units digit of the wanted number. In response to this series of impulses, the stepping relay 34 again vibrates its armature, but now closes a circuit from ground. its armature and back contact, upper armature and front contact of relay 35, upper armature and front contact of switching relay 41, conductor 46, inner upper armature and back contact of switching relay 47, conductor 48, winding of the motor magnet 49 of the units register to grounded battery. In response to each impulse repeated by the stepping relay 34, the motor magnet 49 is operated, and since it has been assumed that 9 impulses are transmitted the units register will advance its brushes 38, 50 and 51 until its brush 51 is in engagement with the contact 52. At the close of the units series of impulses the switching relay 47 is operated in a circuit extending from grounded battery, winding, armature and back contact of the motor magnet 49, the units register brush 50, conductor 53, winding of switching relay 47, conductor 54, upper back contact and armature of slow releasing relay 36 to ground. The relay 47 is energized in this circuit and attracts its armatures to close a locking circuit for itself from ground, its lower armature and front contact to grounded battery at the motor magnet 49.

It will be remembered that the slow releasing relay 57 was energized as soon as relay 56 was operated. With the relays 57 and 47 actuated, a circuit is closed for operating relay 58 from grounded battery, winding of this relay, lower front contact and armature of relay 57, upper-most armature and continuity spring of relay 47, conductor 59, back contacts and armatures of common lock-out relay 60 to ground. Relay 58 at its inner-most armature and back contact interrupts the locking circuit of the relay 57, but since this relay 57 is slow releasing it will hold its armatures attracted for an appreciable interval after its operating circuit is broken, and relay 58 will be held operated for a short interval. At the middle armature and front contact of relay 58, a circuit is extended from ground, through register brush 44 and contact 45, conductor 61, winding of relay 62 to grounded battery. The relay 62 is operated in this circuit to close its contacts. At the upper-most armature and front contact of relay 58 a circuit is extended from ground over conductor 63, upper winding of relay 64, conductor 65, units register brush 51, contact 52, contact 66 of relay 62 which contact is individual to the subscriber whose number is "89", test conductor 67, upper-most armature and back contact of the cut-off relay 68 of the so-called line, lower and upper winding in series of relay 70 to grounded battery. The relays 64 and 70 are operated in series, and the relay 70 locks itself operated in a circuit extending from grounded battery, through both of its windings in series, upper-most back contact and armature of the cut-off relay 68, lower front contact and armature of relay 70 to ground. Relay 64 also locks itself operated in a circuit extending from grounded battery, through both of its windings in series, upper-most back contact and armature of the cut-off relay 68, lower front contact and armature of relay 70 to ground. Relay 64 also locks itself operated in a circuit completed from grounded battery, winding of the common lock-out relay 60, conductor 71, lower winding, front contact and armature of relay 64, conductor 72, upper-most back contact and armature of relay 73 to ground. The energization of the relays 70 and 64 serve to start the primary finder switch and the terminating secondary finder switch to complete the extension of the link circuit to the called line while the common lock-out relay 60 permits only one called line to be tested at a time. It is assumed that the terminating primary allotter is standing with its brushes in engagement with an idle primary finder switch of the group in which the called line is located. Under these conditions as soon as the relay 70 is operated, it closes a circuit from ground, its inner upper armature and front contact, winding of relay 75, back contact, armature and winding of the motor magnet 76 of the terminating primary allotter to grounded battery to operate relay 75. With the relay 75 operated, a circuit is closed for operating the relay 76 from grounded battery, winding of this relay, allotter brush 79, upper-most front contact and armature of relay 75 to ground. The relay 76 is thus caused to attract its armatures and now renders test brush 77 effective

instead of the test brush 78 which is effective when the primary finder switch is hunting for a calling line. Relay 75 also closes an actuating circuit for the motor magnet 79 of the allotted primary finder switch, which circuit is completed from grounded battery, resistance, inner-most armature and front contact of relay 75, allotter brush 80, winding of the motor magnet 79, its armature and back contact, allotter brush 81 to ground. Under the control of this circuit the primary finder switch advances its brushes until the finder test brush 77 engages the test terminal 82, which is individual to the called line, at which time a circuit is closed from ground, upper-most armature and front contact of relay 70, test terminal 82, test brush 77, left hand front contact and armature of relay 76, winding of relay 83, allotter brush 80, inner-most front contact and armature of relay 75, resistance to grounded battery. This circuit serves to operate the relay 83 and to shunt the motor magnet 79 of the primary finder switch which is now in engagement with the terminals of the called line. While the primary finder switch is hunting for the called line, the terminating secondary finder switch hunts for the trunk circuit individual to this last mentioned primary finder switch. The operating circuit for the secondary finder switch is completed as soon as the relay 64 is operated, and is traceable from grounded battery, resistance, upper armature and front contact of relay 64, winding, armature and back contact of the motor magnet 84 of the secondary finder switch, lower front contact and armature of relay 64, conductor 72, upper-most back contact and armature of relay 73 to ground. The trunk circuit individual to the primary finder switch that is hunting for the called line is electrically distinguished by the presence of ground potential on its test terminal 85. This ground potential is applied at the inner-most front contact and armature of relay 76, and as soon as the terminating secondary finder switch advances its test brush 86 into engagement with the test terminal 85, a circuit is completed over conductor 87, winding of relay 88, conductor 89, upper front contact and armature of relay 64, and resistance to grounded battery. This circuit is effective to operate relay 88 and to shunt the motor magnet 84 of the terminating secondary finder switch, thus causing it to stop with its brushes in engagement with the terminals of the link circuit individual to the operating primary finder switch. As soon as the primary and secondary finder switches have completed the extension of the connection to the called line, a circuit is completed from ground, winding of the cut-off relay 68 of the called line, primary finder brush 91, armature and front contact of relay 83, winding of relay 92, secondary finder switch brush 93, conductor 94, armature and contact of relay 90, armature and front contact of relay 88, winding of relay 73 to grounded battery. The relays 73, 92 and cut-off relay 68 are operated in this circuit. The relay 92 at its upper armature and front contact closes a substitute circuit about the armature and front contact of relay 83 and the relay 73 at its inner-upper armature and front contact eliminates the armature and front contact of relay 88, from the circuit just described.

As soon as the relay 73 operates, a circuit is closed for actuating the ringing relay 95 extending from grounded battery, resistance, conductor 96, winding of relay 95, conductor 97, inner-most lower front contact and armature of relay 73, conductor 98, and back contact and armature of relay 99 to ground. Relay 95 on attracting its armatures causes ringing current to be transmitted from the well known type of ringing machine, over conductor 100, right hand winding of relay 101, lower front contact and armature of ringing relay 95, over talking conductor 102 and the link circuit to the called substation and bell, over the other side of the line and link circuit to talking circuit to conductor 103, resistance, upper front contact and armature of ringing relay 95, upper-most front contact and armature of relay 73 to ground. Ringing current is applied over this circuit until the called subscriber responds by removing his receiver from its switchhook whereupon the trip relay attracts its armature in the well known manner; and the ringing relay 95 is short circuited at the right hand armature and front contact of the trip relay 101, causing the ringing relay to de-energize, disconnect the ringing current from the called line, and connect relay 99 to the called line. Battery feeding relay 99 has its windings serially included in the talking conductors 102 and 103. Relay 99 is operated in this circuit and closes a substitute circuit for the slow releasing relay 90, which controls the release of the register sender as well as releases the primary finder switch and the terminating secondary finder switch. This substitute circuit extends from grounded battery, resistance, winding of the relay 90, front contact and armature of relay 90, front contact and armature of relay 99 to ground. Talking battery is supplied to the calling subscriber through the windings of stepping relay 34, while talking battery is supplied to the called party through the windings of relay 99.

When the called subscriber replaces his receiver on its switchhook, the stepping relay 34 de-energizes and shortly afterward the slow releasing relay 35 de-energizes to close a circuit for the motor magnet 40 of the tens register. This circuit extends from

grounded battery, winding, armature and back contact of the motor magnet 40, tens register brush 42, back contact and armature of relay 33, back contact and armature of relay 34 to ground. Under the control of this circuit, the motor magnet 40 advances the brushes of the tens register until the brush 42 is restored to its normal position at which time a circuit is closed from ground, armatures and back contacts of relays 34 and 35, tens register brush 42, units register brush 50, back contact, armature and winding of the motor magnet 49, to grounded battery. Under the control of this last mentioned circuit, the motor magnet 49 advances the brushes of the units register until they are restored to their normal position. With the register brush 50 in its normal position, the locking circuit of the switching relay 47 is interrupted causing this relay to retract its armatures.

At the time when the stepping relay 34 de-energized and before the slow releasing relay 35 retracted its armatures, a circuit was momentarily completed for the slow releasing relay 36. Subsequently the slow releasing relay 35 retracted its armatures, but before relay 36 retracts its armatures a circuit was closed from ground, lower armature and back contact of relay 35, lower armature and front contact of relay 36, winding of relay 33 to grounded battery and in multiple with the winding of relay 56 to grounded battery. This last traced circuit is effective to short circuit the cut-off relay 6 of the calling line and the relay 11 of the primary finder switch. Finally when relay 36 de-energizes, the relays 33 and 56 de-energize. The calling line is now in normal condition and the primary finder switch as well as the originating secondary finder switch remain with their brushes in engagement with the terminals last used.

When the called subscriber replaces his receiver on its switchhook, the relay 99 retracts its armature and closes a circuit from ground, armature and front contact of the trip relay 101, conductor 96, and resistance to grounded battery. This places a short circuit about the slow releasing relay 90, which causes it to retract its armatures and thereby opens the holding circuit including the relays 73, 92 and the cut-off relay 68. These last mentioned relays de-energize leaving the called line in normal condition and leaving the primary finder switch and the terminating secondary finder switch in engagement with the terminals last used.

If the called line is busy when the relay 58 of Fig. 3 operates, the relay 64 will not be operated because the test circuit 67 of the called line will be open at the upper-most armature and back contact of the cut-off relay 68. Since the relay 64 is not operated, the terminating secondary finder switch will not be advanced, and since the relay 70 associated with the called line is not energized, the terminating primary allotter and the primary finder switch will not be operated. Under this condition a busy tone will be transmitted to the calling subscriber over a circuit extending from the busy machine BZ, inner lower armature and front contact of the relay 56, conductor 106, upper-most armature and back contact of slow releasing relay 57, lower-most armature and back contact of relay 73, conductor 107, armature and back contact of relay 64, through the condenser, upper-most front contact and armature of relay 33, through the originating secondary finder switch and the primary finder switch of the calling line and over the other side of the connection to the middle armature of relay 33, through the condenser, right hand winding of relay 99 to ground. The calling subscriber on receiving this busy signal releases the connection by replacing his receiver to its switchhook, whereupon the register sender and the primary finder switch as well as the originating secondary finder switch will take place in the manner previously described.

It will be noted that the originating primary allotter will move to a position to assign another primary finder for use as soon as either of the relays 11 and 23 of the primary finders are energized, since an operating circuit is closed for the allotter from grounded battery, winding, armature and back contact of motor magnet 9, allotter brush 10 to ground at the armature of either relay 11 or 23. Similarly the operation of either relays 92 or 110 control the setting of the terminating primary allotter, while relay 56 controls the adjustment of the originating secondary allotter.

What I claim is:

1. In a telephone system, a plurality of telephone lines, a plurality of non-numerical switches of the step by step type, a plurality of trunks, means for causing a non-numerical switch to seize a calling line, means to cause a second non-numerical switch having wipers to successively test said lines and to seize a wanted line, and means including a trunk circuit and said non-numerical switches only for interlinking said last mentioned switches.

2. In a telephone system, a plurality of telephone lines, a plurality of non-numerical switches, a plurality of trunks, a register sender common to a plurality of said trunks, means for selectively adjusting said register sender in accordance with the designation of a wanted line, means for distinguishing a wanted line as indicated by the adjustment of said register sender, means for causing a non-numerical switch having wipers to hunt for and seize the called line so dis-

tinguished, and a telephone connection including non-numerical switches only and at least one of said trunks.

3. In a telephone system, a plurality of telephone lines, a plurality of non-numerical switches, allotting devices for assigning said switches for use, a plurality of trunks, means for causing an allotted non-numerical switch to seize a calling line, means for thereafter causing a second allotted non-numerical switch to seize a wanted line, and means including only trunk circuits and non-numerical switches for interlinking said last mentioned switches.

4. In a telephone system, a plurality of telephone lines, a plurality of progressively movable non-numerical switches, a plurality of trunks, a register sender common to certain of said trunks, means for selectively adjusting said register sender in accordance with the designation of a wanted line, means for distinguishing a wanted line as indicated by the adjustment of said sender, means for causing a non-numerical switch to hunt for the called line so distinguished, and a telephone connection including only said non-numerical switches and a plurality of said trunks.

5. In a telephone system, a plurality of telephone lines, a plurality of non-numerical switches having wipers capable of assuming a plurality of selective positions, means for causing one non-numerical switch to seize a calling line, means for causing a second non-numerical switch to seize a wanted line, and means including trunk circuits and non-numerical switches only for interlinking said last mentioned switches.

6. In a telephone system, a plurality of telephone lines, a plurality of non-numerical switches operating simultaneously to extend a calling line to a trunk circuit, and a plurality of other progressively movable automatic switches operating simultaneously to extend said trunk to a wanted line.

7. The method of extending telephone calls, which consists in simultaneously building up two portions of a connection from a calling line, registering the designation of the wanted line at a remote point over said partially extended connection, causing this registration to characterize said line by a selectable condition, and then simultaneously building up two other portions of the connection from said first mentioned portions of the connection to the line so characterized.

8. In a telephone system, a group of telephone lines, a group of non-numerical switches for connecting with said lines whether calling or called, two sets of allotters for assigning switches for use dependent upon the operation in which said switches are employed, means for causing one of said allotted switches to seize a calling line on the initiation of a call, a second group of switches for connecting with an allotted switch of the first group of switches on the initiation of a call, an additional allotter for assigning switches of the second group for use, means controlled from a distant point to receive the designation of the wanted line and thereafter distinguishing a wanted line by a selectable condition, a third group of non-numerical switches, one of the second group of switches being linked to a switch of the third group, means under the control of the said sender to cause one of said first group of switches to seize the distinguished line, and means including one of said third group of switches for extending the calling line through a switch of each of said first and second groups of switches to the switch that has seized the called line.

9. In a telephone system, a plurality of telephone lines, a plurality of test circuits therefor, a plurality of non-numerical switches, a sender comprising tens and units registers, a group of relays common to all of said lines, each of said relays being common to a different group of said lines, said relays controlling break points in the testing circuits of said lines, means controlled from a distant point to adjust said tens register in accordance with the tens designation of the wanted line and thereby actuate one of said relays, means controlled from a distant point for actuating said units register to close a second break point in the test circuit of the wanted line, whereby said test circuit is completed to electrically distinguish said wanted line, means for causing a non-numerical switch to seize the line so distinguished, and a telephone connection extending through said actuated non-numerical switch.

10. In a telephone system, a plurality of telephone lines, a group of non-numerical switches for connecting with said lines whether calling or being called, an allotter for assigning a switch for use when one of said lines is calling, a second allotter for assigning an idle one of said switches for use when one of said lines is being called, a register sender and a group of relays arranged to be selectably adjusted from a distant point to distinguish the wanted line, test circuits under the control of a register sender and said group of relays to characterize the wanted line by a selectable condition, means for starting an allotted non-numerical switch to hunt for the line so characterized, and a telephone connection between said calling and called lines including two non-numerical switches.

11. In a telephone system, a plurality of telephone lines, a plurality of primary trunks, means for allotting idle trunks for

use, a primary non-numerical switch individual to each trunk, means for operating the primary non-numerical switch of the allotted trunk to connect said trunk to a calling line on the initiation of a call, secondary trunks, a secondary non-numerical switch for each end of each secondary trunk, means for allotting idle secondary trunks for use, means for operating a secondary non-numerical switch of the allotted secondary trunk to connect said trunk to the primary trunk now connected to the calling line, a register sender arranged to be variably adjusted over said calling telephone line and primary trunk in series to designate any other telephone line as a wanted line, a plurality of starting circuits, a group of multi-contact relays common to said telephone lines, said multi-contact relays and said register sender cooperating to close the starting circuit of the wanted telephone line, and means including a primary non-numerical switch and the other secondary non-numerical switch of the allotted secondary trunk for connecting the wanted telephone line to the selected secondary trunk.

In witness whereof, I hereunto subscribe my name this 8th day of June, A. D. 1920.

WINFRED T. POWELL.