

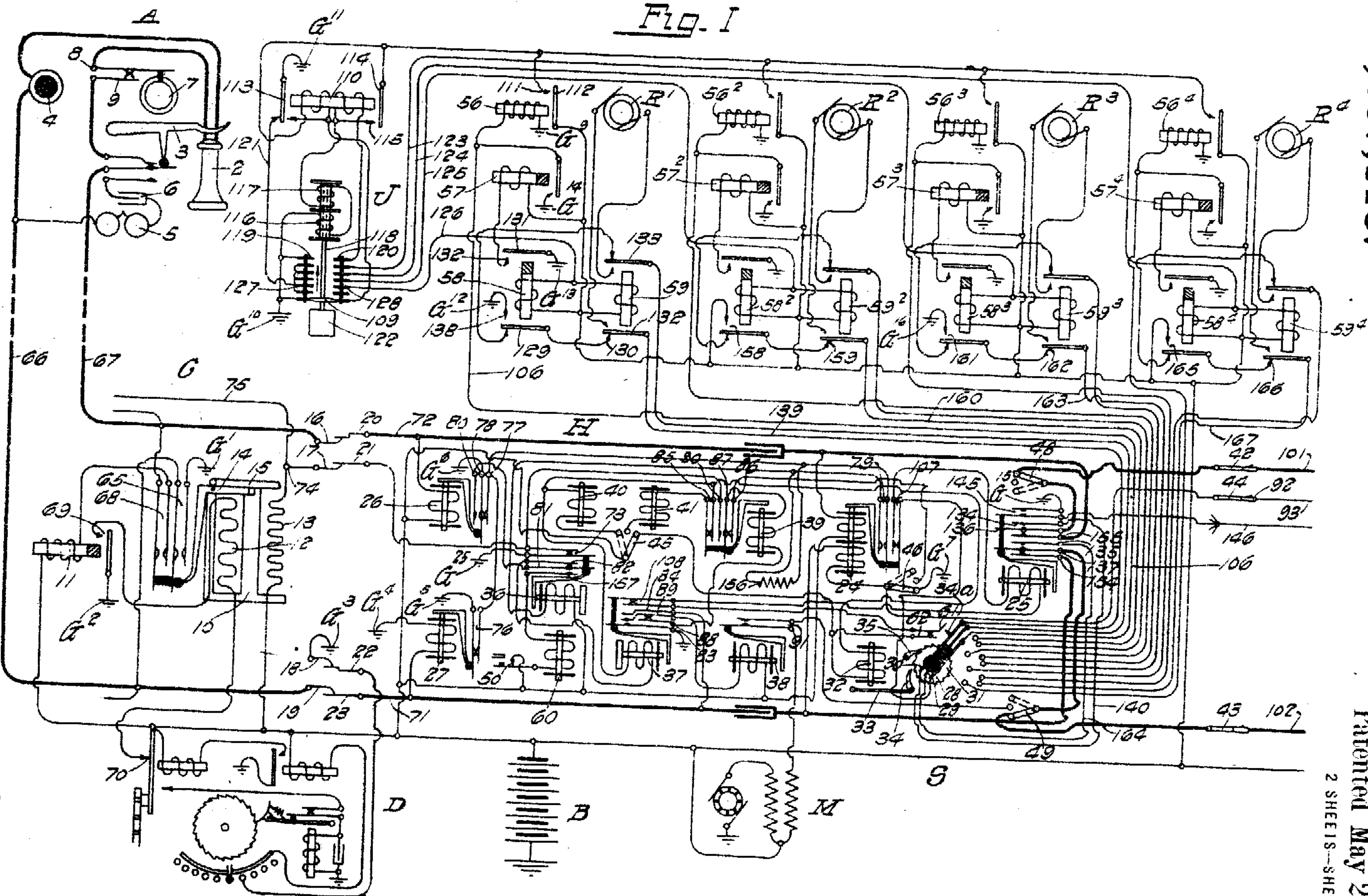
1,267,113.

W. I. POWELL.
PARTY LINE TELEPHONE SYSTEM.
APPLICATION FILED APR. 27, 1916.

Patented May 21, 1918.

2 SHEETS—SHEET 1.

FIG. 1



Inventor
W. I. Powell
By Charles C. Smith
Attorney

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Patented May 21, 1918.
2 SHEETS—SHEET 2.

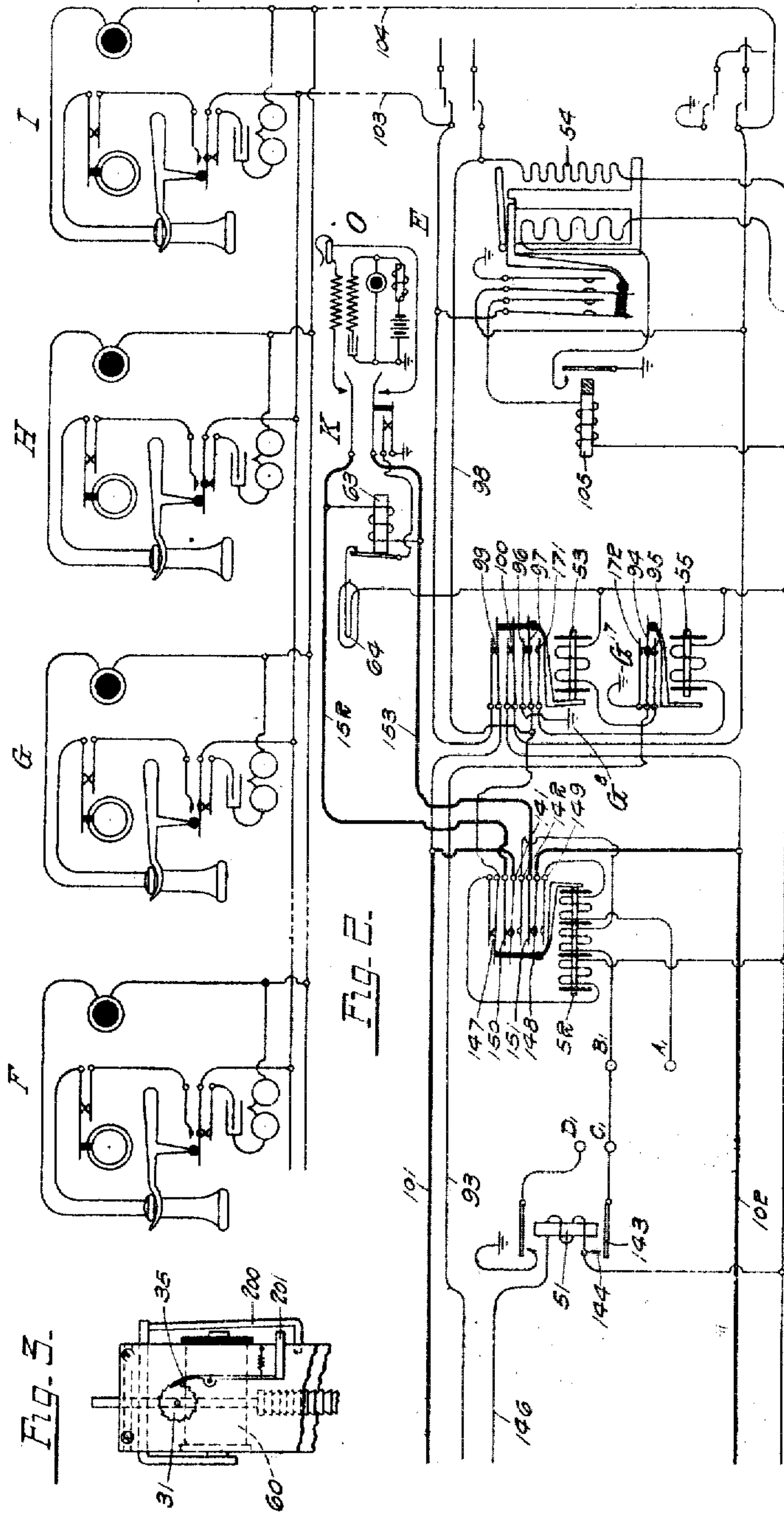
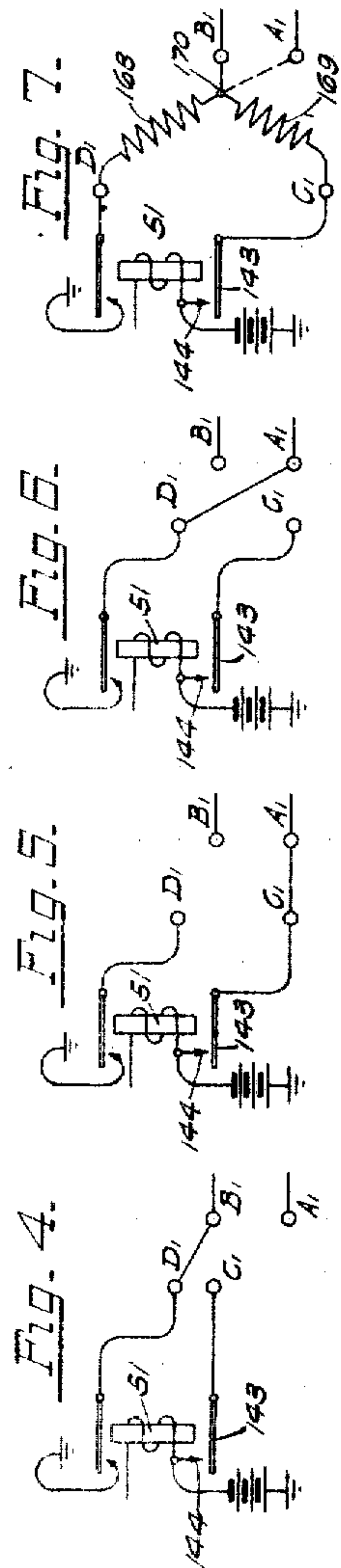
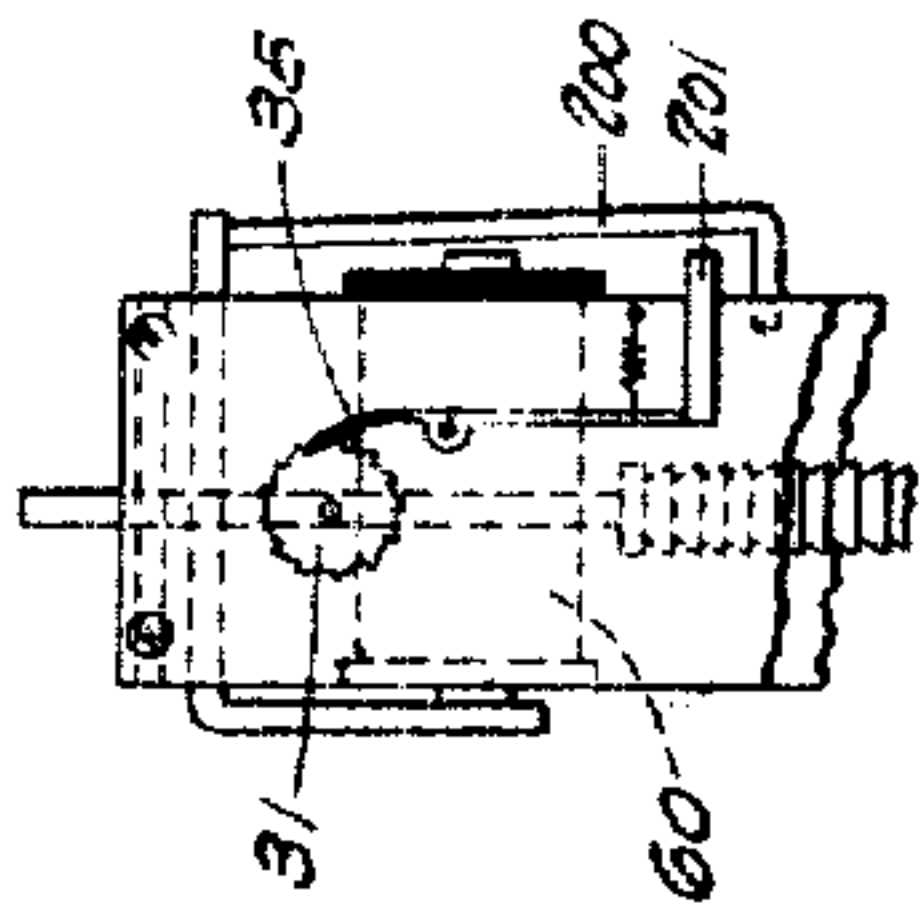


Fig. 3.



Inventor
Winfred T. Powell
By Charles E. Bullock
Attorney

UNITED STATES PATENT OFFICE.

WINFRED T. POWELL, OF CHICAGO, ILLINOIS, ASSIGNOR TO AUTOMATIC ELECTRIC COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION OF ILLINOIS.

PARTY-LINE TELEPHONE SYSTEM.

1,267,113.

Specification of Letters Patent.

Patented May 21, 1918.

Application filed April 27, 1916. Serial No. 94,019.

To all whom it may concern:

Be it known that I, WINFRED T. POWELL, a citizen of the United States of America, and resident of Chicago, Cook county, Illinois, have invented certain new and useful Improvements in Party-Line Telephone Systems, of which the following is a specification.

This invention relates to party-line telephone exchange systems in general, but is concerned more particularly with the so-called automatic party-line telephone systems, in which connections are established through the medium of subscriber controlled switches.

In telephone systems of the above character, when one or more stations on a line has been disconnected it becomes necessary to provide an arrangement whereby when a calling telephone station attempts to complete a connection with the disconnected station, the call will be received by an operator who will proceed to inform the calling station that the called station is no longer accessible.

The principal object of this invention is the provision of an improved, simple and inexpensive arrangement whereby when any station on a party-line has been disconnected or taken out and the said station is called by a subscriber at another station, the call will be switched to a so-called traffic trunk extending to an operator's position.

It is also an object to provide certain details and features of improvement tending to increase the general efficiency and serviceability of a telephone exchange system of this particular character.

To the foregoing and other useful ends this invention consists in matters hereinafter set forth and claimed.

Figures 1 and 2, of the accompanying drawings, taken together represent diagrammatically a complete circuit connection between a calling substation A (Fig. 1) and an operator's equipment O (Fig. 2), it being assumed that substation A attempted to secure connection with substation F (Fig. 2), which for the purposes of this explanation is assumed to have been taken out or disconnected from the line.

Fig. 1 illustrates diagrammatically a substation telephone A, which is connected, at the central office, to an individual or line switch C. A group of line switches, such

as C, is controlled by the common mechanism or master switch D. At H is represented a connector switch with which is associated a frequency selecting switch S. The said frequency selecting switch is operable to elect one of a plurality of ringing current generators, such as R^1 , R^2 , R^3 , and R^4 , and their associated relay equipments. At J is shown a ringer relay interrupter which is common to the ringer relay equipments and is adapted to control the intermittent application of ringing current to called telephone lines. A battery B having one terminal grounded is provided for the purpose of supplying current for operating the central office equipment and for talking purposes. A busy machine M is shown associated with the connector H and is provided for the purpose of supplying a busy tone to the calling station should the connector attempt to complete connection with a busy line.

In Fig. 2 there is illustrated my improved relay equipment which is shown connected in the proper manner to switch calls intended for the discontinued station F to the traffic trunk 152—153. At E is shown a line switch which is similar to the one shown at C. The line switch E serves the party-line having the subscribers' stations G, H, and I, and the subscriber's station F, which has been temporarily disconnected.

Fig. 3 illustrates a portion of the connector switch having particular reference to the method of releasing the frequency selecting device associated with the connector.

Figs. 4, 5, 6, and 7 illustrate the various circuit arrangements which are to be used in the event one of the other stations on the line is disconnected or otherwise rendered inaccessible to calling subscribers, the substation F being retained in service. These arrangements will be hereinafter more fully explained.

The substations may be of any suitable or approved type. Those with which I have elected to illustrate this invention are all alike. Substation A comprises a receiver 2, switch-hook 3, transmitter 4, ringer 5, condenser 6, impulse wheel 7, and impulse springs 8 and 9. The switch-hook, when relieved of the receiver, rises to open the ringer circuit and connects the receiver and transmitter across the line. The impulse wheel 7 is provided with a finger hold dial

(not shown) which is rotated to transmit the required number of impulses. The calling device comprising the wheel 7 and its associated impulse transmitting mechanism 5 may be of the type of calling device shown in U. S. Letters Patent to J. G. Blessing, No. 1,119,394, granted December 1, 1914.

The ringers shown associated with the stations F, G, H and I, of the party line, are 10 of the well known harmonic type—that is, they are each adapted to be operated by ringing current of a certain frequency and not by current of other frequencies. The ringer of each telephone on any particular 15 line is adapted to be operated by a different frequency of ringing current.

The line switch C is of the general type of line switch disclosed in British patent to R. W. James, No. 26,301 of 1906, being, however, of the particular type shown in U. S. 20 Letters Patent to F. Newforth, Jr., No. 13,901, reissued April 13, 1915.

Since line switches of the foregoing type are well known, it will be unnecessary to 25 give an extended description here. It will suffice to say that through the medium of line switch C, the line of substation A, when calling, is given access to a plurality of connector switches one of which is shown at H.

Although in this illustration I show the 30 line switch C as having direct access to the connector switch H, I do not wish to limit myself to the specific arrangement disclosed herein. Selector switches of any suitable 35 type may be placed between the said line switch and connector in order to increase the capacity of the exchange, without departing from the spirit of my invention.

The master switch D is similar to the master switch shown in British patent to T. G. 40 Martin, No. 1419 of 1910. As is well known, the function of the master switch is to maintain the plungers of all the idle line switches opposite the terminals of idle trunk lines.

The connector H is of the general type of 45 connector switch disclosed in United States Letters Patent No. 815,176, granted March 13, 1906, to Keith, Erickson and Erickson; being modified, however, to enable it to operate, in a system in which the operating im- 50 pulses are transmitted over two sides of the line in series, as shown in British patent specification, No. 2270 of 1914, and being provided, furthermore, with means for selecting different ringing generators.

A connector switch of the foregoing character may be given access to a single group of subscribers' lines and is operable in re- 60 sponse to digits of a called number to extend connection to any one of the lines of the group with which it is associated. Since the general construction of such connectors is well known, having been fully described in the publications referred to, no extended de- 65 scription of the construction or operation

will be given at this time, such explanation as is deemed necessary being reserved for the detailed specification.

Since the connector H is adapted for party line service it is provided with a frequency 70 selector S for selective ringing purposes. The frequency selector S may be considered as being a part of the connector switch; and is operable, after the connector has been 75 operated to connect with the wanted line, in response to the final digit of the wanted number to select the proper frequency of ringing current for signaling the wanted substation. For this purpose the switch S is 80 provided with a plurality of sets of contacts adapted to be traversed by the wipers 28, 29, and 30, each set being the terminal of a set of conductors extending to the so-called group ringing relays. For example, the 85 first set of contacts, upon which the wipers are resting, is the terminal of a set of conductors extending to relays 56, 57, 58, and 59, which relays are provided for the purpose of controlling the intermittent applica- 90 tion of ringing current from generator R' to called lines. Each of the remaining sets of contacts is associated with a similar group of relays which in turn are associated, respectively, with ringing current generators R², R³, and R⁴. These generators deliver 95 ringing currents of different frequency. The interrupter J is common to the different sets of group ringing relays and furnishes the intermittent impulses for their operation, as will appear more clearly hereinafter. 100

To return to the frequency selector switch S, the wipers 28, 29, and 30 are mounted upon a ratchet wheel 31, which is adapted to be rotated step by step by the magnet 32 through the medium of its armature 33 and pawl 34. 105 The pawl 35 is provided to prevent backward rotation of the ratchet wheel during successive impulses and serves to retain the wipers in the position to which they have been advanced. The off-normal contact 110 springs 61 and 62 are closed at the first operation of magnet 32. The wipers are released upon the release of the connector H as may be clearly seen by reference to Fig. 3. The retaining pawl 35 is provided with an ex- 115 tension 201. Upon the energization of release magnet 60 of connector H, the release armature 200 is attracted to effect the disconnection of the connector in the well known manner, and in so doing the armature 200 120 engages the extension arm 201, whereby pawl 35 is disengaged from ratchet wheel 31 and the latter is returned to normal by a coiled spring (not shown).

One of the lines to which the connector H 125 has access is shown extending by way of conductors 101 and 102, contact springs of relay 53 (Fig. 2), and line conductors 103 and 104, to the party line substations G, H, and I, which have been previously men- 130

tioned. The extension of line conductors 103 and 104 to substation F is shown dotted to indicate that this substation has been disconnected. An individual line switch, indicated by reference character E, is allotted at the exchange to the line conductors 103 and 104 of the party line, and like line switch C (Fig. 1) is operable by a calling substation via its associated line to extend connection to an idle selector switch.

The relay equipment shown just to the left of line switch E in Fig. 2 comprises the principal part of my invention and the manner in which it is connected for use may be briefly described as follows: All party lines which are filled up to their full capacity have their normal conductors connected direct to the line switch bank springs as shown in the British Patent No. 2270 of 1914, previously referred to. Whenever a substation on a certain line is taken out or disconnected and it is desired to provide traffic trunk service for such line, the normal conductors are opened at suitable terminals provided for this purpose and are connected with a relay equipment, which operates when the disconnected substation on the line is called to connect the normal conductors with a trunk extending to an operator's position. These relay equipments are provided in sufficient number to take care of all the lines requiring the traffic trunk service, there being a separate relay equipment needed for each such line. However, the number of lines which are considered to require traffic trunk service is usually such a small proportion of the total number of lines that the expense is inconsiderable.

The individual relay equipment shown in Fig. 2 comprises the relays 52, 53, and 55. Relay 52, when energized, connects the normal conductors 101 and 102 with the traffic trunk 152—153, while relay 53, when energized, connects these normal conductors with the line. Whether relay 52 is energized or not when the line is called depends upon which group of ringing relays has been selected by the frequency selector of the calling connector and upon the connections of the terminals A', B', C', and D', as will be fully described and explained hereinafter. Relay 55 is operated when the associated line is calling to extend ground G¹² to the connector private bank contacts via conductor 93 in an obvious manner.

For the purposes of this explanation it will be assumed that the subscriber at substation A (Fig. 1) calls the number of the disconnected substation F (Fig. 2), and the manner in which the connection is automatically switched to the traffic trunk through the medium of the relay equipment will be described in detail. Afterward, certain other connections of the relay equipment, illustrated in Figs. 4, 5, 6, and 7 and made

use of when substations other than substation F are disconnected, will be briefly explained.

Referring now to Fig. 1, the subscriber at substation A, upon removing his receiver to initiate the call, closes an energizing circuit for the line relay 11 of the line switch C as follows: ground at G', springs 65, line conductor 66, substation A, line conductor 67, springs 68 and the line relay 11 to the battery B. The line relay, upon energizing, closes a circuit for pull-in winding 12 over the following path: ground at G², springs 69, winding 12, and master switch controlled contacts 70 to the battery B. The winding 12, upon energizing, attracts both the cut-off arm 14 and the plunger-arm 15; the former disconnecting the line conductors 67 and 66 from the winding of line relay 11 and from ground at G', and the latter, through the medium of its plunger, causing bank springs 16, 17, 18, and 19 to engage contacts 20, 21, 22, and 23, respectively. By the engagement of springs 16 and 19 with contacts 20 and 23, respectively, the line conductors 66 and 67 are extended to the line relays 26 and 27 of the connector H. An energizing circuit is thereby closed through line relays 26 and 27 as follows: ground G⁴, relay 27, conductor 71, contact 23, and spring 19, the circuit previously traced to and through substation A, spring 16, contact 20, conductor 72 and the relay 26 to the battery B. Relays 26 and 27 both energize over the above traced circuit whereupon a circuit is closed for release relay 36, which, upon energizing, establishes a holding circuit from ground G²⁵ through springs 73, contact 21, and spring 17 to a point 74, where the circuit divides, one branch extending through the holding winding 13 to the battery B and the other branch extending over conductor 75 to the private bank contacts of all connector switches which have access to the line of station A. The energizing circuit for release relay 36 extends from ground G⁵ through springs 76 to spring 77 where it meets ground G⁶ through spring 78; the circuit then leads through springs 79 of relay 24 and the winding of relay 36 to the battery B. The ground from G²⁵ is extended to the holding winding 13 before the line relay 11 deenergizes to remove ground G² from pull-in winding 12, the line relay 11 being slow acting. The ground potential along conductor 75 to the private contacts prevents any other line from obtaining a connection with the calling station while the receiver is removed. By the engagement of spring 18 with contact 22 upon the operation of line switch C a circuit is completed to operate the master switch D, whereby the plungers of the remaining line switches are moved to position before the terminals of the next idle trunk.

The operation of the substation calling device for the first digit of the number of station F will cause the impulse springs 8 and 9 to be momentarily separated a number of times corresponding to the numeral of said first digit. If the first digit is 2 the impulse springs will be momentarily separated twice to thereby cause line relays 26 and 27 to be momentarily deenergized twice. Each time the relay 26 deenergizes it closes a circuit for the vertical magnet 40. This circuit extends from ground G⁶ through springs 78 and 80, springs 81 and 82, slow acting relay 37, vertical magnet 40, side switch wiper 45 (in first position) to the battery B. The vertical magnet receives two impulses over the above circuit and operates to raise the switch shaft and wipers 42, 43, and 44 two steps to a position opposite the second level or row of bank contacts. The slow acting private control relay 37 is energized by the first impulse of current which passes through it and remains energized during the succeeding impulses. In its operated position, besides closing the circuit of the private magnet 38, the relay 37 short-circuits the relay 27 by the closure of springs 83 and 84. This short-circuiting is for the purpose of decreasing the resistance of the line circuit while line relay 26 is operating. The deenergization of the private control relay 37, after all the impulses have been delivered to the vertical magnet, breaks the circuit of the private magnet 38, which operates to cause the side switch to pass from first to second position. The passage of side switch wiper 45 from first to second position shifts the battery connection from the vertical magnet to the rotary magnet 41.

The calling device at substation A may now be operated in accordance with the second digit of the called number, resulting as before in deenergizations of line relay 26. At each deenergization a circuit is closed through the rotary magnet 41, which circuit extends as follows: ground G⁶, springs 78 and 80, springs 81 and 82, relay 37, springs 85 of relay 39, rotary magnet 41 and side switch wiper 45 to the battery B. The rotary magnet receives two impulses over this circuit and operates to advance the wipers 42, 43 and 44 to the connector bank contacts of the called party line. The private control relay 37 operates in the same manner as for the previous digit to close the circuit of the private magnet 38 as long as impulses are being delivered to the rotary magnet. After the last impulse is delivered the relay 37 deenergizes and opens the circuit of the private magnet 38. If the called line is idle the private magnet thereupon deenergizes to permit the side switch to pass to third position. If the called line is busy, however, the side switch remains

in second position and the calling substation is given the busy signal in the following manner: Whenever a line is busy there is a guarding ground potential established at the connector private bank contacts of that line, as explained in the case of line switch C, with the difference, however, that in the case of a party line the ground potential is applied to the connector bank contacts by means of a relay similar to relay 55 (Fig. 2). Consequently, when the private wiper 44 is rotated onto the contacts of a busy line the ground potential is extended from the guarded private bank contact through the side switch wiper 46 (in second position) springs 86 and 87, and winding of relay 39 to the spring 88 of private control relay 37. When the relay 37 deenergizes, the spring 89 engages spring 88 before it disengages spring 83. Thus the private magnet is included in the circuit traced to spring 88. The private magnet remains energized by the ground extending from the private bank contact of the busy line through the relay 39, and at the same time the said relay 39 also becomes energized over the same circuit. The relay 39, upon energizing, shifts the spring 87 into engagement with the spring 90, whereby the holding ground of the relay 39 and private magnet 38 is transferred from the private bank contact to ground G²⁵. The private magnet 38 being energized, a circuit for the busy tone to the calling line is thereby completed through springs 91 from the busy machine M. The calling line will receive the busy tone until the receiver is restored to the switch hook when the central office apparatus will be released in a manner to be explained. When the relay 39 is energized the springs 85 are separated so that further rotation of the connector is impossible.

If, however, the called line is not in use and therefore idle, when the private control relay 37 deenergizes after the wipers have been rotated onto the contacts of an idle line, the circuit of the private magnet is broken. The private magnet, upon deenergizing, allows the side switch to pass from second to third position. The side switch wipers 48 and 49 (in third position) extend the line through the shaft wipers 42 and 43 to the normal conductors of the called party line. The side switch wiper 46 (in third position) provides an energizing circuit for relay 53 (Fig. 2). This circuit extends from ground G⁷ through side switch wiper 46, private wiper 44, private bank contact 92, conductor 93, springs 94 and 95, and the relay 53 to the battery B. A branch of this circuit extends from the private contact 92 to multiples thereof in the banks of all connector switches which may have occasion to call the same party line. The relay 53, upon energizing, closes

a circuit from ground G^8 through springs 96 and 97, conductor 98 and the cutoff winding 54 to the battery B, whereby the cutoff armature is operated to disconnect the line conductors 103 and 104 from their connection in line switch E. By the closure of springs 99 and springs 100 the connector normals 101 and 102 are connected to the line conductors 103 and 104, respectively.

The engagement of the side switch wiper 45 with its third position contact point connects the operating magnet 32 of the frequency selecting mechanism with the battery B, thus placing the magnet 32 in condition to be operated in accordance with the last digit of the called number.

The operation of the substation calling device for the final digit, assumed to be in this case the digit 1, results in one deenergization of the line relay 26, which transmits an impulse of current from ground G^6 through springs 78 and 80, springs 81 and 82, relay 37, operating magnet 32 and the side switch wiper 45 to the battery B. The magnet 32 receives one impulse over this circuit and operates to advance the wipers 28, 29, and 30 one step to select the group of relays 56—59 which control the application of current from the ringing current generator R' . As soon as the relay 37 deenergizes after the last digit has been transmitted, a circuit is closed through the ringer relay 25 and group relay 56 which extends from ground G^9 through high resistance relay 56, conductor 106, frequency switch wiper 28, springs 107 of relay 24, ringing relay 25, springs 108 of relay 37, off-normal springs 61 and 62, side switch wiper 45 (in third position) to the battery B. The relay 56 is of high resistance and will not permit enough current flow to operatively energize ringer relay 25.

Relay 56, however, energizes and closes a circuit from ground G^{10} through interrupter wiper 109, left hand winding of relay 110, spring 111 and armature 112 to the battery B. Relay 110 energizes and locks from ground G^{11} through its armature 113. At the same time its armature 114 is brought into contact with spring 115 whereby a circuit is closed from ground G^{10} through a solenoid magnet comprising windings 116 and 117, spring 115, armature 114, spring 111, armature 112 to the battery B. The windings 116 and 117, upon energizing, attract the plunger arm 118 carrying the wiper 109. The wiper 109 connects contacts on its left with those on its right, but no circuits are closed until the said wiper 109 reaches the limit of its travel when a circuit is closed from ground G^{10} through contact 119, wiper 109, contact 120, right-hand winding of relay 110, spring 115, armature 114, spring 111 and armature 112 to the battery B. The right-hand wind-

ing of relay 110 upon energizing, opposes the left-hand winding and causes said relay 110 to release its armatures. Armature 113 reengages its back contact, thereby supplying ground from G^{11} over conductor 121 to the contacts shown together. Armature 114, upon restoring, opens the circuit of the windings 116 and 117. The windings 116 and 117, upon deenergizing, release the plunger arm 118 which proceeds to fall slowly due to the action of dash-pot 122. When the wiper 109 is carried over the contacts during the restoring movement, it successively closes circuits along conductors 123, 124, 125 and 126, each circuit leading to a different group of relays. Consider the circuit which extends into the group of relays associated with generator R' . This circuit will be closed when the wiper 109 is on the contact 127 and 128, and extends from ground G^{11} through armature 113 and its back contact, conductor 121, contact 127, wiper 109, contact 128, conductor 126, and slow relay 58 in multiple with relay 59 to the battery B. Relays 58 and 59 energize over this circuit. Relay 58 upon energizing, prepares a circuit from ground G^{12} through spring 138 and armature 129 to spring 130. A circuit is also closed from ground G^{13} through armature 131, spring 132 and the relay 57 to the battery B. Relay 57 upon energizing short circuits high resistance relay 56 from ground G^{14} thereby permitting ringing relay 25 of the connector to operatively energize. When relay 59 energized it connected its armatures to the leads from generator R' so that generator current will flow from the generator R' over both generator leads through armatures 132 and 133 in contact with their respective front springs, through wipers 30 and 29, springs 134 and 135 in contact with springs 136 and 137, respectively, thence over side switch wipers 48 and 49, line wipers 42 and 43, and normals 101 and 102 to the lines 103 and 104. However, this generator current is without any particular function for the reason that substation F whose ringer is adapted to respond to current from generator R' , is disconnected from the line.

As soon as wiper 109 breaks away from contacts 127 and 128 the circuit of relays 58 and 59 is broken and these relays deenergize. Relay 58 being slow acting will retain its armatures for a short time after relay 59 has released its armatures. Therefore, before relay 58 releases its armatures and after relay 59 has allowed its armatures to restore, a circuit is closed from ground G^{12} through spring 138, armature 129, spring 130, armature 132, conductor 139, frequency switch wiper 30, conductor 140, springs 134 and 136, side switch wiper 48, line wiper 42, normal conductor 101, springs 141 and 142 of relay 52, middle winding of relay 52, terminal B', 130

terminal C', armature 143, and spring 141 of relay 51 to the battery B. It should be noticed that relay 51, which is common to the group of connectors of which connector H is one, is energized by the ringer relay 25 over a circuit that extends from ground G¹⁵ through springs 145, common conductor 146 and the said relay 51 to the battery B. The current flowing in the middle winding of relay 52 is of sufficient strength to operatively energize the same and the springs 147 are adjusted to make before the spring 141 breaks away from spring 142, so that a new energizing and locking circuit is established from ground G⁸ through springs 96 and 97, springs 147 and left hand winding of relay 52 to the battery B. The relay 52, when energized, shifts springs 141 and 148 out of contact with springs 142 and 149 and into engagement with springs 150 and 151, respectively, whereby the normals 101 and 102 are extended over conductors 152 and 153 to an operator's position.

It is to be noted that relay 58, upon finally deenergizing, opens the circuit of relay 57 which deenergizes to remove the short circuit which it placed around high resistance relay 56. When this happens relay 56 is again included in circuit with ringer relay 25, which causes the said relay 25 to deenergize, thereby breaking the circuit of relay 51 and completing a circuit which included the connector back bridge relay 24 and relay 63 in bridge of conductors 152 and 153. This latter circuit extends from ground G⁷ by way of side switch wiper 46, lower winding of relay 24, springs 154 and 137 of relay 25, side switch wiper 49, line wiper 43, normal conductor 102, springs 148 and 151, conductor 153, relay 63, conductor 152, springs 150 and 141, normal conductor 101, line wiper 42, side switch wiper 48, springs 136 and 155, and the upper winding of said relay 24 to the battery B. The back bridge relay 24, upon energizing, opens the contacts of its springs 79 and 107. By separating springs 79, the short circuit around resistance 156 is removed, thereby including said resistance in a series circuit with release relay 36 to reduce the current consumption. When springs 107 are separated the circuit of ringer relay 25 is broken. Relay 56 being included in this circuit also deenergizes and opens the circuit of the interrupter mechanism J. The relay 63, upon energizing, attracts its armature and lights the signal lamp 64. The operator, upon noticing the lamp glowing, throws the answering key K to connect her telephone set across the conductors 152 and 153 whereby she may converse with the calling subscriber and inform him that the substation F is no longer accessible.

The calling subscriber at substation A, being notified by the operator that sub-

station F has been discontinued, hangs up his receiver and thereby initiates the restoration of the automatic switches. The separation of the switch-hook springs by the receiver hook opens the circuit of line relays 26 and 27 of the connector H. These relays, upon deenergizing, open the circuit of the release relay 36. The release relay 36 deenergizes to remove ground G²⁵ from the holding winding 13 and to close the following circuit of release magnet 60: ground G⁶, springs 78 and 80, springs 81 and 157, release magnet 60, and off-normal springs 50 to the battery B. The release magnet energizes to release the connector and the frequency selector S, and its own circuit is broken at springs 50 when the switch shaft reaches normal position. The deenergization of holding winding 13 of the line switch C, permits the armature 14 to restore and the plunger arm 15 to withdraw the plunger from the bank, whereupon all the apparatus associated with the calling line will have been restored to normal. Upon the release of the connector, ground is removed from conductor 93, whereupon relays 53 and 52 and the cut-off winding of line switch E are deenergized, thus restoring all apparatus associated with the called line to normal.

It has been noted that relays 58 and 59, 58² and 59², 58³ and 59³, and 58⁴ and 59⁴ are associated, respectively, with ringing generators R¹, R², R³, and R⁴, which generators correspond to the four substations on the party line shown in Fig. 2. Relays 58 and 59 are adapted to connect ground G¹² through contacts 138 and 129, contacts 130 and 132, conductor 139, wiper 30, conductor 140, springs 134 and 136, side switch wiper 48, and line wiper 42 to normal conductor 101 to initially energize relay 52 in the manner hereinbefore explained. Relays 58² and 59² are arranged to connect the ungrounded pole of the battery B through springs 158, springs 159, and conductor 160 to frequency switch wiper 30 (when on first contact of the second set) and thence over the circuit as previously traced. Relays 58³ and 59³ are arranged to connect ground G¹⁶ through springs 161, springs 162, conductor 163, frequency selector wiper 29 (when on second contact of the third set), conductor 164, springs 135 and 137, side switch wiper 49, and line wiper 43 to normal conductor 102 for a purpose to be hereinafter explained. Relays 58⁴ and 59⁴ are arranged to connect the ungrounded pole of the battery B through springs 165, springs 166, conductor 167, frequency selector wiper 29 (when on second contact of the fourth set), and conductor 164 to normal conductor 102. These different connections are utilized to control the relay 52 when some particular station on a party line is discontinued from service. When substation F is discontinued and it

is desired that all calls directed to said substation be received by an operator, the terminal B' should be connected to terminal C' in the manner shown in Fig. 2. Terminal A' will be free. When connected in this manner the relay 52 can only be initially energized by current from the ground side of battery over normal conductor 101 as explained. If, however, G is the substation that is disconnected, the connections should be made as shown in Fig. 4. When thus connected relay 52 can be initially energized only by current from the non-grounded pole of the battery over conductor 101 and will therefore be responsive to the relays of the second group, viz. 58² and 59².

When H is the substation that is discontinued, the connections should be made as shown in Fig. 5, terminal C' being connected to terminal A', and terminals D' and B' remaining disconnected. When thus connected relay 52 can be initially energized only by current from the grounded pole of the battery over normal conductor 102, and is therefore responsive to relays 58³ and 59³.

When I is the substation that is disconnected, the connections should be made as shown in Fig. 6, wherein terminals D' and A' are connected and terminals C' and B' are left free. When thus connected relay 52 can be initially energized only by current from the non-grounded pole of the battery over normal conductor 102, and is therefore responsive to relays 58⁴ and 59⁴.

If both stations F and G are disconnected the connections shown in Fig. 7 may be used. In this layout terminals D' and C' are connected together through resistance 168 and 169 and then to terminal B'. A flow of current from either the grounded or nongrounded terminal of the battery over conductor 101 will initially energize relay 52. If stations H and I are both disconnected the connections will be as shown in Fig. 7 except the point 170 will be connected to A' instead of B'. If stations F and H are disconnected the layout in Fig. 2 may be used with the addition of a conductor from A' to B'. If stations G and I are disconnected the connections as shown in Fig. 5 may be used with the addition of a conductor from A' to B'.

From the foregoing it will be seen that by simply making the proper connections between terminals C', D', A' and B' the relay equipment is enabled to handle calls for any disconnected substation on the line with which it is associated and switch all such calls to the operator's position, thereby providing a very simple and economical method of handling traffic trunk service.

While I have shown and described the principles of my invention in connection with a party line telephone system of a particular character, various modifications

thereof may suggest themselves to those versed in the art, and I do not, therefore, wish to be limited to the exact construction herein shown and described.

What I claim as my invention is:

1. In a telephone system, a line, a plurality of subscribers' stations on said line, means for selectively signaling the subscribers on said line, said means comprising a plurality of ringing current generators of different character, a group of relays for each generator for controlling the application of ringing current to said line, a trunk line leading to a manual switchboard, a battery for operating and talking purposes, means whereby a relay of said group connects a terminal of said battery to a conductor of said first line, a calling line, another relay, said other relay responsive to said battery connection whereby when the calling line signals for a station on said first line, the service of which has been discontinued, the calling line is connected to the manual switchboard over said trunk line.

2. In a telephone system, a line, a plurality of subscribers' stations on said line, means for selectively signaling the subscribers on said line, said means comprising a plurality of ringing current generators of different character, a group of relays for each generator for controlling the application of ringing current to said line, a trunk line leading to a manual switchboard, a battery for operating and talking purposes, means whereby a relay of said group connects a terminal of said battery to a conductor of said first line, a calling line, another relay, said other relay responsive to said battery connection whereby when the calling line signals for a station on said first line, the service of which has been discontinued, the calling line is connected to the manual switchboard over said trunk line, and a signal for said trunk line controlled over said connection.

3. In a telephone system, a line, a plurality of subscribers' stations on said line, means for selectively signaling the subscribers on said line, said means comprising a plurality of ringing current generators of different character, a group of relays for each generator for controlling the application of ringing current to said line, a trunk line leading to a manual switchboard, a battery for operating and talking purposes, means whereby a relay of said group connects a terminal of said battery to a conductor of said first line after said signaling operation, a calling line, another relay, said other relay responsive to said battery connection whereby when the calling line signals for a station on said first line, the service of which has been discontinued, the calling line is connected to the manual switchboard over said trunk line.

4. In a telephone system, a line, a plurality of subscribers' stations on said line, means for selectively signaling the subscribers on said line, said means comprising a plurality of ringing current generators of different character, a group of relays for each generator for controlling the application of ringing current to said line, a trunk line leading to a manual switchboard, a battery for operating and talking purposes, means whereby a relay of said group connects a terminal of said battery to a conductor of said first line after said signaling operation, a calling line, another relay, said other relay responsive to said battery connection whereby when the calling line signals for a station on said first line, the service of which has been discontinued, the calling line is connected to the manual switchboard over said trunk line, and a signal for said trunk line controlled over said connection.

5. In a telephone system, a two-conductor line, a plurality of subscribers' stations connected to said line, means for selectively signaling the subscribers on said line, said means comprising a plurality of ringing current generators of different character, a battery for operating and talking purposes, groups of relays for said generators for controlling the signaling over said line, means whereby a relay of each group connects a terminal of said battery to a conductor of said line, a trunk line extending to a manual switchboard, a calling line, another relay, said other relay connected to a conductor of said first line and responsive to one of said battery connections whereby when the calling line signals for a station on said first line, the service of which has been discontinued, the calling line is connected to the manual switchboard over said trunk line.

6. In a telephone system, a two-conductor line, a plurality of subscribers' stations connected to said line, means for selectively signaling the subscribers on said line, said means comprising a plurality of ringing current generators of different character, a battery for operating and talking purposes, groups of relays for said generators for controlling the signaling over said line, means whereby a relay of each group connects a terminal of said battery to a conductor of said line after said signaling operation, a trunk line extending to a manual switchboard, a calling line, another relay, said other relay connected to a conductor of said first line and responsive to one of said battery connections whereby when the calling line signals for a station on said first line, the service of which has been discontinued, the calling line is connected to the manual switchboard over said trunk line.

7. In a telephone system, a two-conduc-

tor line, a plurality of subscribers' stations connected to said line, means for selectively signaling the subscribers on said line, said means comprising a plurality of ringing current generators of different character, a battery for operating and talking purposes, groups of relays for said generators for controlling the signaling over said line, means whereby a relay of each group connects a terminal of said battery to a conductor of said line, a trunk line extending to a manual switchboard, a calling line, another relay, said other relay connected to a conductor of said first line and responsive to one of said battery connections whereby when the calling line signals for a station on said first line, the service of which has been discontinued, the calling line is connected to the manual switchboard over said trunk line, a signal for said trunk line, and means for operating said signal when said connection is thus extended.

8. In a telephone system, a two-conductor line, a plurality of subscribers' stations connected to said line, means for selectively signaling the subscribers on said line, said means comprising a plurality of ringing current generators of different character, a battery for operating and talking purposes, groups of relays for said generators for controlling the signaling over said line, means whereby relays in two of said groups connect opposite terminals of said battery to a conductor of said line, a trunk line extending to a manual switchboard, a calling line, another relay, said other relay connected to a conductor of said first line and responsive to one of said battery connections whereby when the calling line signals for a station on said first line, the service of which has been discontinued, the calling line is connected to the manual switchboard over said trunk line.

9. In a telephone system, a two-conductor line, a plurality of subscribers' stations connected to said line, means for selectively signaling the subscribers on said line, said means comprising a plurality of ringing current generators of different character, a battery for operating and talking purposes, groups of relays for said generators for controlling the signaling over said line, means whereby a relay for each of two of said groups connects the same terminal of said battery to different conductors of said line, a trunk line extending to a manual switchboard, a calling line, another relay, said other relay connected to a conductor of said first line and responsive to one of said battery connections whereby when the calling line signals for a station on said first line the service of which has been discontinued, the calling line is connected to the manual switchboard over said trunk line.

10. In a telephone system, a two-conductor line, a plurality of subscribers' stations connected to said line, means for selectively signaling the subscribers on said line, said
5 means comprising a plurality of ringing current generators of different character, a battery for operating and talking purposes, groups of relays for said generators for controlling the signaling over said line,
10 means whereby a relay for each of two of said groups connects the same terminal of said battery to different conductors of said line after the signaling operation, a trunk line extending to a manual switchboard, a
15 calling line, another relay, said other relay connected to a conductor of said first line and responsive to one of said battery connections whereby when the calling line signals for a station on said first line, the
20 service of which has been discontinued, the calling line is connected to the manual switchboard over said trunk line.

11. In a telephone system, a two-conductor line, a plurality of subscribers' stations
25 connected to said line, means for selectively signaling the subscribers on said line, said means comprising a plurality of ringing current generators of different character, a battery for operating and talking purposes,
30 groups of relays for said generators for controlling the signaling over said line, means whereby a relay of one group and a relay of another group connect the same terminal of
35 said battery to opposite conductors of said line, a trunk line extending to a manual switchboard, a calling line, another relay, said other relay connected to a conductor of
said first line and responsive to one of said battery connections whereby when the call-
40 ing line signals for a station on said first line, the service of which has been discontinued, the calling line is connected to the manual switchboard over said trunk line.

12. In a telephone system, a two-conductor line, a plurality of subscribers' stations
45 connected to said line, means for selectively signaling the subscribers on said line, said means comprising a plurality of ringing current generators of different character, a bat-
50 tery for operating and talking purposes, groups of relays for said generators for controlling the signaling over said line, means whereby a relay of one group and a relay of another group connect the same terminal
55 of said battery to opposite conductors of said line after the signaling operation, a trunk line extending to a manual switchboard, a calling line, another relay, said other relay connected to a conductor of said
60 first line and responsive to one of said battery connections whereby when the calling line signals for a station on said first line, the service of which has been discontinued, the calling line is connected to the manual
65 switchboard over said trunk line.

13. In a telephone system, a two-conductor line, a plurality of subscribers' stations connected to said line, means for selectively signaling the subscribers on said line, said
means comprising a plurality of ringing
70 current generators of different character, a battery for operating and talking purposes, groups of relays for said generators for controlling the signaling over said line, means whereby a relay of one group and a relay of
75 another group connect opposite terminals of said battery to the same conductor of said line, a trunk line extending to a manual switchboard, a calling line, another relay, said other relay connected to a conductor
80 of said first line and responsive to one of said battery connections whereby when the calling line signals for a station on said first line, the service of which has been discontinued, the calling line is connected to
85 the manual switchboard over said trunk line.

14. In a telephone system, a two-conductor line, a plurality of subscribers' stations connected to said line, means for selectively
90 signaling the subscribers on said line, said means comprising a plurality of ringing current generators of different character, a battery for operating and talking purposes, groups of relays for said generators for con-
95 trolling the signaling over said line, means whereby a relay of one group and a relay of another group connect opposite terminals of said battery to the same conductor of said line after the signaling operation, a
100 trunk line extending to a manual switchboard, a calling line, another relay, said other relay connected to a conductor of said first line and responsive to one of said bat-
105 tery connections whereby when the calling line signals for a station on said first line, the service of which has been discontinued, the calling line is connected to the manual switchboard over said trunk line.

15. In a telephone system, a two-conductor line, a plurality of subscribers' stations
110 connected to said line, means for selectively signaling the subscribers on said line, said means comprising a plurality of ringing current generators of different character, a
115 battery for operating and talking purposes, groups of relays for said generators for controlling the signaling over said line, means whereby a relay of each of certain of said groups connects one terminal of said
120 battery to opposite conductors of said line, and means whereby a relay of each of certain other of said groups connects the other terminal of said battery to the opposite conductors of said line, a trunk line extending
125 to a manual switchboard, a calling line, another relay, said other relay connected to a conductor of said first line and responsive to one of said battery connections whereby when the calling line signals for a station on
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said first line, the service of which has been discontinued, the calling line is connected to the manual switchboard over said trunk line.

5 16. In a telephone system, a two-conductor line, a plurality of subscribers' stations connected to said line, means for selectively signaling the subscribers on said line, said means comprising a plurality of ringing
10 current generators of different character, a battery for operating and talking purposes, groups of relays for said generators for controlling the signaling over said line, means whereby relays of certain of said
15 groups connect the opposite terminals of said battery to a conductor of said line, and means whereby relays of each of certain other of said groups connect the opposite terminals of said battery to the other
20 conductor of said line, a trunk line extending to a manual switchboard, a calling line, another relay, said other relay connected to a conductor of said first line and responsive to one or more of said battery connections whereby when the calling line signals
25 for a station on said first line, the service of which has been discontinued, the calling line is connected to the manual switchboard over said trunk line.

30 17. In a telephone system, a two-conductor line, a plurality of stations in bridge of said line, means for signaling a station on said line by projecting ringing current over said two conductors, a relay for controlling
35 the application of said signaling means, a second relay, said second relay connected to one of said conductors, a trunk line extending to a manual switchboard, a signal for said trunk line, a calling line, a battery
40 for operating and talking purposes, a third relay for connecting a pole of said battery over said conductor to energize said second relay, whereby when the calling line signals for a station on said first line, the service of
45 which has been discontinued, the calling line is connected to the manual switchboard over said trunk line.

18. In a telephone system, a line, a pair of talking conductors for said line, a plurality
50 of stations connected thereto, means for signaling a station on said line, said signaling means comprising a circuit, a relay for controlling said circuit, a second relay, said second relay connected to one of the
55 talking conductors of said line, a trunk line extending to a manual switchboard, a signal for said trunk line, a calling line, a battery for operating and talking purposes, a third relay for connecting a pole of said
60 battery over said one conductor to energize said second relay, whereby when the calling line signals for a station on said first line, the service of which has been discontinued, the calling line is connected to the manual
65 switchboard over said trunk line.

19. In a telephone system, a line, a plurality of stations connected to said line, said line having a terminal at the exchange, a calling line terminating in the exchange, a generator for signaling a station on said
70 first line, a relay for connecting said generator with said first line, a battery for operating purposes, a second relay for connecting one pole of said battery to said terminal after said first relay disconnects said generator, a trunk line extending to an operator's position in a manual switchboard, a third relay connected with said terminal when a station on said line is inaccessible to said calling line, the said third relay responsive to said battery connection to connect
75 said calling line with said operator's position over said trunk line, a signal for said trunk line, and means for operating said signal when said connection is so extended. 85

20. In a telephone system, a line terminating in the exchange or central office, a pair of talking conductors for said line, a plurality of subscribers' stations connected with said line, a plurality of ringing current generators of different character, means for applying said generators to said line to signal the stations thereon, a trunk line extending to a manual switchboard, a signal for said trunk line, a relay connected to the talking
90 conductors of said first line when a station thereon is out of service or disconnected, means whereby calls for the remaining stations are received at the respective stations and means including said relay whereby
95 calls for the disconnected station are connected via said trunk line to said manual switchboard, and means for operating said signal.

21. In a telephone system, a line terminating in the exchange or central office, a plurality of subscribers' stations connected with said line, a plurality of ringing current generators of different character, means for applying said generators to said line to signal
105 the stations thereon, a trunk line extending to a manual switchboard, a signal for said trunk line, a relay connected to said first line when one or more stations thereon are out of service or disconnected, means whereby
110 calls for the remaining stations are received at the respective stations and means including said relay whereby calls for the disconnected stations are connected via said trunk line to said manual switchboard, and means
115 for operating said signal.

22. In a telephone system, a line, a pair of talking conductors for said line, a plurality of stations connected to said line, a terminal for said line in the exchange or central office, a ringing current generator for signaling one of said stations, a calling line, a manual switchboard, a battery for operating purposes, a relay for connecting a pole of said battery to a talking conductor of said
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line and means responsive to said battery connection whereby when the calling line signals for a station on said first line, the service of which has been discontinued, the
5 calling line is connected to the manual switchboard.

23. In a telephone system, a line, a pair of talking conductors for said line, a plurality of stations connected to said line, a terminal
10 for said line in the exchange or central office, a ringing current generator for signaling one of said stations, a calling line, a manual switchboard, a battery for operating

purposes, a relay for connecting a pole of said battery to a talking conductor of said
15 line and means responsive to said battery connection whereby when the calling line signals for a station on said first line, the service of which has been discontinued, the calling line is connected to the manual
20 switchboard, a signal at said switchboard, and means for operating said signal.

Signed by me at Chicago, Cook county, Illinois, this 18th day of April, 1916.

WINFRED T. POWELL.